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Final Environmental Impact Statement for the Land Management Plan

Tonto National Forest

Volume 1: Chapters 1 to 3

Coconino, Gila, Maricopa, Pinal, and Yavapai Counties, Arizona

Cover photograph: View of Devil's Chasm waterfall in the Sierra Ancha Wilderness Area; credit: Kim Stahl

Final Environmental Impact Statement for the Land Management Plan

Tonto National Forest

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Abstract: This environmental impact statement documents analysis of impacts of four alternatives developed for programmatic management of the nearly three million acres administered by the Tonto National Forest. The analysis displays anticipated progress toward desired conditions, as detailed in the Tonto National Forest Land Management Plan, as well as the environmental consequences of implementing each alternative. Alternative A, the no-action alternative, is the 1985 Tonto National Forest Land Management Plan, as amended. Alternative B is the proposed revised forest plan and is reflected in the accompanying Tonto National Forest Land Management Plan. Alternative B addresses the needs to change since the 1985 plan was published and it provides for restoration and diverse ecosystem services. Alternative C maximizes natural processes and focuses on nonmotorized and primitive recreation opportunities. Alternative D maximizes forest products and focuses on motorized and accessible recreation.

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Summary

The Tonto National Forest proposes to revise its existing land and resource management plan to meet the legal requirements of the National Forest Management Act and the provisions of the 2012 Planning Rule (36 CFR 219). There is a need to revise the Tonto National Forest Land and Resource Management Plan (1985), referred to as the 1985 forest plan, to address the changing social and environmental conditions over the past 30-plus years, address the significant issues raised over past nine years of public engagement, and guide resource management activities across the Forest for the next ten to 15 years. The area affected by this environmental impact statement are the National Forest System lands within the Tonto National Forest's nearly three million acres, which includes six ranger districts: Cave Creek, Globe, Mesa, Payson, Pleasant Valley (excluding the Sierra Ancha Experimental Forest), and Tonto Basin.

In March 2017 the Assessment of the Tonto National Forest (USDA Forest Service 2017a), referred to as the Assessment, was published. The Assessment focused on current conditions, trends, and risks to ecological, social, cultural, and economic sustainability across the forest. As part of this effort, the Forest spent three years collecting and compiling existing information on the current state of the Forest and hosted several community forums[1]. Using the results and trends from the Assessment, the Forest's planning team developed eleven themes describing overarching needs and concepts (USDA Forest Service 2017b) that need to be considered and addressed through the plan revision process to create sustainable resources, goods, and services[2].

The public has submitted comments at each major milestone in plan revision, including the assessment, the notice of intent and the needs to change (USDA Forest Service 2017b), and the preliminary proposed plan (USDA Forest Service 2017c). Scoping efforts for forest plan revision began in earnest following the release of the draft assessment report. Tonto National Forest staff invited the public to a number of collaborative work sessions during which key findings from the draft assessment were presented and people were invited to identify needs for change to the 1985 forest plan. The public was asked what revisions needed to be made to current plan direction to address the conditions, trends, and risks evident from the assessment analyses. This process was useful in crafting needs for change to the current plan and identifying management concerns and issues.

Draft needs to change statements were developed and presented to the public through various media, including collaborative working sessions held in each ranger district and in Phoenix. During these working sessions, relationships with and among stakeholders were established and/or strengthened; information was shared; and self-convened, self-directed groups were organized around their key concerns. Input was gathered to refine the needs to change statements, and they were published as a Notice of Intent in the Federal Register (82 Federal Register 65, April 6, 2017).

All other issues and concerns received from the public to date through release of the notice of intent and preliminary proposed plan have been compiled since developing the needs to change statements. Public comment sources compiled include the following:

- needs to change statements,
- issues identified in public scoping comments submitted after the Notice of Intent was published in 2017,

[1] Specific information about forest plan revision public engagement on the Tonto National Forest can be found in chapter 1 of this document under Public Involvement.
[2] For more information about the assessment and the needs to change, go to www.fs.usda.gov/goto/tontoplan.

- comments and themes for each ranger district identified during the wilderness recommendation process conducted during 2017 and 2018, and
- public comments compiled after the preliminary proposed plan was released in November 2017.

Tonto National Forest personnel reviewed all public comments, and identified the following significant issues:

- Differences in recreation opportunities including amount of motorized/ nonmotorized and accessible/primitive recreational opportunities to provide for the future;
- Differences in resource management approaches including amount of active versus passive restoration techniques;
- Differences in land use management and uses including amount of management areas and/or allowed uses;
- Differences in grazing and rangeland management practices on the forest; and
- Differences in perspectives about the future availability of economic opportunities.

From the issues, the following alternatives were developed:

Alternative A is the current 1985 forest plan and is referred to as the no-action alternative or 1985 forest plan. The current 1985 forest plan has no articulated desired conditions for the range of resources on the forest. Therefore, it will be analyzed using desired conditions from the forest plan (modified version of the preliminary proposed plan released in November 2017). The 1985 forest plan does not reflect changes in economic, social, and ecological conditions, new policies and priorities, and new information based on monitoring and scientific research, therefore plan direction likely will not achieve, or not achieve as quickly, the desired conditions. This alternative provides a baseline for estimating the effects of the other alternatives.

Alternative B is the proposed action and is a balance of natural forces and human influences. This alternative was developed to respond to key issues identified in the Assessment, needs to change, and public engagement. Alternative B includes plan direction that allows for adaptive management to address sustainable recreation and ecological changes that have the potential to alter the provision of ecosystem services of the Tonto National Forest.

Alternative C is the alternative where natural forces are most predominant. This alternative was developed in response to public comments that expressed a desire to reduce human impacts on the Forest. Based on feedback to the notice of intent, preliminary proposed plan, and public engagement, this alternative emphasizes primitive recreation opportunities, increased protections to natural resources including the highest number of recommended wilderness acres, use of natural processes for restoration, limiting some aspects of grazing, restricting use in impaired riparian systems, and prioritizing natural resources over some economic development opportunities.

Alternative D is the alternative where human influences are most predominant. This alternative was developed to address public comments that expressed a desire for easier access and multiple use opportunities on the Tonto National Forest. Related comments received on the notice of intent, preliminary proposed plan, and public engagement focused on providing more accessible recreation opportunities, and having fewer restrictions on land uses including no additional recommended wilderness acres. Alternative D also emphasizes active restoration techniques to achieve desired conditions and provides for more economic opportunities on the Forest, including grazing and mining.

Based upon the effects of the alternatives, the forest supervisor of the Tonto National Forest will select one of the analyzed alternatives or a combination of elements from these separate alternatives. A record of decision will document the forest supervisor's final decision.

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Chapter 1. Purpose of and Need for Action

Introduction

The Forest Service has prepared this environmental impact statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This environmental impact statement discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. Additional documentation may be found on the plan revision website (https://www.fs.usda.gov/goto/tontoplan) and the schedule of proposed actions (SOPA) for the Tonto National Forest at https://www.fs.usda.gov/sopa/forest-level.php?110312.

Location

The Tonto National Forest covers 2,965,716 acres in central Arizona and is the fifth largest national forest in the National Forest System. The Tonto National Forest spans a range of ecosystems from the Sonoran Desert through a variety of chaparral and pinyon pine/juniper up to the ponderosa pine and mixed conifer of the Mogollon Rim. The Tonto National Forest is divided into six ranger districts: Cave Creek, Globe, Mesa, Payson, Pleasant Valley, and Tonto Basin (figure 1).

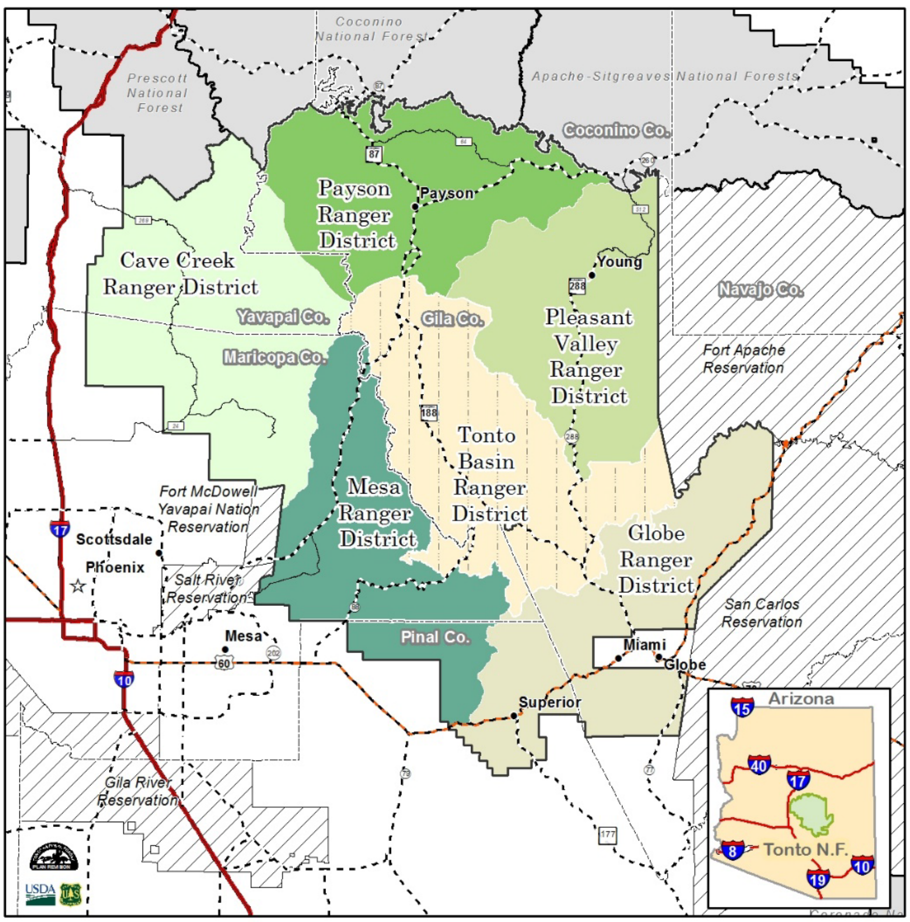


Figure 1. Vicinity map of the Tonto National Forest

The Sierra Ancha Experimental Forest, which is within the Tonto National Forest boundary, is managed by the Rocky Mountain Research Station. The Tonto National Forest is adjacent to the northeastern edge of the Phoenix metropolitan area, which has a population of nearly 4.9 million people (US DOC Bureau of the Census 2020). The city of Phoenix itself has a population of approximately 1.6 million (US DOC Bureau of the Census 2020), making it the sixth largest city in the United States. The Phoenix area is a popular destination for conferences, conventions, and tourism with its warm and sunny year-round climate, wide variety of business, cultural, and recreational offerings, serviced by many direct flights from most major U.S. cities. These factors combine to make the Tonto Nation Forest one of the most heavily-visited national forests, with approximately two to three million recreational visitors annually (USDA Forest Service 2016).

Purpose and Needs to Change

The 1985 Land and Resource Management Plan for the Tonto National Forest (1985a forest plan), including amendments, is the primary document currently guiding the Forest in meeting the mission of the Forest Service and managing its lands to provide for healthy, resilient ecosystems that meet the diverse needs of the American people. The National Forest Management Act of 1976 directs every national forest to revise its forest plan:

- Every ten to 15 years;
- When conditions or demands in the area covered by the forest plan have changed significantly;
- When changes in agency policies, goals, or objectives would have a significant effect on forest-level programs; and
- When monitoring and evaluation indicate that a revision is necessary.

Over 30 years have passed since the regional forester approved the original forest plan. These years have yielded new scientific information and understanding, and changes in economic, social, and ecological conditions, resulting in a shift in management emphasis from outputs to outcomes. A complete revision of the forest plan is needed to: (1) meet the legal requirements of National Forest Management Act and the provisions of the 2012 Planning Rule[3], (2) guide natural resource management activities on the forest for the next ten to 15 years, and (3) address the needs for change in management direction.

In preparation for forest plan revision, the Tonto National Forest identified guidance in the 1985 forest plan that is working, new conditions that need to be addressed, and ongoing challenges that could be better addressed. This preparatory work is documented in three documents completed in March 2017, the "Assessment Report of Ecological Conditions, Trends, and Risks to Sustainability (volume 1)" and "Assessment Report of Social, Cultural, and Economic Conditions, Trends, and Risks to Sustainability (volume 2)" (USDA Forest Service 2017a) and "Tonto National Forest's Needs to Change Management Direction of Its Existing 1985 forest plan" (USDA Forest Service 2017b). The Tonto National Forest identified current ecological and socioeconomic conditions and trends taking place on the forest and associated "needs to change" to be addressed in the revised forest plan. Findings from the Final Assessment reports resulted in needs to change statements which have been grouped into three main categories and are described below:

- Forestwide Management
- Ecological Sustainability
- Social, Cultural, and Economic Sustainability

[3] 36 CFR 219

Forestwide Management

Topics that emerged from forestwide management discussions included collaboration and partnerships, education, monitoring, Forest Service staffing and internal workings, forest plan components, technology, communication, enforcement, transparency, resource protection, and project management.

Workshop participants stated again and again that the Forest Service needs to better communicate within their agency as well as to the public. Transparency came up in most meetings especially regarding how the Forest Service uses comments from the public in decision making and how they can better acknowledge community input throughout the forest plan revision process. The concept of the Forest Service maintaining working relationships and partnerships with existing volunteer groups was brought up frequently.

Education and outreach were highly discussed at most meetings especially in the context of youth and how to get young people involved in public lands. There were also many conversations about the number of visitors to the Tonto National Forest that are not from neighboring communities and that some education needs to be directed at those people too.

The needs to change statements related to forestwide management are listed below:

1. There is a need for plan components that incorporate best available scientific information (BASI).
2. There is a need to reduce the complexity of plan components related to management areas that fragment the landscape by their arrangement, boundaries, and differing management direction.
3. There is a need to remove plan components that require developing additional planning documents, many of which require updates on a regular cycle.
4. There is a need for plan components that are adaptable to changes in technology, tools, and communication style demands.
5. There is a need for management approaches that emphasize public education about the Tonto National Forest's diverse ecological, social, and economic resources, the multiple-use philosophy, public laws and regulations, and management strategies.
6. There is a need for a monitoring program that tracks progress toward desired conditions and allows for a responsive adaptive management program with available resources.
7. There is a need to include management approaches that strengthen existing relationships, promote new relationships, and incorporate strategies that prioritize partnerships (e.g., local, State, and Federal agencies, Tribal governments, law enforcement, permittees, recreation and forest user groups, environmental groups, users with historic ties to the forest, and youth groups).
8. There is a need for management approaches that promote seeking outside assistance in addition to working with partners and volunteers to manage resources and monitor activities.
9. There is a need for management approaches that emphasize better coordination and collaboration with other forests, local governments, and tribes to minimize conflict between local planning and zoning direction as a result of our decisions, while at the same time becoming more aware of how local regulation might enhance our own management goals, or alternatively, interfere with our own desired outcomes.
10. There is a need for management approaches that integrate forest restoration and Tribal needs, for working across boundaries in partnership with tribes to manage landscapes, and to address threats to Tribal resources to meet common objectives.

Ecological Sustainability

Topics that emerged from the Ecological Sustainability discussions included watershed health, forest health, fire and fire management, invasive species, water resources protection, wildlife, grazing and rangeland management, climate change, science and monitoring, restoration, forest thinning, and preservation concerns.

Most discussions across the communities centered on watershed and forest health characteristics, the danger of large fires and using fire as a management tool, and the protection of local water resources. Species and species management were prevalent topics across most meetings, this included wildlife species and invasive species (both terrestrial and aquatic); much of the invasive species conversations were tied to fire discussions and centered on post-fire vegetation.

The needs to change statements related to ecological sustainability are listed below:

1. There is a need to develop desired conditions and other plan components that support heterogeneity and habitat diversity at multiple spatial scales.
2. There is a need to include plan components that focus on addressing the impacts of exotic and invasive species on terrestrial and aquatic ecosystems.
3. There is a need to develop desired conditions, standards, and guidelines that address terrestrial and aquatic habitat linkages and connectivity for species migration and movement across the landscape.
4. There is a need for plan components that incorporates adaptive management strategies that increase ecosystem resiliency to changing environmental conditions and stressors.
5. There is a need for standards or guidelines that prioritize use of native plant materials (the use of local and genetically appropriate seed sources) for revegetation, restoration, and rehabilitation of native plant communities to provide for the conservation of ecosystem diversity and maintain healthy ecosystem function.
6. There is a need to add plan components that emphasize landscape scale restoration.
7. There is a need to develop desired conditions (at multiple scales) for vegetation structure by promoting a diversity of seral states[4], vegetation function, and species composition.
8. There is a need for plan components, including desired conditions and objectives that recognize fire-adapted ecosystems, the role of fire on the landscape (including wilderness), and its use as a management tool, including planned and unplanned ignitions.
9. There is a need for plan components, including desired conditions and standards and guidelines, to address current and foreseeable stressors in desert ecosystems (e.g., fire, exotic species, and other disturbances) and to better understand post-disturbance recovery of desert species.
10. There is a need to develop standards and guidelines that promote the maintenance, restoration and monitoring of soil condition and function (e.g., hydrology, stability, and nutrient cycling) by improving and maintaining sufficient ground cover (biotic and abiotic components).
11. There is a need for desired conditions that identify appropriate riparian characteristics (e.g., biodiversity, connectivity, and water availability) that promote functionality and resiliency while taking into account multiple stressors.

[4] A seral state is one of a series of transitional plant communities that develop during gradual successive change following disturbance.

12. There is a need for standards and guidelines that minimize ecological impacts of multiple uses in riparian areas.
13. There is a need for standards and guidelines that reduce pollutant runoff into streams.
14. There is a need for providing plan components on the sustainable management of groundwater and groundwater dependent ecosystems (e.g., springs, wetlands, riparian areas, and perennial waters) and their interconnections.
15. There is a need to develop plan components for the long-term health and sustainability of watersheds using best available scientific information.
16. There is a need to develop plan components to ensure stream channels and floodplains are dynamic and resilient to disturbances.
17. There is a need to develop standards or guidelines to provide for the conservation and recovery of federally listed species, as well as maintain viable populations of species of conservation concern.
18. There is a need to include plan components that consider potential climate change impacts (e.g., increases in storm events, uncharacteristic wildfire, drought, flooding, and other extreme weather) to ecosystems and natural resources.

Social, Cultural, and Economic Sustainability

Topics that emerged from the Social, Cultural and Economic Sustainability discussions included recreation, cultural resources, education, law enforcement, economics, events, multiple use, access, population and resource concerns, grazing, outreach, managed use, public involvement, communities, stewardship, and road maintenance. These have been grouped into social, cultural, and economic sustainability.

The topic of recreation - its impacts and sustainability, was actively discussed at every community workshop, many of these discussions also focused on safety for all recreation types and that there may need to be distinct areas for specific types of recreation (e.g., shooting). Discussions within the topic of recreation also addressed access and concerns surrounding limiting forest access to communities. Access was also addressed as a concern regarding cultural resources and the perception that with enhanced access vandalism or cultural resource degradation would increase. The topic of law enforcement was raised as its own topic of concern and in many other contexts including recreation, cultural resources, multiple-use, increased population, and resource concerns.

The needs to change statements related to social, cultural, and economic sustainability are listed below:

1. There is a need to add plan components that recognize the Tonto National Forest’s role in contributing to local economies, including service-based sectors such as recreation and tourism, timber, grazing, and other multiple-use related activities and products.
2. There is a need to include plan components for key ecosystem services identified in the Assessment including: water for consumption; water for recreation; habitat for hunting, fishing, and watchable wildlife; sustainable and productive rangelands; and cultural heritage.
3. There is a need for updating plan components that provide for the management of sustainable water supply for multiple uses (e.g., wildlife, grazing, and recreation) including public water supplies.
4. There is a need for plan components to ensure the sustainability and availability of forest products such as firewood, medicinal and ceremonial plants, and edible plants.

5. There is a need for desired conditions that incorporate a wide range of silvicultural practices to promote forest health, resiliency, and sustainability.
6. There is a need to add plan components for rangeland management that maintain or restore ecological integrity of rangelands.
7. There is a need for plan components to allow flexibility in rangeland management to prepare for changing conditions such as drought, fire, social and economic needs.
8. There is a need to include plan components for sustainable recreation management to ensure that recreation resources are integrated into all resource management decisions.
9. There is a need for desired conditions to address the long-term sustainability of recreation infrastructure (e.g., trails, facilities, and roads), maintenance, design, and improvement.
10. There is a need for management approaches to address changing trends in services, activities, and types of facilities desired by the public, while balancing those trends with other resources.
11. There is a need for plan components to address user conflicts (e.g., recreational shooting and hikers, equestrians, and bicyclists, and motorized and nonmotorized users).
12. There is a need for plan components to incorporate scenery management with all forest management (e.g., restoration, habitat diversity, and timber management) to further positive outcomes for all resources.
13. There is a need for desired conditions that address transmission corridors and renewable energy generation, including wind, solar, biomass, and geothermal, while protecting natural resources, heritage and sacred sites, traditional Tribal activities, and scenery.
14. There is a need for plan components regarding the use of common variety mineral materials, such as commercial contracts, personal use, and free use permits.
15. There is a need for standards and guidelines for meteorite collection, rock hounding and mineral collection.
16. There is a need for plan components that ensure sustainable infrastructure (e.g., roads, trails, recreation and administrative facilities, range improvements, and maintenance backlog).
17. There is a need for plan components aimed at managing for Native American traditional cultural properties and sacred sites, and non-Native American traditional cultural properties, while conserving anonymity of such sites where appropriate.
18. There is a need for plan components that protect historic properties and Tribal use areas at risk of damage or destruction during non-prescribed/unplanned fire.
19. There is a need to update plan components to protect areas that may be identified as a sacred site or part of an important cultural landscape by Tribe.
20. There is a need for desired conditions in the plan that address the alignment of heritage resources management objectives (the management of historic properties and landscapes, sacred sites, and contemporary uses) with other resource management objectives (e.g., ecosystem restoration, rangeland management, and recreation).
21. There is a need to develop, modify, or remove plan components to allow flexible and efficient management of special uses while balancing resource protection with public needs.
22. There is a need to develop plan components related to Forest Service lands acquisitions, disposals, and exchanges.

23. There is a need for plan components that encourage the protection of existing public access and address the acquisition of new public access opportunities.
24. There is a need to include management approaches to develop a strategy to address issues related to known and suspected trespass and encroachment issues present on the forest.
25. There is a need for the revised plan to identify and evaluate potential additions to the National Wilderness Preservation System and eligibility of rivers for inclusion in the National Wild and Scenic Rivers Systems, and potentially other types of designated areas.
26. There is a need to reevaluate designated and proposed special areas that no longer suit the original purpose for designation (e.g., research natural areas, botanical areas, and burro territories), excluding congressionally designated areas.

Proposed Action

The Tonto National Forest proposes to revise its 1985 Land Management Plan (1985 forest plan) to provide strategic, program-level guidance for management of the forest's resources and uses over the next ten to 15 years. Proposed changes to the forest plan include incorporating resource desired conditions and management areas, as well as determining objectives, standards, guidelines, suitability, and monitoring requirements for forest resources. The forest plan changes the description and allocation of the management areas to move the majority of the land toward forestwide desired conditions and adds management areas that emphasize management differences across the large landscape.

The proposed action (forest plan) focuses on the needs to change identified in the assessment and incorporates significant issues raised during the scoping process. These are addressed in the following types of plan components found throughout the forest plan:

- Desired conditions are specific social, economic, and ecological conditions of the forest plan area, or a portion of the forest plan area, that are described in terms specific enough to allow for progress toward their achievement. Desired conditions are what drive the plan. All project-level management activities should be aimed at the achievement of the desired conditions for those resources in the area where the project is located. Desired conditions can be thought of as vision statements that help define a collective vision for the National Forest in the future (36 CFR 219.7(e)(1)(i). Desired conditions help frame the purpose and need during project-level planning. Desired conditions are not commitments or final decisions approving projects and activities. The desired conditions for some resources may currently exist, but for other resources they may only be achievable over a long period of time.
- Objectives are concise, measurable, and time-specific statements of a desired rate of progress toward desired conditions and should be based on reasonably foreseeable budgets (36 CFR 219.7(e)(1)(ii)). Objectives, along with the strategies (from management approaches or Forest Service handbook direction) used to accomplish them, can be thought of as the tools we will use to prioritize project activities to reach desired conditions. Objectives are mileposts along the road toward desired conditions and in implementation the Tonto National Forest may exceed the measurable component in the given time period.
- Standards can be thought of as the sideboards the Tonto National Forest will operate within as we develop projects. They are mandatory constraints on project and activity decision-making established to help achieve or maintain the desired conditions, to avoid or mitigate undesirable effects, or to meet applicable legal requirements (36 CFR 219.7(e)(1)(ii)). A deviation from a standard within a project requires a plan amendment for that deviation.

- Guidelines describe constraints on project and activity decision-making that allow for departure from its terms, so long as the intent of the guidelines is met (36 CFR 219.7(e)(1)(iv)). Guidelines serve the same purpose as standards, but they differ from standards in that they provide flexibility in defining compliance, while standards are absolute constraints. In other words, guidelines are mandatory with some flexibility on how they are implemented, so long as they are meeting the intent of the existing guideline. Projects may deviate from the exact language of the guideline so long as they are meeting the purpose of the guideline and any deviation from the purpose or intent requires a plan amendment.
- Suitability is described as specific lands within a plan area that are suitable for various uses or activities based on the desired conditions applicable to those lands. The forest plan also identifies lands within the forest plan area as not suitable for uses that are not compatible with desired conditions for those lands. Identifying suitability of lands for a use in the plan indicates that the use may be appropriate but does not make a specific commitment to authorize that use. Final suitability determinations for specific authorizations occur at the project- or activity-level decision-making process. Generally, the lands on the national forest are suitable for all uses and management activities appropriate for national forests unless identified as not suitable. The suitability of lands need not be identified for every use or activity; however, every plan must identify those lands that are not suitable for timber production (section 219.11) (36 CFR 219.7(e)(1)(v)).
- Management areas identify parts of the Forest that need different management direction than what is provided for forestwide resources. They have their own unique desired conditions. Management areas include designated areas, those that have been either statutorily or administratively designated, and are proposed or recommended areas identified through the planning process.
- Monitoring and evaluation requirements track if management actions are appropriately moving resources toward desired conditions and indicate if future actions, or the forest plan, need modification.

This forest plan is not an assemblage of program plans that have unique plan components for every resource. What is important is that resource plan components are looked at as a whole and combined to meet the requirements for ecological integrity, diversity of plant and animal communities, multiple-use management, ecologically sustainable production of goods and services, and they contribute to economic and social sustainability.

To effectively manage to the desired conditions of a resource, project planners and decision makers must ensure they use the entire plan and not just the plan components listed for that resource. Effective integrated resource management recognizes the interdependency of ecological, social, cultural, and economic resources and how management of one resource can influence the management or condition of other resources.

The plan is strategic in nature and does not specifically authorize any projects or activities. Site-specific decisions are made following project-specific proposals and analyses that comply with the forest plan, with additional opportunities for public involvement.

Specific details about the forest plan, and its alternatives are provided in chapter 2.

Scope of the Analysis

Analysis in this environmental impact statement is limited to the needs to change revision topics listed above and to significant issues (discussed below). Many issues raised during the scoping process are beyond the scope of this plan revision process and are not considered in the environmental impact statement. For example, issues associated with site-specific activities that are addressed by project-level decisions are not addressed. The plan is strategic in nature and does not specifically authorize any projects or activities. Site specific decisions are made following project specific proposals and analyses that comply with the forest plan, with additional opportunities for public involvement.

Decision Framework

The Forest Supervisor of the Tonto National Forest is the responsible official for this project and will make the final decision on the selected alternative for the revised forest plan. The Forest Supervisor will review the proposed action (forest plan), the other alternatives, and their environmental consequences, then decide which forest plan alternative best addresses the identified needs to change and issues raised during the scoping process, the requirements of the National Forest Management Act (P.L. 94-588) and the Multiple Use- Sustained Yield Act (P.L. 86-517) of 1960, and the diverse needs of forest users and sustainable resource management.

Based on the analysis in this environmental impact statement, including public comments and the project record, the responsible official prepared a draft record of decision, subject to an objection process guided by direction in the Planning Rule (36 CFR 219 Subpart B (219.50 to 219.62)). A final record of decision and accompanying forest plan will set a course of action for managing the Tonto National Forest for the next ten to 15 years. Project-level environmental analysis will still need to be completed for specific proposals to implement the forest plan's direction.

Public Involvement

Since kicking off the forest plan revision process in January 2014, the Tonto National Forest plan revision team has been working to involve, and collaborate with, the public during the various phases of the planning process[5]. The Tonto National Forest recognizes that our partners and the public have valuable ideas, knowledge, opinions, and needs that can inform and improve management of the forest. To provide meaningful dialogue and collaboration, the Tonto National Forest has offered a variety of public engagement opportunities throughout the plan revision process.

Public participation for the assessment phase included listening sessions, workshops, and a series of public meetings to gather local knowledge to understand how the public values the forest. In addition, the Tonto National Forest plan revision team has interacted with others through presentations and meetings with county planners, Tribes, stakeholders, and other government entities. The Notice of Intent (NOI) for the proposed action to prepare an environmental impact statement was published in the Federal Register on April 6, 2017, with a comment period from April 6, 2017 – May 22, 2017. The Notice of Intent asked for public comment on the needs to change statement developed from the assessment.

A preliminary proposed plan was released in November 2017 and offered an additional 45-day comment period. This allowed the Tonto National Forest, as well as the public and partners, to better understand how the assessment and needs to change work together to develop plan direction to feed into the draft forest plan. Additional meetings and discussions were held following the release of the preliminary proposed plan. The draft forest plan (proposed action) was a modified version of that document. Public participation for the development of the draft forest plan and analysis of alternatives has included a variety of opportunities (e.g., a series of open house public meetings, field trips, and stakeholder workshops) to engage. The Tonto National Forest also used internet-based collaboration techniques to gather public input and engaging communities at a local level through presentations at meetings hosted by

[5] Additional information about public engagement throughout the plan revision process can be found in Appendix C: Public Engagement and Coordination and on the forest plan revision website.

organizations, government groups, and Tribes; informational booths at fairs and local community events; and presentations and field trips for local schools. Information has been provided on a dedicated forest plan revision web page and through mailings, flyers, news releases, YouTube, Facebook, Twitter, and radio interviews.

The Notice of Availability for the draft land and resource management plan (draft forest plan) and draft environmental impact statement was published in the Federal Register on December 13, 2019, for a 90-day comment period ending March 12, 2020. Additional meetings and discussion (e.g., a series of open houses public meetings, two technical partner meetings, and district office working days) were held during the comment period. Information was also widely available online, hard copies at all Tonto National Forest offices, and hard copies at many of the local libraries in and around the Forest.

A Notice of Opportunity to object to the revised land management plan (forest plan) for the Tonto National Forest will be posted to the Federal Register initiating a 60-day objection period as required by 36 CFR 219. Eligibility to object to the Forest Supervisor's draft record of decision for the revised forest plan is limited to individuals and organizations that commented on the draft forest plan and draft environmental impact statement, otherwise expressed an interest in the project during the formal comment periods, or to object to any new information not previously available during formal comment periods. The objection process allows the Responsible Official, the Reviewing Official, Interested Persons, and eligible objectors to have the opportunity to seek reasonable solutions to conflicting views of plan components before the Responsible Official approves a plan, plan amendment, or plan revision.

The original 60-day objection period, which began on March 25, 2022, closed on May 24, 2022. The web link included in the original federal register notice and legal notice to submit objections electronically was incorrect due to a technical issue with the website. For this reason, the Forest Service re-initiated the objection period to ensure all potential objectors have an opportunity to participate in the process. The legal notice and federal register notice of opportunity to object (NOO) was published on July 8, 2022. The objection submission period ended on September 6, 2022, with 17 objections received. Of those, 14 objections have been determined eligible to participate in the objection process in compliance with 36 CFR 219.54.

A legal notice of eligible objectors was published in the Arizona Capitol Times on September 16, 2022. This publication initiated a 10-day period in which individuals or organizations who have provided previous substantive formal comments in the plan revision process could request to be an Interested Persons, as described in 36 CFR 219.57. which allows participation in meetings between the objectors and the Forest Service.

Objection resolution meetings occurred February 21 & 22, 2023. The purpose of these meetings was to further discuss concerns and remedies for some of the topics raised during the plan revision objection process. These meetings were held virtually and were open to the public. No decisions were made during these meetings. On May 19, 2023, the Regional Forester (the Reviewing Official) issued her final instructions[6] to the Tonto Forest Supervisor (the Responsible Official) and responded to the eligible objectors. These final instructions included required changes to the final plan, this final environmental impact statement, or other supporting documents before the Forest Supervisor could sign the Record of Decision and implement the new plan. While clarifying information was added, none of the required changes were substantive or changed the conclusions found in this analysis.

[6] A list of these final instructions and how the forest responded can be found in Appendix A of the Record of decision.

Tribal Engagement and Consultation

Tribal engagement efforts for the Tonto National Forest plan revision process have been conducted with various approaches since the initial kick-off[7]. Consultation with Tribes has consisted of formal letters and phone calls to all Tribal groups with ancestral ties to the national forest. This was followed up with several in-person meetings with the forest Tribal relations liaison, forest planner, forest archaeologist, forest supervisor and/or deputy forest supervisor along with various Tribal members among the thirteen Tribes with whom we consult.

Many of the Tribes who consider the Tonto National Forest an important place, both spiritually and culturally, have a strong interest in the management of the Forest. The revised forest plan was developed collaboratively with the Tribes and incorporates much of the management concerns and values that were shared with us. Tonto National Forest personnel continuously seek to engage with Tribes through and after the plan revision process.

Issues

Issues serve to highlight effects or unintended consequences, both anticipated and unanticipated, that may occur from the proposed action or alternatives. This gives opportunities during the analysis to reduce adverse effects and compare trade-offs for the decision maker and public to understand. Issues were identified from public comments, specifically comments on the notice of intent, published in the Federal Register on April 6, 2017, and comments received on the preliminary proposed plan. The public, other agencies, and Tribes submitted over 1,500 comments in response to the notice of intent and preliminary proposed plan. These comments were grouped into main themes:

- **Accessible Recreation**: the need for more easily accessible and developed recreation opportunities on the forest. Comments related to this theme focused on increasing the recreation opportunities on the forest, maintaining recreation developments, and less restrictive management on recreation.
- **Primitive Recreation**: the need for increased opportunities for primitive recreation on the forest. Comments related to this theme concentrate on undeveloped, backcountry, and nonmotorized recreation as well as additional areas recommended for special management.
- **Economics**: the economic importance of the forest to our surrounding communities and stakeholders. Comments related to this theme focused on ensuring economic viability of multiple uses on the forest.
- **Conservation**: the need to protect and conserve the forest resources in their most natural condition. Comments related to this theme focused on protection of plant and animal species, stricter management for resource protection, and more special management area designations.
- **Restoration**: the importance of restoration on the forest. Comments related to this theme focused on timber and fuels activities, invasive species treatments, and stream improvement projects to restore natural resources.

These comment themes were discussed through internal engagement. Each of these themes had many commenters and many did not agree on the overall management strategy to achieving the expected results. For this reason, these comment themes were further broken down and used the flush out significant issues.

[7] Additional information about Tribal engagement and consultation throughout the forest plan revision process can be found in Appendix C: Public Engagement and Coordination and in the project record, as appropriate.

A list of draft issues and an idea about how they would translate into draft alternatives were presented at a stakeholder holder meeting on April 25, 2018. The feedback from this meeting helped to shape significant issues. Alternatives were developed around those significant issues that involved unresolved conflicts concerning alternative uses of available resources (40 CFR 1500). See chapter 2 for more information.

The Tonto National Forest identified the following significant issues during scoping that drove alternative development:

Recreation Opportunities

Many areas of the Tonto National Forest have experienced an increased concentration of recreation use over the life of the 1985 forest plan. Public comments expressed desires for a variety of recreational opportunities. Some comments were focused on promoting more primitive recreation or nonmotorized opportunities. Other comments expressed concern that recreational opportunities were not accessible enough or desired more motorized opportunities. The forest plan and alternatives aim to address both the availability of motorized and nonmotorized recreational opportunities in a sustainable manner. The following are a few of the received comments used to help define the recreation opportunities issue.

- "*Increasing priority placed on motorized recreation in the Tonto will have a big pay-off in terms of forest health and responsible forest use by the off-highway vehicle (OHV) community and this should be incorporated into the proposed plan as both a management approach and a specific objective in the motorized recreation section.*" – Tonto Recreational Alliance
- "*I would like the see additional trail mileage for mountain bikes, maintenance of existing trails, and new access like parking lots…*" – organized letter campaign from the mountain biking community
- *"Hikers need areas that are safe from wheeled vehicles such as mountain bikers and OHV."* – Forest community member
- *"…please save all the valuable wild land that you can."* – Forest community member

Natural Resource Management

Overall, public comments expressed a desire to restore vegetation composition and structure so that it is in-line with historic conditions and has a reduced risk of uncharacteristically severe wildfires. However, comments differed as to whether this restoration should be more active or passive. Some comments focused on more passive restoration approaches, removing other uses, and letting nature take its course so the forest can become more resilient on its own. Other comments advocated for a more active approach using more direct forms of management (e.g., mechanical treatments) to help the forest reach natural conditions. Feedback on current management direction related to the northern goshawk has also been explored as it puts additional limitations on restoration activities. The forest plan seeks to provide guidance that allows for resilient vegetative communities with the management flexibility necessary to achieve this. The following are a few of the received comments used to help define the natural resource management issue.

- *"An emphasis on landscape scale restoration will provide benefits to big game, small game, and other species…and should not be limited to forested areas."* – Theodore Roosevelt Conservation Partnership
- *"…limiting your goal to 50 acres of treatment of invasive plants per year…demonstrates a total lack of commitment of the Forest to dealing with this serious problem."* – Friends of the Tonto

- *"[The Tonto National Forest] should recognize the role that designated areas play…protecting riparian areas and wetlands, supporting more natural habitat for at-risk species, preserving soils, protecting air and water quality."* – Sierra Club

Grazing and Rangeland Management

Livestock grazing is an appropriate use of National Forest Lands when managed in a responsible manner. Some comments received promoted continuing current grazing and rangeland management forest wide. Other comments suggested limiting or excluding grazing in certain areas such as in riparian areas or in desert ecosystems. The forest plan seeks to provide guidance that allows for responsible grazing and rangeland management in appropriate areas. The following are a few of the received comments used to help define the grazing and rangeland management issue.

- "*…resting a treated area from domestic livestock grazing to allow establishment of fine fuels such that low-intensity ground fire can be applied to the forest floor, and aligning allotment management plans such that future livestock grazing does not deplete the fine fuels that are required to maintain the prescribed fire schedule*." – Center for Biological Diversity
- "*The preliminary proposed plan fails to explicitly recognize that there is a need to make more productive use of the underutilize grazing capacity and vacant allotments that are suitable for grazing. Alternatives should be developed that provide greater guidance about the role of grazing anticipated outputs, and how sound grazing management can contribute to the economy.*" – Arizona Cattle Growers Association

Economics

There is a need for plan direction that recognizes the Tonto National Forest's role in contributing to local economies through extractive uses of the forest such as timber and mining. Comments were received advocating for both more and less extractive uses. The forest plan seeks to provide guidance that allows for contributions to local economies in a responsible manner. The following are a few of the received comments used to help define the economics issue.

- "*The Department supports public land use that provides Arizona's public and resources with a net benefit and does not support the conversion of public lands from multiple use to designations or management areas that would result in a new loss to wildlife resources, wildlife related recreational opportunities, and wildlife dependent economic benefits."* – Arizona Game and Fish Department
- *"Our members have continued to express the importance of livestock grazing to the economy, culture, and resource management across the greater Tonto area."* – Arizona Cattle Growers Association

Land Allocations and Allowed Uses

Many comments expressed concerns about the allocation of management areas on the Tonto National Forest and what uses should and should not be allowed within them. Some comments focused on more use restrictions on the landscape to protect resources, including designations or allocations to accomplish this. Other comments saw special areas[8] and management areas as too restrictive and not flexible enough to allow for effective management. The forest plan seeks to provide guidance that allows for flexible and effective management of National Forest System lands and protected resources. The following are a few of the received comments used to help define the land allocations and allowed uses issue.

[8] There are two proposed special areas in the 1985 forest plan; the forest plan has proposed allocation of management areas and does not use the term "special areas," with the exception of the Apache Leap Special Management Area.

- "*The Department is concerned as to how the Lakes and Rivers Management Areas, and any of the potential special designation results from public input would impact multiple use of public lands, wildlife related recreation, and wildlife management activities."* – Arizona Game and Fish Department
- "*Thoughtful and active management can and should maintain the character and values of a landscape for the long term without necessarily denying access.*" – International Mountain Biking Association
- *"Other uses that could conflict with the nature and purposes of the Arizona National Scenic Trail may be allowed only where there is a determination that those uses would not substantially interfere with the nature and purpose of the trail."* – Arizona Trail Association

Concerns

Not all comments informed issues. We also identified eight concerns during scoping that did not rise to the significance of issues and/or were outside of the decision on the forest plan. Many of these still informed plan development or the environmental impact statement, but do not have a cause-effect relationship between an alternative and a significant effect in the analysis. These include:

- a desire to be more involved in the planning process;
- specific suggestions for the monitoring plan;
- a desire for more integration of partnerships or public education;
- suggestions of methods for analyzing environmental consequences;
- concerns already addressed by law, regulation, and policy;
- concerns related to private lands within or near the tonto national forest; and
- concerns regarding the list of species of conservation concern.

All comments are cataloged as part of the project record. Volume 3 of the environmental impact statement, Appendix A: Response to Comments, includes concerns responses and concern response statements that were developed as part of responding to public comments.

Chapter 2. Alternatives, Including the Proposed Action

Introduction

This chapter describes and compares the alternatives considered for revision of the Tonto National Forest Land Management Plan. It includes a description and map of each alternative considered. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative (e.g., treating acres mechanically vs treating acres with fire) and some of the information is based upon the environmental, social, and economic effects of implementing each alternative (e.g., the number of jobs and amount of income created).

Alternative Development Process

All alternatives were developed to address:

- the purpose and need, as described in chapter 1, which includes the needs to change;
- changes in socioeconomic or environmental conditions since the 1985 forest plan; and
- issues identified from comments received during public scoping of the revision effort and from comments received on initial plan components, alternative themes, and management areas.

Environmental, social, and economic desires do not always coincide to provide a uniform path of action. Besides having separate and unique desired conditions, ways to achieve those desired conditions can also vary. Therefore, the range of alternatives were developed to encompass the diverse possibilities for management of this landscape and unresolved issues. The 1985 forest plan (alternative A) was evaluated by the interdisciplinary team and other forest staff to determine what management direction was still relevant and should be retained in the proposed revised plan, as well as what was outdated and in need of revision, which resulted in the Needs to Change. The Tonto National Forest then developed the preliminary proposed plan to address these needs to change. In November 2017, the Forest released the preliminary proposed plan for public and forest employee review and feedback. During this same time the Forest hosted six open house style public meetings and a technical partner workshop to receive feedback on the preliminary proposed plan. These collaborative efforts between the Forest Service and external groups and individuals led to development of the forest plan (alternative B).

Based on comments submitted during scoping of the Notice of Intent to prepare an environmental impact statement and in response to the preliminary proposed plan, other unresolved conflicts became evident. These included contrasting user perspectives about the recreation opportunities on the forest, natural resource management, grazing and rangeland management, economic development, and land allocations and allowed uses on the forest. Two additional alternatives (alternatives C and D) were generated based on issues not addressed by the proposed plan. These issues are described in more detail in Chapter 1 under the section “Issues.”

Alternative C was developed in response to public comments that expressed a desire to reduce human impacts on the forest. Based on feedback to the Notice of Intent, Preliminary Plan, and public engagement, this alternative emphasizes primitive recreation opportunities, increased protections to natural resources, use of natural processes for restoration, limiting some aspects of grazing, and prioritizing natural resources over some economic development opportunities.

Alternative D was developed to address public comments that expressed a desire for easier access and multiple use opportunities on the Tonto National Forest. Related comments received on the Notice of Intent, Preliminary Proposed Plan, and public engagement focused on providing more accessible recreation opportunities and having fewer restrictions on land uses including no additional recommended wilderness acres. Alternative D also emphasizes active restoration techniques to achieve desired conditions and provides for more economic opportunities on the forest including grazing and mining.

From the comment period on the draft environmental impact statement, we received comments suggesting additional alternatives. These comments did not bring up any additional issues and therefore were able to be addressed within the same four alternatives (A, B, C, and D) described above. The four alternatives work to provide “a clear basis for choice among options by the decision maker and the public” (40 CFR 1502.14).

Alternatives Considered in Detail

The interdisciplinary team developed four alternatives: alternative A, the no action or 1985 forest plan; alternative B, proposed action or forest plan; alternative C, where natural processes would be emphasized; and alternative D, where human uses would be emphasized. These alternatives were developed in response to issues described in chapter 1.

Elements Common to All Alternatives

All four alternatives share a number of features. In particular they all:

- comply with applicable laws, regulations, and policies;
- contain plan components: desired conditions, standards, guidelines, timber suitability, and monitoring (desired conditions are common across all alternatives and are described in detail in the forest plan);
- include mechanical treatments (thinning and commercial harvests), while offering opportunities for fuelwood collection when projects allow;
- conserve soil and water resources and do not allow significant or permanent impairment of the productivity of the land;
- provide protection for riparian areas;
- provide necessary ecological conditions to support at-risk species in the plan area;
- use a common list of species of conservation concern selected based on regional guidance and recommendations from forest, and state agency specialists;
- protect cultural resources;
- provide sustained multiple uses, products, and services in an environmentally acceptable manner (including timber, livestock forage, recreation opportunities, and leasable and locatable minerals);
- incorporate the scenery management system and recreation opportunity spectrum;
- manage for special qualities of existing designated areas (table 1, figure 2); and
- include 19 eligible wild and scenic rivers (displayed in figure 2) with desired conditions to maintain their outstanding remarkable values.

In addition, progress toward desired conditions and the effectiveness of standards and guidelines are evaluated by a monitoring plan that provides continual feedback and evaluation.

Changes to Elements Common to All Alternatives

Between the draft and final environmental impact statements the following changes were made:

- Visual management system was replaced by the scenery management system which incorporates the use of scenic integrity objectives in future forest management. The scenic integrity objectives are adjusted to fit the desired management for each alternative. This change has been incorporated into chapter 3;
- Recreation opportunity spectrum was included in the recreation analysis. The existing recreation opportunity spectrum reflects current conditions as amended with the Tonto National Forest's Travel Management Record of Decision. Recreation opportunity spectrum changes by alternative to reflect the desired management of each alternative. This change has been incorporated into chapter 3.
- Desired conditions were updated based on comments received, updates in best available scientific information, and internal review. Most of these updates were to clarify intent, update language, or add missing information but did not change the purpose or analysis related to the desired conditions. Detailed information about these changes can be found in the administrative record;
- The list of species of conservation concern was updated based on best available scientific information or changed resource conditions resulting in threats to species persistence; and
- Corridor boundaries for eligible wild and scenic rivers were updated, the lower Salt River, Lime Creek, and Dude Creek were removed from eligibility, and East Verde River and Christopher Creek were determined eligible.

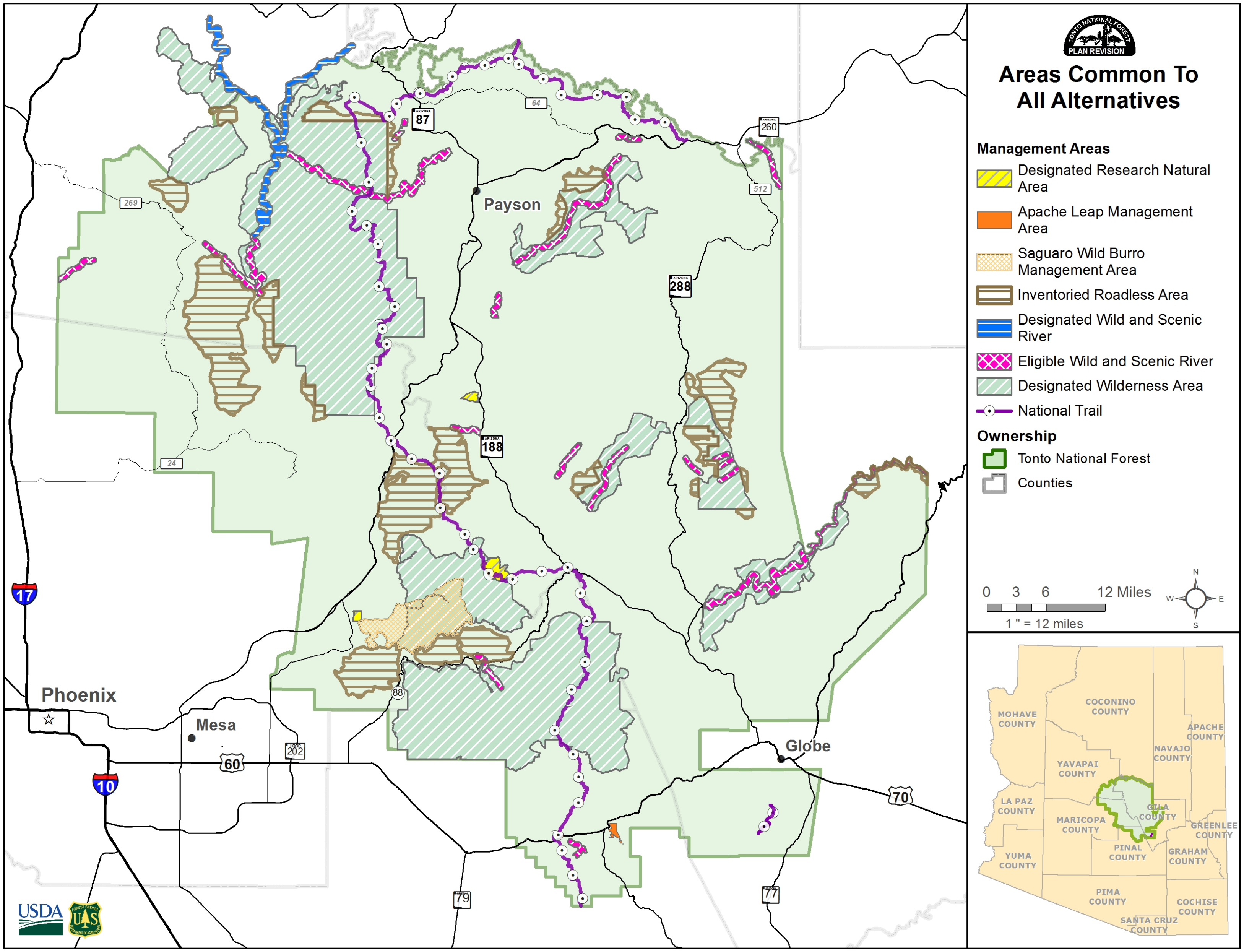


Figure 2. Management areas common to all alternatives for the Tonto National Forest

Table 1 lists the management areas common to all alternatives.

Table 1. Areas common to all alternatives

Type	Name
Designated Wilderness	Four Peaks, Hellsgate, Mazatzal, Pine Mountain, Salome, Salt River Canyon, Sierra Ancha, and Superstition
Designated Wild and Scenic Rivers	Fossil Creek and Verde River
Designated Research Natural Areas	Buckhorn Mountain, Bush Highway, and Haufer Wash
National Trails	Arizona National Scenic Trail, Highline National Recreation Trail, and Six Shooter Canyon National Recreation Trail
Significant Caves	17 Significant Caves (see forest plan for more info)
Eligible Wild and Scenic Rivers	19 eligible segments (see appendix E for more information)
Inventoried Roadless Areas	13 inventoried roadless areas
Management Area	Saguaro Wild Burro Management Area (which includes a wild burro territory)
Management Area	Apache Leap Special Management Area

Elements Common to Alternatives B, C, and D

Management of most forest resources are the same for alternative B, C, and D except for a few resources that change (represented in table 3 through table 10). Some of the features shared by these alternatives include, but are not limited to:

- Incorporating objectives, which are measurable actions within a period of time, to achieve or move resources towards desired conditions.
- Emphasizing vegetation treatments in frequent-fire forested systems (ponderosa pine and mixed conifer-frequent fire) that are highly departed from the vegetative desired conditions and historic fire regimes. Also emphasizing restoration of highly departed non-forested vegetation types (Juniper Grass, Pinyon Juniper Grass, Colorado Plateau Great Basin Grassland, Sagebrush Shrubland, and Montane Subalpine Grassland) with treatments such as mechanical treatments, prescribed or naturally ignited wildfires, seeding, or other techniques;
- Including an emphasis on restoration treatments in riparian areas and those benefitting water resources; including treatments such as stream channel and habitat restoration, watershed restoration, and invasive species removal;
- Providing direction on invasive species management in multiple ecological response units for the benefit of native and at-risk species;
- Increasing direction on soil protection, maintenance, and restoration, e.g., after vegetation treatment projects or human activity;
- Increasing guidance on fostering relationships, developing opportunities to leverage partnerships and collaboration, and enhancing communication;
- Recognizing and supporting traditional uses by Federally recognized Tribes;
- Emphasizing sustainable recreation and increasing guidance on implementing a sustainable recreation program;
- Providing additional management direction for eligible wild and scenic rivers; and
- Providing management direction for the Salt River Horse Management Area.

Changes to Elements Common to Alternatives B, C, and D

Between the draft and final environmental impact statement the following changes were made:

- The Salt River Horse Management Area has been developed to address comments and concerns related to forest management. Public comments express a desire to incorporate the plan direction for the Salt River Horses only within the specific area where the Salt River Horses are known to exist. This is consistent with management responsibilities where the Forest Service is responsible for managing the land and not the Salt River Horses, which are the responsibility of Arizona Department of Agriculture;
- Analysis of the Sierra Ancha Experimental Forest has been removed from alternatives B, C, and D because it is managed by the Rocky Mountain Research Station and is not within the scope of the plan revision process. This area no longer has management direction included within the Tonto National Forest plan. Removing this information does not change the designation; rather, the land management plan does not overlay additional guidance outside of the experimental forest establishment plan;
- Plan components (objectives, standards, and guidelines) and plan content (distinctive roles and contributions, management approaches, and descriptions) have been updated based on comments received, updates in best available scientific information, and internal review. Most of these updates are to clarify intent, update language, or add missing information without changing the purpose or analysis. In a few instances, the analysis has been updated as a result of these changes. Detailed information about these changes can be found in the administrative record; and
- Updates have been made to the monitoring plan based on information gathered during the technical partner meeting and public comments. These updates, including additional questions and indicators, better address the effectiveness of plan components in achieving desired conditions. Detailed information about these changes can be found in the administrative record.

Alternative A

Alternative A is the Tonto National Forest’s current 1985 forest plan, which is over 30 years old. It emphasizes commodity-driven fire and vegetation management, lacks guidance to improve ecological integrity, assumes all currently open and vacant allotments are open, and only addresses recreation management without using sustainable practices or using partners and volunteers. The current plan has no articulated desired conditions for the range of resources on the forest (e.g., recreation and vegetation management), therefore it will be analyzed using desired conditions from the forest plan (modified version of the preliminary proposed plan). The 1985 forest plan does not reflect changes in economic, social, and ecological conditions, new policies and priorities, and new information based on monitoring and scientific research, therefore plan direction likely will not achieve desired conditions. This alternative provides a baseline for estimating the effects of the other alternatives.

The comparison of alternatives (table 3 to table 10) provide specific details on the differences among alternatives.

Issue 1: Recreation Opportunities

The 1985 forest plan allows for flexible levels of recreation site maintenance. Certain developed recreation sites are specified to be managed for standard service levels while others are identified to be managed at a less than standard level. There is an emphasis on maintained trails and roads. Although plan direction can point to the concept of sustainable recreation, the concept is not specifically mentioned nor are there specific objectives that would help achieve it.

Issue 2: Natural Resource Management

The resource areas changing by alternative from the forest plan related to this issue are vegetation and wildland fire management and riparian area management.

Vegetation and Wildland Fire Management

Alternative A is output driven management. Standards and guidelines for much of the vegetation are focused on habitat and increasing forage production. Alternative A emphasizes timber management as a tool for providing forest products for local and regional industrial and individual needs while meeting wildlife habitat needs. While objectives are aimed to improve age class distribution, objectives are narrowly defined for a few types and mostly very prescriptive for wildlife (e.g., vegetation structure for Mexican spotted owls, and northern goshawk) and to increase forage production.

There is an emphasis on reintroducing fire into fire dependent ecosystems and allowing it to resume its natural role, but no clear objectives for frequent fire systems. Objectives for fire are only specific to 'providing a mosaic of age classes within the total type which would provide for a mix of successional stages, and to allow fire to resume its natural ecological role within ecosystems." While the existing plan does recognize the need to re-establish fire in frequent fire ecosystems, it does a poor job at defining and providing management direction for the diversity of frequent fire ecosystems (e.g., there is no mention of the Madrean oak types/communities such as the Madrean encinal woodland ecological response unit). Alternative A also includes guidelines related to the northern goshawks which place management constraints on restoration activities (e.g., prescribed fire and mechanical treatments) during the breeding season.

The need to restore semi-desert grasslands was identified as one of the needs for change. These ecosystems have experienced dramatic reductions regionally. There are no treatment objectives specific to semi-desert grasslands in the existing plan. Standards and guidelines are few, and do not provide much guidance on key considerations to maintaining and restoring conditions. The action alternatives provide clear desired conditions, objectives to restore semi-desert grasslands, and guidelines to maintain intact perennial grasslands where the potential exists (areas that have not experienced significant shrub encroachment).

There are no clear objectives for restoration in desert ecosystems, though there is direction for active fire suppression, or if fire is identified as being able to meet resource needs.

Riparian Area Management

In alternative A, the forest plan does include management direction to rehabilitate and maintain riparian conditions, but lacks clarity on where to prioritize riparian restoration, primarily focused on improving riparian vegetation structure with overstory cover targets. Objectives for alternative A narrowly focuses on restoring vegetation structure and habitat and less on restoring the ecological integrity of riparian areas (e.g., where stream channel conditions, soils, and vegetation are impaired).

Issue 3: Grazing and Rangeland Management

Alternative A continues current management direction to balance livestock numbers with forage capacity. This alternative lacks specifications that would move us towards desired conditions. Under alternative A there would most likely be no change in livestock management from current management practices. There is no direction to address vacant allotments, which has created a backlog on the forest.

Issue 4: Economics

The 1985 plan is primarily commodity driven with an emphasis on outputs from the forest. The purpose of the 1985 forest plan is to provide for multiple use and sustained yield of goods and services from the Forest. The economic focus for the 1985 plan was on timber and grazing. Though these are still economic opportunities on the forest, the 1985 plan doesn’t provide management for additional opportunities (e.g., sustainable recreation, mining).

Issue 5: Land Allocation and Allowed Uses

Aside from the forest-wide direction, the entire forest is also divided into management areas (figure 3 and table 2), each with their own set of plan components based on their emphasis. Most management areas have multiple emphases, which can result in no specific emphasis occurring in those areas.

Table 2. Management areas (MAs) in the 1985 forest plan

MA	Name	Purpose or emphasis
1A	Pine Mountain Wilderness	Manage for wilderness values wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes.
1B	Mazatzal Wilderness	Manage for wilderness values, wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes.
1C	Verde Wild River	This segment of the Verde River is designated as a wild river under the Wild and Scenic Rivers Act (Public Law 90-542). The Act requires that this segment be administered in such a manner as to protect and enhance its designated outstandingly remarkable scenic, fish and wildlife, and historical/cultural values, while protecting the river’s free flowing character and water quality. The Comprehensive Management Plan for the Verde Wild and Scenic River (USDA Forest Service 2004) describes the outstandingly remarkable values in further detail.
1D	Verde Scenic River	This segment of the Verde River is designated as a scenic river under the Wild and Scenic Rivers Act (Public Law 90-542). The Act requires that this segment be administered in such a manner as to protect and enhance its designated outstandingly remarkable scenic, fish and wildlife, and historical/cultural values, while protecting the river’s free flowing character and water quality. The Comprehensive Management Plan for the Verde Wild and Scenic River (USDA Forest Service 2004) describes the outstandingly remarkable values in further detail.
1E	Horseshoe and Bartlett Recreation Area	Water-oriented developed and dispersed recreation. Capacity management will be established where needed to ensure a quality of recreation experience, and to protect resources and public health and safety. Recreation sites in this management area will emphasize a mix of day use and overnight use. The visual resource is an important consideration in the management of this area.
1F	General Management Area	Manage for a variety of renewable natural resources with primary emphasis on wildlife habitat improvement, livestock forage production, and dispersed recreation. Watersheds will be managed so as to improve them to a satisfactory or better condition. Improve and manage the included riparian areas (as defined by FSM 2526) to benefit riparian dependent resources.
2A	Superstition Wilderness	Manage for wilderness values, wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes.
2B	Salt River Canyon Wilderness	The preservation of naturally occurring flora, fauna, aesthetics and ecological processes while providing a very high-quality white-water river running experience. Special consideration will be given to nesting bald eagle home range requirements. Watershed protection is also an important emphasis, and the stream shall be maintained in a free-flowing condition with water quality maintained or improved.

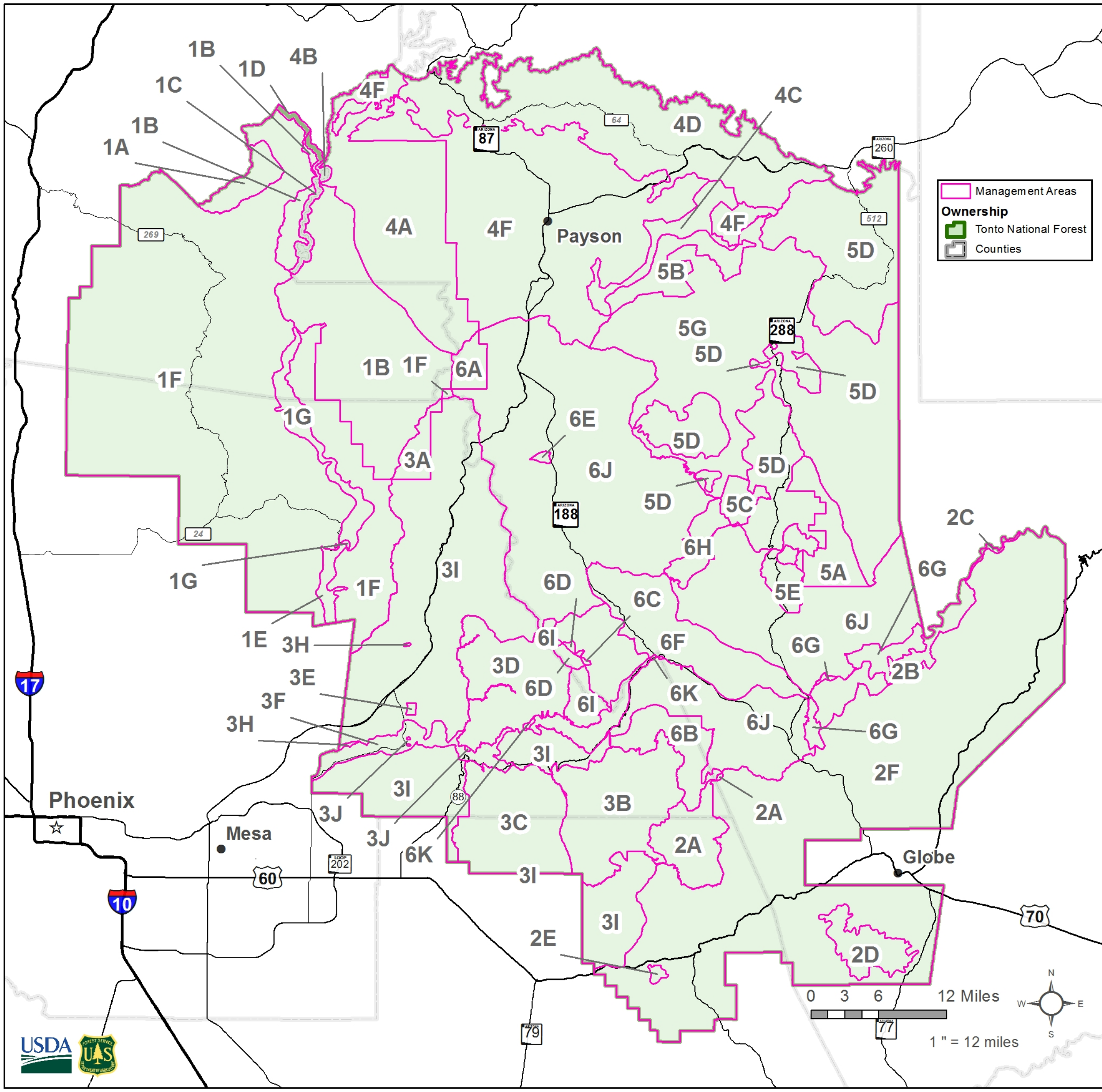
MA	Name	Purpose or emphasis
		Other activities that are authorized by the Wilderness Act will be conducted so as to minimize their impact on the wilderness characters.
2C	Upper Salt River	The preservation of naturally occurring flora and fauna, and esthetic values while providing a very high-quality white-water-running experience. Special consideration will be given to nesting bald eagle home range requirements. Watershed protection is also an important emphasis. Watershed protection is also an important emphasis, and the stream shall be maintained in a free-flowing condition with water quality maintained or improved. Other activities will be authorized so long as they are consistent with primary management emphasis for this river and its adjacent lands.
2D	Pinal Mountain Recreation Area	Manage for dispersed and developed recreation opportunities, for sustained yield of livestock forage, and to maintain watersheds to a satisfactory or better condition. Sawtimber and fuelwood harvest will be compatible with the recreation and grazing opportunities and will be done primarily for salvage and sanitation purposes. Uses such as electronic sites will be allowed on special uses. This visual resource is an important consideration in the management of this area.
2E	Proposed Picket Pose Mountain Research Natural Area.	Manage to provide opportunities of nondestructive research and education. Use restrictions will be imposed as necessary to keep areas in their natural or unmodified condition. There will be no harvest of forest plan products, including fuelwood and jojobas.
2F	General Management Area	Manage for a variety of renewable natural resources with primary emphasis on wildlife habitat improvement, water quality maintenance, livestock forage production, and dispersed recreation. Watersheds will be managed so as to improve them to a satisfactory or better condition. Improve and manage the included riparian areas (as defined by FSM 2526) to benefit riparian dependent resources.
2G	Apache Leap Special Management Area	Manage the area to: 1) preserve the natural character of Apache Leap, 2) allow for traditional uses of the area by Native American People, and 3) protect and conserve the cultural and archeological resources of the area.
3A	Mazatzal Wilderness	Manage for wilderness values, wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes.
3B	Superstition Wilderness (Eastern End)	Manage for wilderness values, wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes.
3C	Superstition Wilderness (Wester End)	Manage for wilderness values, wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes.
3D	Four Peak Wilderness	Manage for wilderness values, wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes.
3E	Bush Highway Research Natural Area	Manage to provide opportunities of nondestructive research and education. Use restrictions will be imposed as necessary to keep areas in their natural or unmodified condition. There will be no harvest of forest products, including fuelwood.
3F	Lower Salt River Recreation Area	Manage for water-oriented developed and dispersed recreation. Capacity controls will be established where needed to ensure a quality recreation experience, and to protect resources and public health and safety. Recreation sites in this management area will emphasize day use only during the summer season, and a mix of day use and overnight use during the winter season in these sites developed for this dual use. The visual resource is an important consideration in the management of this area.
3G	Proposed Desert Botanical Garden	Manage cooperatively with the Desert Botanical Garden to preserve the desert landscape, introduce and establish endangered plant species, develop a “living” museum to interpret the natural history of the Sonoran Desert and to provide opportunity for public enjoyment of the natural surroundings through participation in

MA	Name	Purpose or emphasis
		non-destructive recreational activities. The visual resource is an important consideration in the management of this area.
3H	Proposed Sycamore Creek and Blue Point Cottonwood Natural Areas	Manage to provide protection to natural features and vegetative communities. Management is directed toward maintaining as nearly as possible existing conditions and natural processes for public enjoyment, demonstration, and stud. A high level of protection is required to maintain water flows and quality. The visual resource is an important consideration in the management of this area.
3I	General Management Area	Manage for a variety of renewable natural resources with primary emphasis on improvement of wildlife habitat, livestock forage production, and dispersed recreation. Watersheds will be maintained so as to improve them to a satisfactory or better condition. Improve and manage the included riparian areas to benefit riparian dependent resources.
3J	Bureau of Reclamation Primary Jurisdiction Areas	All management activities under the jurisdiction of the Bureau of Reclamation and their contractor, the Salt River Project.
4A	Mazatzal Wilderness	Manage for wilderness values, wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes.
4B	Verde Wild River	This segment of the Verde River is designated as a wild river under the Wild and Scenic Rivers Act (Public Law 90-542). The Act requires that this segment be administered in such a manner as to protect and enhance its designated outstandingly remarkable scenic, fish and wildlife, and historical/cultural values, while protecting the river's free flowing character and water quality. The Comprehensive Management Plan for the Verde Wild and Scenic River (USDA Forest Service 2004) describes the outstandingly remarkable values in further detail.
4C	Hellsgate Wilderness	Manage for wilderness values, wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes.
4D	Mogollon Rim Area	Manage for a variety of renewable resource outputs with primary emphasis on intensive, sustained yield timber management, timber resource protection, creation of wildlife habitat diversity, increased populations of emphasized harvest species, and recreation opportunity. Timber harvesting methods and timing will include improvement of wildlife habitat quality and watershed condition, and will consider impacts on intensive range and recreation management. Mining activities are authorized in conformance with existing laws and regulations. Visual quality protection will be emphasized in the area of the Highline Train, a National Recreation Trail.
4E	Proposed Fossil Springs Natural Area	Manage to provide protection to natural features and vegetative communities. Management is directed toward maintaining as nearly as possible existing conditions and natural processes for public enjoyment, demonstration, and study. A high level of protection is required to maintain water flows and water quality. The visual resource is an important consideration in the management of this area.
4F	General Management Area	Manage for a variety of renewable natural resources with primary emphasis on improvement of wildlife habitat, livestock forage production, and dispersed recreation. Watersheds will be maintained so as to improve them to a satisfactory or better condition. Improve and manage the included riparian areas to benefit riparian dependent resources.
5A	Sierra Ancha Wilderness	Manage for wilderness values, wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes.
5B	Hellsgate Wilderness	Manage for wilderness values, wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes.

MA	Name	Purpose or emphasis
5C	Salome Wilderness	Manage for wilderness values, wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes.
5D	Mogollon Rim-Sierra Ancha Area	Manage for a variety of renewable resource outputs with primary emphasis on intensive, sustained yield timber management, timber resource protection, creation of wildlife habitat diversity, increased populations of emphasis harvest species, and recreation opportunity. Timber harvesting methods and timing will include improvement of wildlife habitat quality and watershed condition, and will consider impacts on intensive range and recreation management. Mining activities are authorized in conformance with existing laws and regulations. Visual quality protection will be emphasized in the area of the Highline Train, a National Recreation Trail.
5E	Sierra Ancha Experimental Forest	The experimental forest was established and is managed for purposes of research on vegetative treatments for increasing water yield. The experimental forest is operated by the Rocky Mountain Research Station, Flagstaff, Arizona, often cooperatively with Arizona State University and the University of Arizona.
5F	Proposed Upper Forks Parker Creek Research Natural Area	Manage to provide opportunities for nondestructive research and education. Use restrictions will be imposed as necessary to keep areas in their natural or unmodified condition. There will be no harvest of forest products including fuelwood.
5G	General Management Area	Manage for a variety of renewable natural resources with primary emphasis on improvement of wildlife habitat, livestock forage production, and dispersed recreation. Watersheds will be maintained so as to improve them to a satisfactory or better condition. Improve and manage the included riparian areas to benefit riparian dependent resources.
6A	Mazatzal Wilderness	Manage for wilderness values, wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes.
6B	Superstition Wilderness	Manage for wilderness values, wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes.
6C	Three Bar Wildlife Area	Manage to protect the unique watershed and wildlife habitat values of the area. Dispersed recreation activities may occur except for those that adversely affect the character of the area. Continue existing Cooperative Agreements for wildlife management and watershed research.
6D	Buckhorn Mountain Research Natural Area	Manage to provide opportunities for non-disruptive research and education. Use restrictions will be imposed as necessary to keep areas in their natural or unmodified condition. There will be no harvest of forest products including fuelwood.
6E	Haufer Wash Research Natural Area	Manage to provide opportunities for non-disruptive research and education. Use restrictions will be imposed as necessary to keep areas in their natural or unmodified condition. There will be no harvest of forest products including fuelwood.
6F	Roosevelt and Apache Lakes Recreation Area	The primary emphasis for this area is water-oriented developed and dispersed recreation. Capacity controls will be established where needed to protect soil and water resources and public health and safety. Recreation sites in this management area will emphasize a mix of day use and overnight use. The visual resource is an important consideration in the management of this area.
6G	Salt River Canyon Wilderness	Manage for wilderness values, wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes.
6H	Salome Wilderness	Manage for wilderness values, wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes.

MA	Name	Purpose or emphasis
6I	Four Peaks Wilderness	Manage for wilderness values, wildlife habitats and natural ecological processes while allowing livestock grazing and recreation opportunities that are compatible with maintaining these values and processes.
6J	General Management Area	Manage for a variety of renewable natural resources with primary emphasis on improvement of wildlife habitat, livestock forage production, and dispersed recreation. Watersheds will be maintained so as to improve them to a satisfactory or better condition. Improve and manage the included riparian areas to benefit riparian dependent resources.
6K	Bureau of Reclamation Primary Jurisdiction Areas	All management activities under the jurisdiction of the Bureau of Reclamation and their contractor, the Salt River Project

The only proposed special areas in the 1985 forest plan are management area 2E Picketpost Mountain Proposed Research Natural Area (1,261 acres) and management area 5F Upper Forks Parker Creek Proposed Research Natural Area (1,441 acres). Refer to figure 3 for a map that includes these areas.



Management Areas Unique to Alternative A

Mgmt. Area	Name
1A	Pine Mountain Wilderness
1B	Mazatzal Wilderness
1C	Verde Wild River
1D	Verde Scenic River
1E	Horseshoe and Bartlett Recreation Areas
1F	General Management Area
1G	Bureau of Reclamation project works
2A	Superstition Wilderness
2B	Salt River Canyon Wilderness
2C	Upper Salt River
2D	Pinal Mountain Recreation Area
2E	Proposed Picket Post Mountain Research Natural Area
2F	General Management Area
3A	Mazatzal Wilderness
3B	Superstition Wilderness (Eastern End)
3C	Superstition Wilderness (Western End)
3D	Four Peaks Wilderness
3E	Bush Highway Research Natural Area
3F	Lower Salt River Recreation Area
3H	Proposed Sycamore Creek and Blue Point Cottonwood Natural Areas
3I	General Management Area
3J	BOR Primary Jurisdiction Areas
4A	Mazatzal Wilderness
4B	Verde Wild River
4C	Hellsgate Wilderness
4D	Mogollon Rim Area
4E	Proposed Fossil Springs Natural Area
4F	General Management Area
5A	Sierra Ancha Wilderness
5B	Hellsgate Wilderness
5C	Salome Wilderness
5D	Mogollon Rim-Sierra Ancha Area
5E	Sierra Ancha Experimental Forest
5F	Proposed Upper Forks Parker Creek Research Natural Area
5G	General Management Area
6A	Mazatzal Wilderness
6B	Superstition Wilderness
6C	Three Bar Wildlife Area
6D	Buckhorn Mountain Research Natural Area
6E	Haufer Wash Research Natural Area
6F	Roosevelt an Apache Lakes Recreation Area
6G	Salt River Canyon Wilderness
6H	Salome Wilderness
6I	Four Peaks Wilderness
6J	General Management Area
6K	BOR Primary Jurisdiction Areas

Figure 3. Management areas unique to alternative A. See table 2 for detailed list of corresponding management areas.

Alternative B

Alternative B is the forest plan (modified version of the preliminary proposed plan) and was developed to respond to key issues identified in the assessment, needs to change, and public engagement. Alternative B includes plan direction that emphasizes the use of adaptive management to address potential ecological changes that have the potential to alter the provision of ecosystem services of the Tonto National Forest.

The comparison of alternatives (table 3 to table 10) provide specific details on the differences among alternatives.

Changes to Alternative B Between Draft and Final Environmental Impact Statement

Between the draft and final environmental impact statement the following changes were made:

- Objectives for the resources related to issues (e.g., recreation and riparian areas) have been updated based on comments received, updates in best available scientific information, and internal review. Most of these updates clarify intent, update language, or add missing information but do not change the purpose or analysis. In a few instances, the analysis has been updated as a result of these changes. Detailed information about these changes can be found in table 3 to table 10 and in the administrative record; and
- The lakes and rivers management area boundary has been adjusted based on public comments related to livestock grazing and recreation opportunities. It is now a 0.25-mile buffer around Roosevelt Lake, Apache Lake, Canyon Lake, Saguaro Lake, Horseshoe Lake, Bartlett Lake, the Verde River, and the Lower Salt River (designated wilderness and proposed research natural areas are not included in the management area). Historic grazing is permitted only where existing infrastructure or natural boundaries prevent livestock from accessing the rivers and lakes (LRMA-G-05). There is also now language about livestock occasionally crossing the Verde River if permitted in the allotment management plan (LRMA-G-06).

Issue 1: Recreation Management

Alternative B provides direction that emphasizes the use of adaptive management to address changing conditions while managing for sustainable multiple uses. It would balance public demands for both motorized and nonmotorized recreation activities with natural resource desired conditions. It would also:

- emphasize that recreation opportunities are relevant and responsive to changing user demands while achieving sustainability;
- maintain roads and facilities based on user demands, with decommissioning prioritized where infrastructure is not sustainable (e.g., conflicts with other resource desired conditions, unused); and
- provide specific direction for the Lakes and Rivers Management Area designed to prioritize recreation management over other select resources to accommodate high levels of recreation along the lakes and major rivers of the Forest.

Issue 2: Natural Resource Management

The resource areas driving change in the forest plan related to this issue are vegetation and wildland fire management and riparian area management.

Vegetation and Wildland Fire Management

In alternative B, vegetation management would focus on restoring fire as a key ecosystem process in frequent-fire ecological response units, with a particular emphasis on forested frequent fire ecological response units. This would be accomplished through a balance of mechanical treatments and wildland fire (wildfire and prescribed fire). Depending on the ecological response unit, a variety of other treatments, such as invasive species treatments, or reseeding native species, may be necessary to meet plan objectives. Fire would be actively suppressed in desert ecological response units, and plan objectives/restoration for deserts would be primarily focused on reducing disturbance to sensitive soils and treating invasive species (specifically exotic and invasive grass species).

Objectives would be established for frequent fire ecological response units to restore herbaceous surface vegetation and ground cover. The majority of the floral species diversity in these systems comes from the herbaceous surface vegetation, which is also the fuel for the frequent, mostly low intensity/low severity surface fires that are characteristic in these ecological response units. Objectives include a wide range of average, annual acres to be treated. These ranges were developed to incorporate both ecological and management realities. The high end of the ranges given for fire represents the acres that would be expected to burn each year if a specific ecological response unit was able to be managed based mostly on ecological objectives, with no constraints. The lower end represents the incorporation of the constraints described under “Resource Assumptions and Methods” (see volume 4, Appendix B: Description of the Analysis Process), and in some cases may not be sufficient to maintain current conditions or would result in increased departure from desired conditions. The high and low ranges given for mechanical treatments represents the most optimistic and the most pessimistic outcomes, based on the constraints described in appendix B, and the last decade of mechanical treatments on the Tonto National Forest.

Riparian Areas Management

Alternative B places a greater emphasis on restoring riparian areas and setting management priorities than alternative A by setting realistic treatment objectives aimed to address riparian areas that are most impaired (nonfunctional and functional-at-risk riparian areas). Plan objectives under this alternative provide clear direction on where to prioritize and accomplish restoration efforts by directing efforts at nonfunctional and functional-at-risk areas. Additionally, there is an increased focus on restoring spring ecosystems, aquatic habitat restoration, and treating invasive species in riparian areas. Standards and guidelines would provide the necessary plan direction to ensure that projects are designed in such a way to achieve desired conditions. This alternative would also include additional guidelines to maintain riparian species diversity.

Issue 3: Grazing and Rangeland Management

Alternative B emphasizes the use of adaptive management to balance livestock numbers with resource conditions. Plan components help us move toward desired conditions for rangelands. This alternative includes a plan component that requires the Forest to evaluate allotments as they become vacant and determine the best use of the land. This could include use for conversion to forage reserve, closure, or grant to a current or new permittee.

In this alternative the Lakes and River’s Management Area would restrict grazing in currently vacant allotments, possibly causing them to be unusable in the future.

Issue 4: Economics

Alternative B includes plan direction that emphasizes the use of adaptive management to address potential ecological changes where they may alter the economic contributions of the Tonto National Forest. It attempts to balance economic uses of the forest with protection of forest resources. This alternative recognizes the importance of the forest to local communities but strives to balance multiple uses in a sustainable way.

Issue 5: Land Allocation and Allowed Uses

Proposed areas in alternative B were evaluated against their ability to achieve the desired conditions. and would allow the Forest land managers to address changing conditions while managing for sustainable multiple uses and protecting important ecosystems.

There are 43,204 acres of recommended wilderness in this alternative. These acres represent 11 areas which were evaluated to have the highest level of wilderness characteristics on the forest. See Appendix D: Wilderness Recommendation Process for more detail. These areas were selected because the Forest land managers can manage in perpetuity for these characteristics. Selecting these areas would allow the Tonto to increase primitive type areas on the forest and meet the needs of the public.

There are four botanical areas proposed in this alternative: Fossil Springs Proposed Botanical Area (9 acres), Little Green Valley Fen Proposed Botanical Area (21 acres), Horseshoe Proposed Botanical Area (3,590 acres), and Mesquite Wash Proposed Botanical Area (10 acres). These areas are proposed in alternative B to protect important botanical resources on the Tonto National Forest by identifying specific uses compatible with the purpose of these areas.

There are four proposed research natural areas in this alternative: Dutchwoman Butte Proposed Research Natural Area (86 acres), Picketpost Mountain Proposed Research Natural Area (1,261 acres), Three Bar Proposed Research Natural Area (22,920 acres), and Upper Forks Parker Creek Proposed Research Natural Area (1,441 acres). These areas are proposed in alternative B because they represent areas the Tonto National Forest and cooperators have identified as needing management to further protect and enhance the natural features for which these research natural areas have been recommended.

This alternative also includes the Lakes and Rivers Management Area (45,553 acres). This area is included in alternative B because plan direction will provide additional guidance to sustain and promote the high-use and enhanced recreation around the major lakes and rivers.

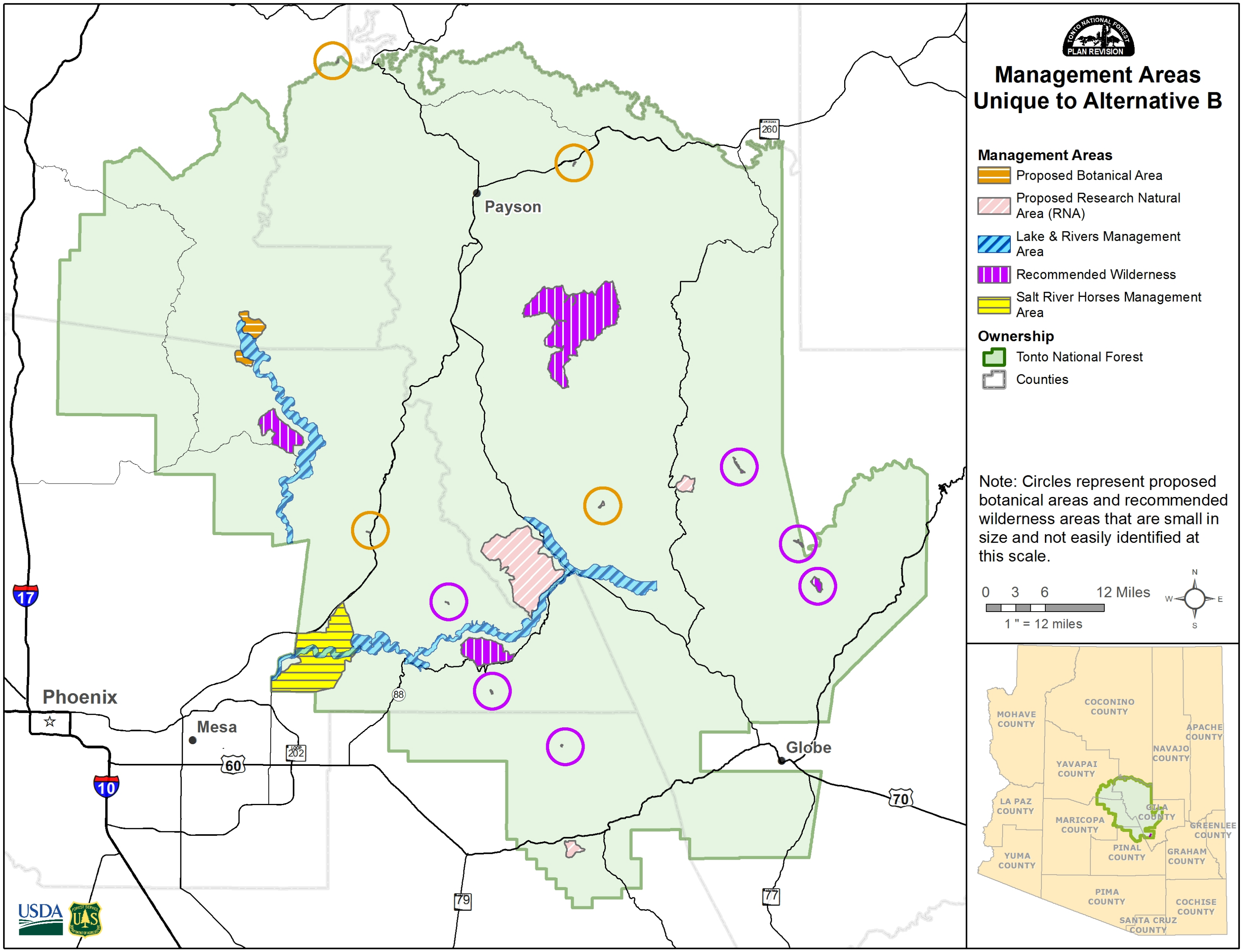


Figure 4. Management areas unique to alternative B

Alternative C – Natural Forces Predominant

Alternative C has been developed in response to public comments that express a desire to reduce human impacts on the forest. Based on feedback to the notice of intent, preliminary plan, and public engagement, this alternative emphasizes primitive recreation opportunities, increased protections to natural resources, use of natural processes for restoration, limiting some aspects of grazing, and prioritizing natural resources over some economic development opportunities.

The comparison of alternatives (table 3 to table 10) provide specific details on the differences among alternatives.

Changes to Alternative C Between Draft and Final Environmental Impact Statement

Between the draft and final environmental impact statement the following changes have been made:

- An additional recommended wilderness area has been incorporated into this alternative based on public comments. This adds about 31,000 acres near Roosevelt Lake. This does not impact the analysis of recommended wilderness. More detailed information can be found in Appendix A: Response to Comments and Appendix D: Wilderness Recommendation Process.

Issue 1: Recreation Management

Alternative C calls for components of the forest plan to provide minimal human impacts to the Forest. It emphasizes primitive recreation opportunities, increased protections to natural resources, use of natural processes for restoration, limiting some aspects of grazing, and prioritizing natural resources over some economic development opportunities. This alternative would trend more to dispersed recreation use over time as the absence of developed sites for recreation would be more in line with an emphasis on natural processes. Nonmotorized uses would be prioritized over motorized uses, and new recreational infrastructure would only be considered to meet desired conditions of other Forest resources or address safety concerns.

Issue 2: Natural Resource Management

The resource areas driving change in the forest plan related to this issue are vegetation and wildland fire management and riparian area management.

Vegetation and Wildland Fire Management

In alternative C, vegetation management in frequent-fire ecological response units relies on wildland fire as the primary restoration tool. Mechanical thinning would only be used in limited situations (e.g., Wildland Urban Interface areas or invasive species treatments). As a result, fewer commercial forest products would be available, and fewer suitable timber acres would be treated. Alternative C places more emphasis on restoring frequent fire woodland ecological response units through an increase in plan objectives for fire than the other alternatives. Objectives to restore grass and herbaceous cover for highly departed ecological response units (e.g., pinyon-juniper grass and juniper grass) are similar to alternative B. Objectives for desert ecosystems are the same as alternative B. Fire is actively suppressed, and restoration is primarily focused on reducing disturbance to sensitive soils and treating invasive species (specifically exotic and invasive grass species).

Acres of recommended wilderness would be significantly increased under this alternative.

Riparian Areas Management

Plan components and effects are the same as alternative B, with additional plan components and effects described below. Alternative C would include the following standard:

- If a riparian area is nonfunctional, as identified in the Proper Functioning Condition Assessment framework or similar protocol, all permitted and allowed uses and activities will be removed until riparian recovery is achieved.

This standard would exclude all uses and activities in riparian areas that are nonfunctional. This standard would only apply to riparian areas that have the ability to reach their potential extent and where major stressors are under National Forest System jurisdiction. Monitoring would establish when riparian recovery is achieved and establish the appropriate use levels. Potential management options might include (but would not be limited to) fencing riparian areas, relocating or removing camp sites, and removing water diversions (those under National Forest System jurisdiction).

Issue 3: Grazing and Rangeland Management

Under alternative C, currently vacant allotments would be closed. This alternative includes a plan component that requires the Forest to evaluate allotments as they become vacant, and determine the best use of the land. This could include conversion to forage reserve, closure, or grant to a current or new permittee. The purpose of this is to enhance natural resource protection and allow areas to function in their natural ecological role. Land use restrictions in areas with impaired riparian systems has the potential to limit grazing in the future.

Issue 4: Economics

Alternative C focuses on allowing nature to function in its natural ecological role, prioritizing restoration over economic development opportunities. There is a decrease in the production of forest products, an increase in restrictions on the extraction of common variety minerals, and closure of vacant allotments.

Issue 5: Land Allocation and Allowed Uses

Alternative C has the highest number of acres allocated to management areas. This is consistent with the themes of alternative C because uses in these areas generally provide greater protection of natural resources, increased primitive recreation opportunities, and use of natural processes for restoration.

This alternative includes 399,029 acres of recommended wilderness. These acres represent 50 areas across the forest that have high wilderness characteristics, or moderate levels of wilderness characteristics with high opportunities. These criteria were selected because they fit into the theme of the alternative with an increase in primitive recreation opportunities and an emphasis on fire techniques for restoration, which is more in line with recommended wilderness management.

There are four botanical areas proposed in this alternative: Fossil Springs Proposed Botanical Area (9 acres), Little Green Valley Fen Proposed Botanical Area (21 acres), Horseshoe Proposed Botanical Area (3,590 acres), and Mesquite Wash Proposed Botanical Area (10 acres). There are also four proposed research natural areas in this alternative: Dutchwoman Butte Proposed Research Natural Area (86 acres), Picketpost Mountain Proposed Research Natural Area (1,261 acres), Three Bar Proposed Research Natural Area (22,920 acres), Upper Forks Parker Creek Proposed Research Natural Area (1,441 acres). The inclusion of these areas would allow for greater protection of important botanical and important natural resources on the forest.

This alternative does not include the Lakes and Rivers Management Area. The purpose of the Lakes and Rivers Management Area is to manage the high use around the major lakes and rivers on the Tonto National Forest, sometimes over the management of natural resources, which is inconsistent with alternative C.

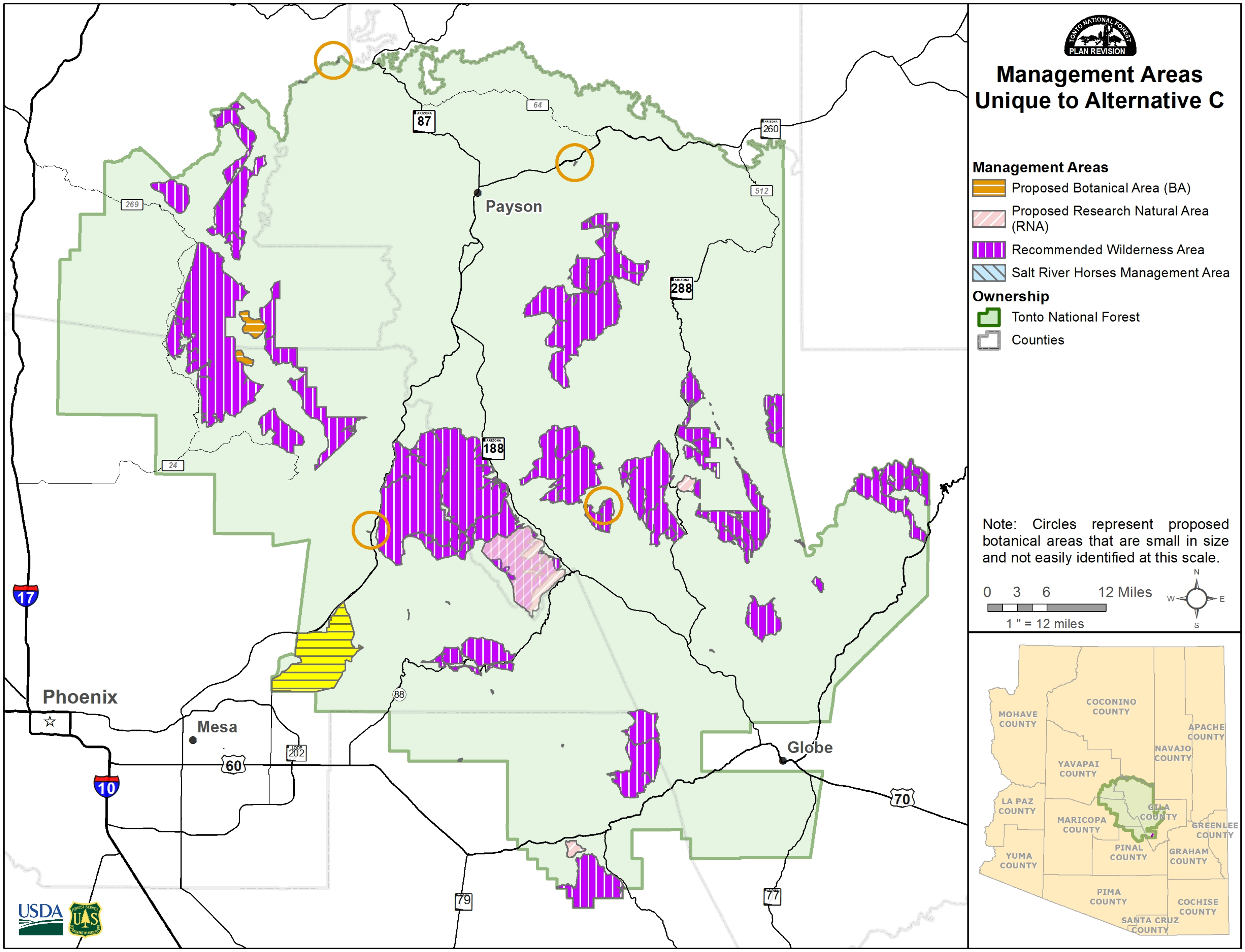


Figure 5. Management areas unique to alternative C

Alternative D – Human Forces Predominant

Alternative D has been developed to address public comments that express a desire for easier access and multiple use opportunities on the Tonto National Forest. Related comments received on the notice of intent, preliminary proposed plan, and public engagement focus on providing more accessible recreation opportunities and having fewer restrictions on land uses including no additional recommended wilderness acres. Alternative D also emphasizes active restoration techniques to achieve desired conditions and provides for more economic opportunities on the Forest including grazing and mining.

The comparison of alternatives (table 3 to table 10) provide specific details on the differences among alternatives.

Changes to Alternative D Between Draft and Final Environmental Impact Statement

Between the draft and final environmental impact statement the following changes have been made:

- The lakes and rivers management area boundary has been adjusted based on public comments relating to livestock grazing and recreation opportunities. It is now a 0.25-mile buffer around Roosevelt Lake, Apache Lake, Canyon Lake, Saguaro Lake, Horseshoe Lake, Bartlett Lake, the Verde River, and the Lower Salt River (designated wilderness and proposed research natural areas are not included in the management area). Historic grazing is permitted only where existing infrastructure or natural boundaries prevent livestock from accessing the rivers and lakes (LRMA-G-05). There is also now language about livestock occasionally crossing the Verde River if permitted in the allotment management plan (LRMA-G-06).

Issue 1: Recreation Management

This alternative calls for components of the proposed forest plan to focus on providing more accessible recreation opportunities that favor motorized recreation, having fewer restrictions on land uses (e.g., special uses).

Developed recreation and motorized uses / trails receive much of the emphasis in this alternative, with consideration to add new motorized trails and expand or create new developed sites to meet user demands and respond to changing trends in recreation visitation to certain areas. The Lakes and Rivers Management Area would provide specific direction designed to prioritize recreation management over other select resources to accommodate high levels of recreation along the lakes and major rivers of the Forest.

Issue 2: Natural Resource Management

The resource areas driving change in the forest plan related to this issue are vegetation and wildland fire management and riparian area management.

Vegetation and Wildland Fire Management

In alternative D, vegetation management in frequent-fire ecological response units focuses on restoring conditions primarily through mechanical treatments and focuses on increasing the supply of forest products. Prescribed burning is mainly focused in areas that have been previously thinned, and there would be fewer opportunities to use wildfires to meet resource objectives. Objectives to restore grass and herbaceous cover for highly departed ecological response units (e.g., pinyon-juniper grass and juniper grass) are similar to alternative B. However, there would be fewer treatment objective acres (more treatment objective acres are allocated to forested ecological response units). Alternative D also includes guidelines related to the northern goshawk which place management constraints on restoration activities (e.g., prescribed fire and mechanical treatments) during the breeding season. Objectives for desert ecosystems are the same as alternative B. However, there would be fewer treatment objective acres. Due to the increased use and limited restrictions in this alternative, treatment objectives would be mainly focused on highly impacted areas or high-risk areas.

Riparian Areas Management

While this alternative places more emphasis on other program areas (e.g., increasing developed recreation opportunities and maximizing forest products), riparian areas would still be managed to achieve desired conditions. Only riparian plan objectives are different for alternative D. Standards and guidelines would be the same as alternative B and alternative C. There are no specific objectives for restoring stream channel and riparian conditions, spring ecosystems, and aquatic habitat restoration (as described and included in alternatives B and C). Only the invasive species treatment objective of treating or controlling invasive species on 2 to 10 stream reaches every 5 years in riparian areas is included in this alternative.

Issue 3: Grazing and Rangeland Management

Alternative D is most similar to current management, alternative A. Vacant allotments would be granted to new or current permittees. This would increase the levels of authorized grazing on every ranger district. In addition, if an allotment becomes vacant in the future, the district would work to grant it and maintain current grazing levels. In this alternative the Lakes and Rivers Management Area would restrict grazing in currently vacant allotments, possibly causing them to be unusable in the future.

Issue 4: Economics

Alternative D focuses on increasing economic contribution of the forest and highlights the economic benefits of the forest in a number of ways. The alternative emphasizes increasing timber management to increase forest products, increasing developed and accessible recreation, allowing for removal of common variety minerals, and maintaining current grazing levels. All of these pieces directly impact the economic contribution of the Tonto National Forest.

Issue 5: Land Allocation and Allowed Uses

The purpose of alternative D is greater access and multiple use opportunities. In order to allow for greater access, and less use restriction in areas on the forest, this alternative does not include any recommended wilderness areas, proposed research natural areas, or proposed botanical areas.

Although the wilderness evaluation map for the wilderness recommendation process displays many areas and acres that possess wilderness characteristics, this alternative emphasizes restoration, access, and management that would use mechanical treatments and motorized access. Addressing these themes in this alternative is not consistent with the management of recommended wilderness areas; therefore no recommended wilderness is being analyzed. Similarly, land use restrictions in proposed research natural areas and proposed botanical areas would limit access and use in the areas, which is inconsistent with this alternative.

This alternative includes the Lakes and Rivers Management Area (45,553 acres), which provides management for the high use levels around the major lakes and rivers on the forest. By including the Lakes and Rivers Management Area, there is additional guidance to sustain and promote the high-use, access, and enhanced recreation these areas provide, consistent with the purpose of this alternative.

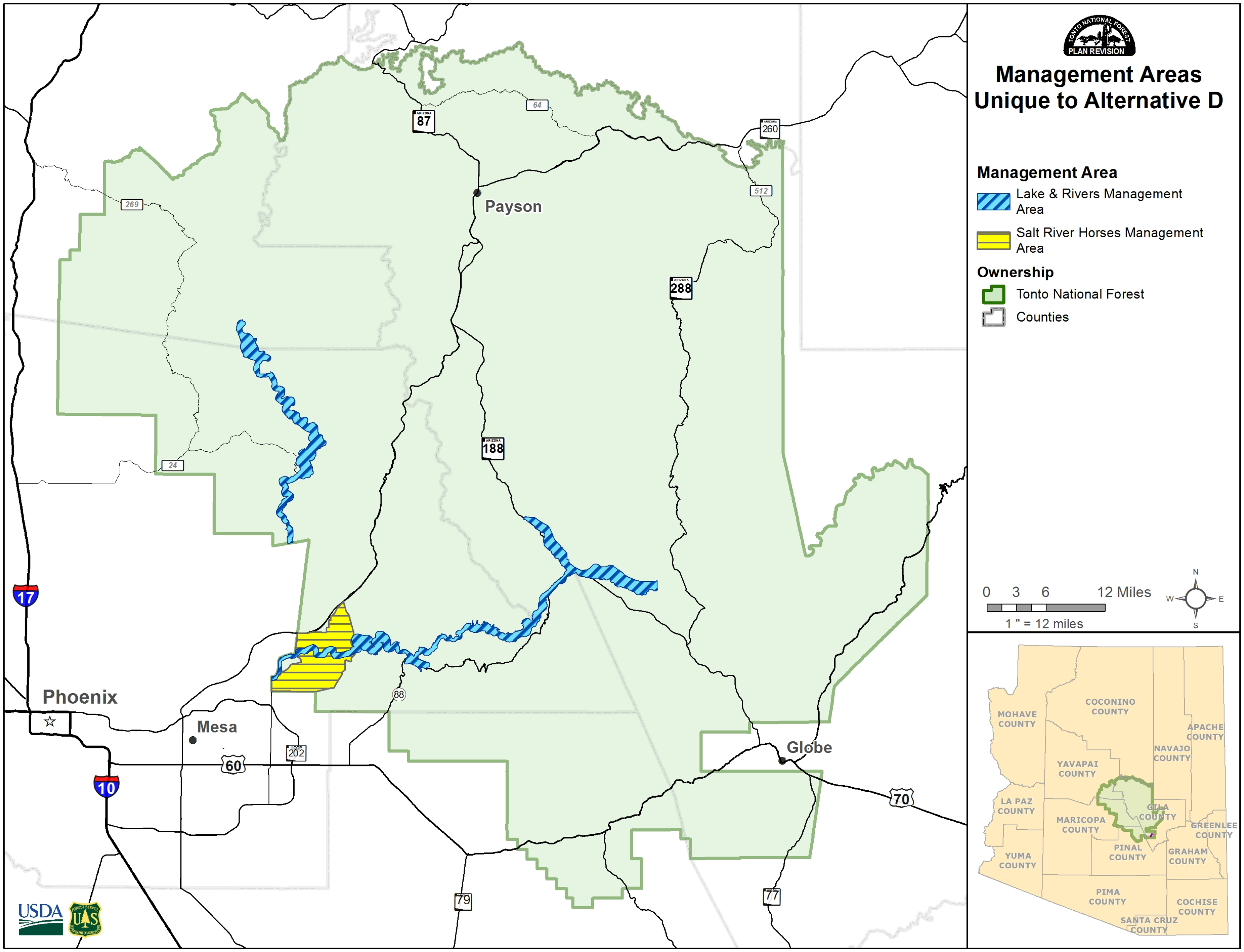


Figure 6. Management areas unique to alternative D

Comparison of Alternatives

Five key issues were developed during scoping to highlight effects or unintended consequences that may occur from the proposed action or alternatives. Alternatives were developed around these significant issues that involved unresolved conflicts concerning alternative uses of available resources (40 CFR 1500). These issues are described in more detail in chapter 1. This section provides a summary of the effects of implementing each alternative. Information in the following tables is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives. This section includes eight tables to provide a comparison between alternatives.

- Table 3 through table 6 display plan components changing by alternatives based on issues 1 through 4
    - Table 3 addresses issue 1: recreation opportunities
    - Table 4 addresses issue 2: natural resource management
    - Table 5 addresses issue 3: grazing and rangeland management
    - Table 6 addresses issue 4: economics
- Table 7 compares management areas by alternative (addresses issue 5: land allocation and allowed use)
- Table 8 displays a comparison of expected outputs by alternative
- Table 9 shows the effectiveness of each alternative in meeting each resource area’s desired conditions
- Table 10 identifies which needs for change statements relate to those key issues and evaluates which alternative(s) best meet those needs

These tables were updated between the draft and final environmental impact statement to reflect changes to the alternatives earlier in the chapter.

Table 3 is a comparison of plan components by recreation opportunities. These changes in plan components were developed to address the primary concerns from the public related to the issue.

Table 3. Comparison of plan components changing by alternative for issue 1: recreation opportunities

Resource	Plan Component	Alternative A	Alternative B	Alternative C	Alternative D
Recreation	Objective	None	Within 10 years of plan approval, develop or modify 1 to 4 systems[1] of sustainable, designated motorized trails (e.g., motorcycle, jeep, and off-highway vehicle trails) to adequately provide for these user groups and reduce user conflicts. Within 10 years of plan approval, develop or modify 1 to 4 systems of sustainable, designated nonmotorized trails (e.g., mountain biking, equestrian, hiking) to adequately provide for these user groups and reduce user conflicts.	Within 10 years of plan approval, modify 2 to 8 systems of sustainably designated nonmotorized trails (e.g., mountain bike trails, equestrian trails, and hiking trails) to adequately provide for these user groups and reduce user conflict.	Within 10 years of plan approval, develop or modify 2 to 8 systems of sustainably designated motorized trails (e.g., dirt bike and jeep trails) to adequately provide for these user groups and reduce user conflict.
Recreation	Objective	None	Every 5 years, take appropriate action (e.g., close, decommission, or convert) on at least 10 miles of motorized and/or nonmotorized trails[2] that may not offer recreational value (e.g., unsustainable, low-use, or have no remarkable destination value) or are not needed for administrative use.	Every 5 years, decommission or close 10 miles of motorized trails that may not offer recreational value (e.g., unsustainable, low-use, or have no remarkable destination value) or are not needed for administrative use.	Every 5 years, decommission or close 10 miles of motorized trails that may not offer recreational value (e.g., unsustainable, low-use, or have no remarkable destination value) or are not needed for administrative use.
Roads	Objective	None	Decommission[3] 100 – 600 miles of a combination of unauthorized routes and national forest system roads identified through the travel management process every ten years.	Same as alternative B	None

1 – A System (of trails) is a group or collection of trails or roads that are interconnected, defined access points, similar recreation destination values.

2 -- Designated trails / routes

3 – Decommission includes activities that result in restoration of unneeded roads to a more natural state using one or more of the options found per FSM 7734.

Table 4 is a comparison of plan components by natural resource management. These changes in plan components were developed to address the primary concerns from the public related to the issue. Bolded text in these tables represent the parts of the components that are changing by alternative. The acronyms displayed in this table are:

PPF - Ponderosa Pine Forest
PPE – Ponderosa Pine-Evergreen Oak
MCD - Mixed Conifer–Frequent Fire
PJG - Pinyon-Juniper Grass
JUG - Juniper Grass
MEW - Madrean Encinal Woodland
MPO - Madrean Pinyon Oak

Table 4. Comparison of plan components changing by alternative for issue 2: natural resource management

Resource Area	Plan Component	Alternative A	Alternative B	Alternative C	Alternative D
Vegetation and Wildland Fire	Frequent-fire forested ecological response unit objective	None	Restore or maintain conditions in frequent-fire forested ecological response units (PPF, PPE, and MCD), emphasizing treatments within PPE by: **Treating 50,000 to 122,000 acres** over a 10-year period with mechanical thinning and fire (Assume about 22 percent prescribed fire). **Treating 105,000 to 325,000 acres** over a 10-year period with fire. (Assume about 22 percent prescribed fire)	Restore or maintain conditions in frequent-fire forested ecological response units (PPF, PPE, and MCD) **primarily using fire** within PPE by: **Treating 11,000 to 22,000 acres** over a 10-year period with mechanical thinning and fire. (Assume about 22 percent prescribed fire). **Treating 144,000 to 423,000 acres** over a 10-year period using fire. (Assume about 22 percent prescribed fire)	Restore or maintain conditions in frequent-fire forested ecological response units (PPF, PPE, and MCD) **through more intensive mechanical treatments** (forest products focus): **Treating 50,000 to 190,000 acres** over a 10-year period with mechanical thinning and fire. (Assume about 22 percent prescribed fire). **Treating 16,000 to 62,000 acres** over a 10-year period using fire (Assume about 22 percent prescribed fire)
Vegetation and Wildland Fire	Woodland ecological response unit objective	None	Restore or maintain conditions in woodland ecological response units with frequent fire (PJG, JUG, MEW, MPO) by: **Treating 400 to 2,000 acres** over a 10-year period with mechanical thinning and wildland fire. **Treating 20,000 to 200,000 acres** over a 10-year period with fire. (assume about 22 percent prescribed fire)	Restore or maintain conditions in woodland ecological response units with frequent fire (PJG, JUG, MEW, MPO) by: **Treating 230,000 to 410,000 acres** over a 10-year period using fire. (assume about 22 percent prescribed fire)	There are no objectives for woodland ecological response units – treatments are prioritized for frequent-fire forested ecological response units and forest products (including commercial timber harvest).

Resource Area	Plan Component	Alternative A	Alternative B	Alternative C	Alternative D
Vegetation and Wildland Fire	Semi-desert grassland ecological response unit objective	None	Restore at least 500 acres if semi-desert grasslands over a 10-year period.	Same as alternative B	Same as alternative B
Vegetation and Wildland Fire	Desert ecological response unit objective	None	Survey, inventory, or treat 10,000 to 15,000 acres of invasive species (e.g., buffelgrass, fountain grass, and red brome) in desert ecological response units (Sonoran Desert plant communities and Sonora-Mojave mixed-salt desert scrub) over a 10-year period.	Same as alternative B	Same as alternative B
Wildlife, Fish, and Plants	Guideline	Establish a minimum of 3 nest areas and 3 replacement nest areas per post-fledging family area. The nest areas and replacement nest areas should be approximately 30 acres in size. A minimum total of 180 acres of nest areas should be identified within each post-fledging family area.	None	None	A minimum of 6 nest areas (known and replacement) should be located per territory. Goshawk nest and replacement nest areas should generally be located in drainages, at the base of slopes, and on northerly (NW to NE) aspects. Nest areas should generally be 25 to 30 acres in size
Wildlife, Fish, and Plants	Guideline	Post-fledging family areas will be approximately 600 acres in size. Post-fledging family areas will include the nest sites and consist of the habitat most likely to be used by the fledglings during their early development.	None	None	Goshawk per post-fledging family areas of approximately 420 acres in size should be designated surrounding the nest sites
Wildlife, Fish, and Plants	Guideline	Limit human activities in or near nest sites and post-fledging family areas during the breeding season so that goshawk reproductive success is not affected by human activities. The breeding season extends from March 1 through September 30.	None	None	Human presence should be minimized in occupied goshawk nest areas during nesting season of March 1 through September 30

Resource Area	Plan Component	Alternative A	Alternative B	Alternative C	Alternative D
Riparian Areas, Seeps, Springs Wetlands, and Riparian Management Zones	Objective	None	Complete active and passive restoration projects on at least 125 miles of streams every 10 years to improve the ecological integrity of perennial and intermittent riparian ecosystems rated as nonfunctional and functional-at-risk[1].	Same as alternative B	None
Riparian Areas, Seeps, Springs Wetlands, and Riparian Management Zones	Objective	None	Improve or maintain 10 to 15 individual springs over a 10-year period.	Same as alternative B	None
Riparian Areas, Seeps, Springs Wetlands, and Riparian Management Zones	Standard	None	None	If a riparian area is nonfunctional, as identified in the Proper Functioning Condition Assessment framework or similar protocol, all permitted and allowed uses will be removed until riparian recovery is achieved.	None
Riparian Areas, Seeps, Springs Wetlands, and Riparian Management Zones	Guideline	None	In riparian management zones, projects and management activities should be designed and implemented to **maintain or restore** long-term natural streambank stability, native vegetation, floodplain, and soil function.	Same as alternative B	In riparian management zones, projects and management activities should be designed and implemented to **maintain** long-term natural streambank stability, native vegetation, floodplain, and soil function.
Invasive Species	Objective	None	Treat and control invasive species on 2 to 10 stream reaches (generally 0.25 miles) every five years.	Same as alternative B	Same as alternative B

1 - Both nonfunctional and functional-at-risk are synonyms with the Proper Functioning Condition assessment framework and terms “Nonfunctional” and “Functional-at-risk.” Nonfunctioning riparian areas are highly degraded, and do not provide adequate vegetation, landform, or woody material to dissipate stream energy associated with moderately high flows, and thus are not reducing erosion or providing ecosystem services such as improving water quality. Functional-at-risk riparian areas are limited in functioning condition, however existing hydrological, vegetative, or geomorphic attributes make them susceptible to impairment.

Table 5 is a comparison of plan components by grazing and rangeland management. These changes in plan components were developed to address the primary concerns from the public related to the issue.

Table 5. Comparison of plan components changing by alternative for issue 3: grazing and rangeland management

Resource Area	Plan Component	Alternative A	Alternative B	Alternative C	Alternative D
Rangelands, Forage, and Grazing	Objective	None	At least one vacant allotment should be evaluated for one of the following options every two years, until there are no vacant allotments. • Conversion to forage reserves to improve resource management flexibility, • Grant to current or new permittees, or • Closure to permitted grazing, in whole or in part. If additional allotments are waived without preference, they will be evaluated for one, or a combination, of the above options as part of the above two-year timeframe.	At least one vacant allotment should be evaluated and closed to permitted grazing every two years, until there are no vacant allotments. If additional allotments are waived without preference they will be evaluated and closed as part of the above two-year timeframe.	At least one vacant allotment should be evaluated and granted to a current or new permittee every two years, until there are no vacant allotments. If additional allotments are waived without preference they will be evaluated and granted to a current or new permittee as part of the above two-year timeframe.
Rangelands, Forage, and Grazing	Standard	None	None	All currently vacant allotments will be closed.	None

Table 6 is a comparison of plan components by economics. These changes in plan components were developed to address the primary concerns from the public related to the issue.

Table 6. Comparison of plan components changing by alternative for issue 4: economics

Resource Area	Plan Component Type	Alternative A	Alternative B	Alternative C	Alternative D
Mining, Minerals, and Abandoned Mines	Standard and/or Guideline	None	Mineral materials (e.g., sand and gravel) should not be removed from the riparian management zone without adequate engineering controls to protect surface waters.	(Standard instead) Mineral materials (e.g., sand and gravel) shall not be removed from the riparian management zone.	None

Table 7 is a comparison of management areas (land allocation and allowed use). These changes in allocation of management areas were developed to address the primary concerns from the public related to the issue of land allocation and allowed uses.

Table 7. Comparison of management areas among the four alternatives for issue 5: land allocation and allowed uses

Management Area Type	Alternative A	Alternative B	Alternative C	Alternative D
Designated Wilderness	Four Peaks, Hellsgate, Mazatzal, Pine Mountain, Salome, Salt River Canyon, Sierra Ancha, and Superstition. About 588,575 acres.	Four Peaks, Hellsgate, Mazatzal, Pine Mountain, Salome, Salt River Canyon, Sierra Ancha, and Superstition. About 588,575 acres.	Four Peaks, Hellsgate, Mazatzal, Pine Mountain, Salome, Salt River Canyon, Sierra Ancha, and Superstition. About 588,575 acres.	Four Peaks, Hellsgate, Mazatzal, Pine Mountain, Salome, Salt River Canyon, Sierra Ancha, and Superstition. About 588,575 acres.
Recommended Wilderness	None	11 areas; about 43,204 acres.	50 areas; about 399,029 acres.	None
Designated Wild and Scenic Rivers	Fossil Creek, Verde River. About 57 miles.	Fossil Creek, Verde River. About 57 miles.	Fossil Creek, Verde River. About 57 miles.	Fossil Creek, Verde River. About 57 miles.
Eligible Wild and Scenic Rivers	19 eligible segments. About 188 miles.	19 eligible segments. About 188 miles.	19 eligible segments. About 188 miles.	19 eligible segments. About 188 miles.
Proposed Botanical Areas	None	Fossil Springs, Little Green Valley Fen, Horseshoe, Mesquite Wash. About 3,630 acres.	Fossil Springs, Little Green Valley Fen, Horseshoe, Mesquite Wash. About 3,630 acres.	None
Proposed Research Natural Areas	Picketpost Mountain, Upper Forks Parker Creek. About 2,701 acres.	Dutchwoman Butte, Picketpost Mountain, Three Bar, Upper Forks Parker Creek. About 25,707 acres.	Dutchwoman Butte, Picketpost Mountain, Three Bar, Upper Forks Parker Creek. About 25,707 acres.	None
Management Areas	Management Areas 1A – 6K covering the whole Forest and includes: Blue Point Cottonwood, Fossil Springs Natural Area, Sycamore Creek Natural Area, Three Bar Wildlife Area, Apache Leap Special Management Area, Saguaro Wild Burro Management Area.	Lakes and Rivers Management Area, Salt River Horse Management Area, Apache Leap Special Management Area, and Saguaro Wild Burro Management Area. About 94,820 acres.	Salt River Horse Management Area, Apache Leap Special Management Area, and Saguaro Wild Burro Management Area, About 49,267 acres.	Lakes and Rivers Management Area, Salt River Horse Management Area, Apache Leap Special Management Area, and Saguaro Wild Burro Management Area. About 94,820 acres.

Table 8 displays the alternative expected outputs of each alternative. Outputs can be quantitatively distinguished across alternatives and consider the specific roles and contributions made by the Forest Service. The acronyms displayed in this table are:

PTSQ: projected timber sale quantity
PWSQ: projected wood sale quantity
AUMs: animal unit months
MBF: thousand board feet
MCF: thousand cubic feet

Table 8. Alternative comparison of expected outputs

Expected Outputs	Alternative A	Alternative B	Alternative C	Alternative D
Jobs and Income	3,237 jobs $171,526,000 income	3,298 jobs $174,094,000 income	3,267 jobs $172,848,000 income	3,309 jobs $174,556,000 income
Suitable Timber Acres	189,295 acres	188,851 acres	184,224 acres	189,517 acres
Timber MBF and MCF for PTSQ and PWSQ	PTSQ 7,400 MBF 1,800 MCF PWSQ 2,200 MCF	PTSQ 15,400 MBF 3,400 MCF PWSQ 4,100 MCF	PTSQ 10,600 MBF 2,400 MCF PWSQ 3,000 MCF	PTSQ 18,600 MBF 4,000 MCF PWSQ 4,700 MCF
Fuelwood (tons or cords)	4,270 MCF 79,039 Tons	4,440 MCF 83,344 Tons	4,350 MCF 81,140 Tons	4,450 MCF 83,658 Tons
Mechanical Treatments	No Objectives; 38,250 acres over a 10-year period	50,400 to 124,000 acres over a 10-year period	11,000 to 22,000 acres over a 10-year period	50,000 to 190,000 acres over a 10-year period
Wildland Fire Acres (Natural and Prescribed Fire and assumes about 22 percent prescribed fire)	No Objectives; 55,000 to 140,000 acres over a 10-year period	125,000 to 649,000 acres over a 10-year period	385,000 to 855,000 acres over a 10-year period	66,000 to 252,000 acres over a 10-year period
Range (AUMS)	191,369	Same as alternative A	May reduce AUMs	May increase AUMs

Table 9 displays how effective an alternative is at achieving desired conditions for each resource identified in the forest plan. The alternative that has the best ability to achieve desired conditions is labeled the "most effective." The alternative that would achieve desired conditions, but at a potentially slower rate, is labeled as effective. The alternative that would be the slowest at achieving desired conditions is labeled as "least effective." The alternative that would have the most difficulty in achieving desired conditions is labeled as "ineffective."

Table 9. Comparison of how alternatives meet desired conditions by resource

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Recreation Overall	Ineffective	Most effective	Effective	Most effective
Developed Recreation	Ineffective	Most effective	Least effective	Effective
Dispersed Recreation - Motorized	Ineffective	Effective	Least effective	Most effective
Dispersed Recreation - Nonmotorized	Ineffective	Effective	Most effective	Least effective
Dispersed Recreation - Water Based	Ineffective	Most effective	Least effective	Effective
Dispersed Recreation - Recreational Shooting	Ineffective	Most effective	Least effective	Effective
Recreation – Wildlife-Related	Ineffective	Most effective	Ineffective	Effective
Lands, Special Uses, and Access				
Special Uses	Ineffective	Effective	Least effective	Most effective
Lands and Access	Ineffective	Most effective	Least effective	Effective
Alternative Energy Production and Delivery	Least effective	Effective	Ineffective	Most effective
Rangelands, Forage, and Grazing				
Rangeland Health	Least effective	Most effective	Effective	Least effective
Permittees	Effective	Effective	Ineffective	Most effective
Cultural and Historic Resources	Least effective	Effective	Most effective	Ineffective
Tribal Relations and Areas of Tribal Importance	Least effective	Effective	Most effective	Ineffective
Economic Contributions	Effective	Most effective	Least effective	Most effective
Environmental Justice	Least effective	Effective	Least effective	Most effective
Forestry and Forest Products	Least effective	Effective	Least effective	Most effective
Scenery	Least effective	Effective	Most effective	Least effective
Mining, Minerals, and Abandoned Mines	Effective	Most effective	Ineffective	Effective
Roads	Effective	Effective	Effective	Effective
Facilities	Effective	Effective	Effective	Effective

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Vegetation Ecological Response Units (ERU) and Fire and Fuels (Overall)	Least effective	Most effective	Effective	Least effective
Ponderosa Pine Evergreen Oak ERU	Least effective	Most effective	Effective	Effective
Ponderosa Pine Forest ERU	Least effective	Most effective	Effective	Least effective
Mixed Conifer – Frequent Fire ERU	Least effective	Most effective	Effective	Least effective
Mixed Conifer with Aspen ERU	Least effective	Most effective	Effective	Least effective
Madrean Pinyon Oak ERU	Ineffective	Most effective	Effective	Ineffective
Madrean Encinal Woodland ERU	Ineffective	Most effective	Effective	Ineffective
Pinyon Juniper Grass ERU	Ineffective	Most effective	Effective	Ineffective
Juniper Grass ERU	Ineffective	Most effective	Effective	Ineffective
Pinyon Juniper Woodland ERU	Effective	Effective	Effective	Effective
Pinyon Juniper Evergreen Shrub ERU	Effective	Effective	Effective	Effective
Interior Chaparral ERU	Effective	Effective	Effective	Effective
Semi-desert Grassland ERU	Ineffective	Least effective	Least effective	Least effective
Desert ERUs (Mojave Sonoran Desert Scrub and Sonora Mojave Mixed Salt Desert Scrub)	Ineffective	Least effective	Effective	Ineffective
Riparian Ecological Response Units	Least effective	Effective	Effective	Least effective
Watersheds and Water Resources	Least effective	Most Effective	Effective	Least effective
Wildlife, Fish, and Plants	Ineffective	Effective	Most effective	Effective
Invasive Species	Ineffective	Most Effective	Effective	Least effective
Soils	Ineffective	Effective	Most effective	Ineffective
Caves and Karsts	Least effective	Most effective	Ineffective	Ineffective
Air Quality	Least effective	Effective	Effective	Least effective

Table 10 identifies which needs for change statements relate to those key issues and evaluates which alternative(s) best meet those needs. Needs to change statements that are addressed equally across each alternative are not included in this table. Alternatives are ranked as "best" for the alternative that best meets the identified need, "good" for meeting the need but not most effectively, "neutral" for not meeting the need or not having any negative affects toward meeting the need, or "undesirable" for not moving towards meeting the identified need for change.

Table 10. Comparison of how each alternative meets the needs to change

Key Issue	Need to Change	Alternative A	Alternative B	Alternative C	Alternative D
Recreation Opportunities	Management approaches to address changing trends in services, activities, and types of facilities desired by the public, while balancing those trends with other resources.	Undesirable	Best	Neutral	Good
Recreation Opportunities	Plan components to address user conflicts (e.g., recreational shooting and hikers, equestrians and bicyclists, and motorized and nonmotorized users).	Undesirable	Best	Good	Good
Natural Resource Management	Management approaches that promote seeking outside assistance in addition to working with partners and volunteers to manage resources and monitor activities.	Undesirable	Best	Good	Good
Natural Resource Management	Desired conditions that identify appropriate riparian characteristics (e.g., biodiversity, connectivity, water availability) that promote functionality and resiliency while taking into account multiple stressors.	Undesirable	Best	Good	Neutral
Natural Resource Management	Standards and guidelines that minimize ecological impacts of multiple uses in riparian areas.	Neutral	Good	Good	Undesirable
Natural Resource Management	Include plan components that consider potential climate change impacts (e.g., increases in storm events, uncharacteristic wildfire, drought, flooding, and other extreme weather) to ecosystems and natural resources.	Undesirable	Best	Good	Good
Land Allocations and Allowed Uses	Reduce the complexity of plan components related to management areas that fragment the landscape by their arrangement, boundaries, and differing management direction.	Undesirable	Good	Neutral	Good
Land Allocations and Allowed Uses	Management approaches that emphasize better coordination and collaboration with other forests, local governments, and Tribes to minimize conflict between local planning and zoning direction as a result of our decisions, while at the same time becoming more aware of how local regulation might enhance our own management goals, or alternatively, interfere with our own desired outcomes.	Neutral	Good	Good	Good
Land Allocations and Allowed Uses	Identify and evaluate potential additions to the National Wilderness Preservation System and eligibility of rivers for inclusion in the National Wild and Scenic Rivers Systems, and potentially other types of designated areas.	Undesirable	Good	Best	Neutral
Grazing and Rangeland Management	Plan components for rangeland management that maintain or restore ecological integrity of rangelands.	Neutral	Good	Best	Good
Grazing and Rangeland Management	Plan components that allow flexibility in rangeland management to prepare for changing conditions such as drought, fire, social and economic needs.	Undesirable	Best	Undesirable	Good

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by the National Environmental Policy Act (NEPA) to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the notice of intent (April 2017), preliminary proposed plan (November 2017), initial alternative themes (April 2018), and draft environmental impact statement (March 2020), provided suggestions for alternative methods for achieving the purpose and need. Some of these alternatives are outside the scope of the purpose and need, duplicative of the alternatives considered in detail, or include components that would cause unnecessary environmental harm. Therefore, a number of alternatives were considered, but dismissed from detailed consideration for the reasons summarized below.

Alternative that analyzes all recommended wilderness areas with moderate and high evaluation rankings

The Tonto National Forest received comment letters on the draft environmental impact statement asking the Forest to analyze an alternative that includes all areas from the recommended wilderness evaluation that received a moderate wilderness characteristic ranking or above. This request for an additional alternative was considered but eliminated from detailed study. Per agency policy in the Forest Service Handbook, not all lands included in the inventory and subsequent evaluations are required to be carried forward in an alternative. Based on the evaluation and input from public participation opportunities, the Responsible Official shall identify which specific areas, or portions thereof, from the evaluation to analyze as recommended wilderness in one or more alternatives in the plan environmental impact statement (36 CFR 219, FSM 1920, and FSH 1909.15).

Additionally, the Multiple Use Sustained Yield Act (MUSYA) mandates national forests be managed for multiple uses which includes recreation, motorized access, wilderness area management, and ecosystems management to protect wildlife habitat. The alternative, which would have included 643,923 acres of recommended wilderness, was not analyzed in detail because it would inhibit the Tonto National Forest in achieving multiple use desired conditions outlined in the revised forest plan. Management of recommended wilderness is for the protection of the wilderness characteristics, which could restrict some uses of national forest system lands. For example, many of the areas with moderate ranked characteristics would benefit from restoration and weed treatments that would be more efficient and effective using mechanical tools, moving those areas closer to desired conditions. Based on the above, an alternative with over 643,000 acres of recommended wilderness would not meet the purpose and need.

Alternative that focuses on increasing the opportunities for mountain biking

The Tonto National Forest received form letters requesting an alternative that would enhance and increase recreational opportunities for mountain biking. Based on the National Visitor Use Monitoring survey, mountain biking is only a subset of the recreational uses on the forest and an alternative focused specifically on that use alone does not meet the desired conditions for recreation. In addition, alternative D was developed to address public comments that expressed a desire for easier access and multiple use opportunities on the forest which would include increased accessible recreation opportunities such as mountain biking. None of the action alternatives decrease or preclude the use of mountain bikes where legally permitted. Based on the above, an alternative focused solely on mountain biking would not meet the purpose and need.

Alternative that directs only extractive uses of the forest (such as mining, logging, and grazing) to increase economic contribution

The Tonto National Forest received comments requesting an alternative that would direct only extractive uses of the forest (e.g., mining, logging, and grazing) to increase economic contribution. An alternative which would direct forest management on specific resources at the exclusion of others would be contrary to law, and therefore, would not be a selectable alternative. Specifically, the Multiple-Use Sustained-Yield Act of 1960 says that "national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes" (16 U.S.C. 528).

Further, this alternative would not meet the desired conditions for the multiple uses in the plan (e.g., recreation, special uses, and wildlife). Alternative D considers fewer restrictions on land uses including mining, logging, and range and is designed to increase economic contribution. Based on the above, an alternative focused solely on extractive uses of the forest would not meet the purpose and need, is unnecessary, and is not legally compliant.

Alternative that removes grazing from the entire forest

The Tonto National Forest received comments requesting an alternative that would remove grazing from the entire forest. A no-grazing alternative would not meet legal direction that forests will be managed using multiple use and sustained yield principles per the National Forest Management Act and Multiple-Use Sustained Yield Act of 1960. This alternative also would not allow the attainment of the desired condition for livestock grazing to contribute to the long-term socioeconomic diversity, stability, and cultural identity of local communities. Therefore, a no grazing alternative is inconsistent with existing laws, Forest Service policy and direction, as well as the purpose and need of revising the forest plan.

Under all alternatives the rangelands management and livestock grazing program has multiple mechanisms to evaluate, review, and adapt management as needed to effectively protect resources and respond to changing conditions. Stocking decisions regarding the amount of livestock grazing authorized for each grazing allotment are considered as part of the project-level National Environmental Policy Act analysis and is beyond the scope of this programmatic analysis for the forest plan. Project-level analysis would cover changes to authorized grazing through term grazing permits (subject to forestwide standards and guidelines); allotment management plans; and annual operating instructions. In addition, the alternatives include a range of options on how to deal with vacant and understocked allotments that could increase or decrease grazing numbers. Based on the above, an alternative that removes grazing on the forest is not considered necessary and is not legally compliant.

Alternative that removes mining from the entire forest

The Tonto National Forest received comments requesting an alternative that would remove mining from the entire forest. An alternative which would direct forest management of some resources at the exclusion of others would be contrary to law, and therefore, would not be a selectable alternative. Specifically, the Multiple-Use Sustained-Yield Act of 1960 says that "national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes" (16 U.S.C. 528). This alternative also would not allow the attainment of the desired conditions for mining, minerals, and abandoned mines to contribute to the long-term socioeconomic diversity, stability, and cultural diversity of local communities. Therefore, a no mining alternative is inconsistent with existing laws, Forest Service policy and direction, as well as the purpose and need of revising the forest plan.

Under all alternatives the mining and minerals management program has multiple mechanisms to evaluate activities on the forest as part of project-level National Environmental Policy Act analysis and is beyond the scope of this programmatic analysis for the forest plan. Alternative C also emphasizes increased protections to natural resources, limiting some aspects of grazing, and prioritizes natural resources over some economic development opportunities. Based on the above, an alternative that removes mining on the forest is not considered necessary and is not legally compliant.

Alternative that removes designation of currently designated areas on the forest (e.g., wilderness areas and research natural areas)

The Tonto National Forest received comments requesting an alternative that would remove designation of some currently designated areas (e.g., wilderness areas and research natural areas) on the forest. It is not a requirement under the 2012 Planning Rule to explore the un-designation of currently designated areas. In addition, the removing the designation of currently designated areas could not be fully accomplished through plan revision, as it requires a separate National Environmental Policy Act process. The 2012 Planning Rule directives states “once established, the designation continues until a subsequent decision by the appropriate authority removes the designation. Changes in actual designations do not occur as part of the plan decision” (FSH 1909.12).

Forest plans can recommend the removal of designation, but it was determined the plan revision process was not the appropriate venue for such an action. If, in the future, the Tonto National Forest explores removing the designation of an area, of which it has the authority to do so, it would be completed through project level National Environmental Policy Act analysis specific to that area.

Alternative that includes a Mineral Exploration Management Area and a Wildlife Emphasis Management Area

The Tonto National Forest received comments requesting an alternative that would include a mineral exploration management area and a wildlife emphasis management area. The planning team developed language for these requested management areas in an attempt to address issues brought up during scoping and public meetings.

The Mineral Exploration Management Area would have consisted of an area generally located on Globe Ranger District, within what is known as the Copper Triangle and was proposed throughout the public involvement process. Mining and related activities on National Forest System lands are governed by specific laws that identify procedures and conditions under which prospecting, exploration, and development of minerals can be carried out. The search for mineral deposits is possible throughout the Forest in lands that are open to mineral entry under the mining laws. However, the Globe and Mesa Ranger Districts receive proposed plans of operations for mineral exploration activity more often than any other district on the Forest. Resource issues and conflicts for mineral activity on the Globe and Mesa Ranger Districts primarily consist of effects to cultural resources, wildlife, and riparian areas. For mineral exploration proposals, site specific mitigation measures are applied to each project, addressing specific concerns for cultural resources, wildlife, and riparian areas in order to minimize adverse environmental impacts on National Forest System surface resources.

The Wildlife Emphasis Management Area was developed in response to a proposal from local stakeholders to maintain wildlife connectivity and preserve landscape integrity between the Mazatzal and Four Peaks Wilderness Areas. Movement across the landscape is a crucial part of life for many species, contributing to gene flow, dispersal, and colonization important in meta-population dynamics. Thus, the primary purpose of this management area was to promote connectivity that will benefit species, in particular between wilderness areas. While significant infrastructure is present in the area (SR 87 and transmission lines), plan content should seek to protect the existing values and encourage projects that make these barriers more permeable.

After consideration and attempting to develop these two management areas, it was found that both were redundant with proposed management forestwide within the developed alternatives. For example, alternative C has a recommended wilderness area that overlaps with over half of the proposed Wildlife Emphasis Management Area and also provides the publicly identified protection measures. This area also overlaps with several inventoried roadless areas which already provide for nonmotorized protections. Additionally, the proposed wildlife area is not an area that has a concentration of species at risk, and does not take into account existing highways that are not under Forest Service authority. Alternative D considers fewer restrictions on land uses, including mining and minerals. Any programmatic level direction that would be included in a Mineral Exploration Management Area is redundant with direction already described in the alternatives, particularly alternative D, or would be considered site-specifically at a project level. For these reasons, consideration of these management areas were eliminated from detailed study in this environmental impact statement.

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Chapter 3. Affected Environment and Environmental Consequences

This section forms the scientific and analytic basis for the comparisons under §1502.14. It shall consolidate the discussions of those elements required by sections 102(2)(C) (i), (ii), (iv), and (v) of the National Environmental Policy Act which are within the scope of the statement and as much of section 102(2)(C)(iii) as is necessary to support the comparisons. The discussion will include the environmental impacts of the alternatives including the proposed action, any adverse environmental effects which cannot be avoided should the proposal be implemented, the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented."

Introduction

This chapter summarizes the physical, biological, social, and economic environments of the plan area and the potential environmental consequences that may occur on those environments by implementing each alternative. It also presents the scientific and analytical basis for the comparison of alternatives presented in chapter 2. Where indicated, more detailed information, including methodology, assumptions, and effects analyses can be found in appendix B and in the planning record.

Comments were received on the draft environmental impact statement between December 13, 2019 – March 12, 2020. Changes have been made to the alternatives as detailed in chapter 2. Where necessary, the analysis has been updated by resource area to reflect these changes. Details for what changed in response to comments can be found in appendix A.

Programmatic Framework of the Land Management Plan

The focus of this analysis is to examine the implications or longer-term environmental consequences of managing the Tonto under the programmatic framework provided by the forest plan and proposed alternatives. Forest plans do not authorize, fund, or carry out any project or activity. Instead, they provide a programmatic framework that guides site-specific actions that may be carried out in the future.

Because a land management plan (forest plan) does not authorize or mandate any site-specific projects or activities (including ground-disturbing actions), there can be no direct effects. The forest plan sets the stage for what future management actions are needed to achieve desired outcomes (e.g., desired conditions and objectives), and provides the sideboards (e.g., suitability, standards, and guidelines) under which future activities may occur to manage risks to ecological, social, and economic environments. The forest plan also identifies potential management approaches that may be used to help achieve desired conditions. To actually plan and proceed with a site-specific project, project-level planning, environmental analysis, and decisions must occur and decisions must occur guided by the direction in the forest plan.

Forest Plan Coding System

Throughout this analysis resource areas identify specific plan components in the forest plan. The plan uses a coding system to reference plan components more easily and to determine where the plan components apply. These codes consist of a series of letters and numbers to establish what resource area and plan component is being referenced. The coding is structured in an AA-BB-CC-## format.

In this coding system, the first series of letters reference a specific resource area in the forest plan (e.g., ERU for ecological response units or REC for recreation). If present, the middle two series of letters reference the sub-resource (level 2 and level 3) of the specific resource area. The last series of letters reference the type of plan component (e.g., DC for desired condition, O for objective, S for standard, and G for guideline). These can include lands of specific character or use type (e.g., DES for desert ecosystems or DIS-WB for dispersed recreation water-based) found within the resource. Each code then ends with a number that aligns with the individual plan component to differentiate between similar type plan components.

Throughout chapter 3 the first occurrence of a plan component will be either quoted or paraphrased followed by the plan component code in parenthesis. For example: Partners and volunteers work effectively to increase capacity for managing forest resources, assist in communicating with and educating the public, and achieve restoration and sustainable recreation goals (FW-PV-DC-01). All following references to the plan components will just include the associated code.

A full description of the plan code structure, including a list of associated acronyms, can be found in the forest plan.

Environmental Analyses and Overall Assumptions

During development of the environmental analyses that follow, the Tonto National Forest planning team has used the best available scientific information, which is documented in the planning record. The environmental analyses focus on the needs for changing the existing plan and the significant issues identified through the scoping process.

The discussions in chapter 3 refer to the potential for consequences to occur, realizing they are only estimates in many cases. To estimate the consequences of alternatives at the programmatic plan level, we must assume the kinds of resource management activities allowed under the prescriptions will occur to the extent necessary to move toward or achieve the objectives of each alternative. In many cases, the nature of the consequences is similar across the forest but the magnitude of the consequences vary by the difference in plan objectives and specific plan components for different management areas by alternative.

Several assumptions were made in the analyses of alternatives:

- The Tonto National Forest plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carry out any project or activity (including ground-disturbing actions). As a result, it does not result in direct effects. However, there may be implications, or longer-term indirect or cumulative environmental consequences from managing the forest under this programmatic framework.
- Before any ground-disturbing actions take place, they must be authorized in a subsequent site-specific environmental analysis. Therefore, none of the alternatives would cause unavoidable adverse impacts or an irreversible or irretrievable commitment of resources.
- The planning components (desired conditions, objectives, standards, guidelines, management areas, and monitoring) will be followed when planning or implementing site-specific projects and activities.
- Law, regulation, and policy regulations will be followed when planning or implementing site-specific projects and activities.
- Funding levels will be similar to the past 5 years.

- The planning timeframe for the effects analysis is 10 to15 years; although other timeframes may be specified in the analysis, depending on the resource and potential consequences.
- Monitoring identified in the plan's monitoring chapter will occur.
- The land management plan (forest plan) will be amended, as needed, during the life of the plan.
- Large fires, and other natural events that change resources, have occurred during the planning effort. This does not impact the analysis below as the plan incorporates language to address these changes and manage for large natural events.
- Concurrent management activities occur during the planning effort under the 1985 Tonto National Forest plan.

For the following analysis, all alternatives are evaluated in terms of how well they achieve the same set of desired conditions, regardless of whether the alternative articulates those desired conditions.

Assumptions and methods used for some resources can be found in appendix B.

Partnerships and Volunteers

Forest managers rely on the participation and involvement from partners, organizations, and individuals from neighboring communities to help achieve effective management and protection of vast resources throughout the Forest. Given the agency's constraints on personnel, funding, and other resources, these relationships are extremely valuable for multiple resource areas throughout the Forest including soils, wildlife, recreation, fire, watersheds, and even business administration (e.g., clerical paperwork such as entering volunteer hours, processing permits, answering public phone calls and inquiries).

Affected Environment

Partnerships and volunteers are a timely topic on the Tonto National Forest. Depending on staff workloads and availability, some ranger district offices (districts) on the Forest and the Supervisor's Office have developed and maintained successful relationships with local partners and volunteers. Seasonal student and intern crews are able to complete large sections of trail maintenance, campground hosts and site stewards maintain popular recreation areas, individual volunteers process permit requests and maintain files, and well-organized partners coordinate closely with the Forest to implement large projects and seek solutions to management issues. Annual volunteer clean-ups are also organized at the District level for areas with high visitation; the 2017 Four Peaks Clean Up event collected nearly 12 tons of garbage with 200 volunteer participants and several sponsoring clubs, and the 2017 spring Lower Salt River Clean Up event collected nearly 9 tons of trash with more than 500 participants and several sponsoring non-profits and clubs.

Some districts may not have the staffing levels needed to sustain a quality group of dedicated volunteers and partners; individual volunteers may be used to complete certain tasks, but large partnerships and group volunteer activities are not as developed as they could be.

The quality of the partnerships and volunteer programs across the Tonto National Forest vary from year to year. As staff changes occur, budgets decrease, and other projects become Forest priorities. On the other hand, when departments are staffed appropriately and districts place priority on partnerships and volunteer programs, the programs have the potential to thrive and both the agency and the public can benefit. For example, in 2014, volunteer and partner contributions totaled 47,250 hours on the Tonto National Forest and in 2016 the Tonto South Zone Volunteer and Partnership Program won the National Citizen Stewardship and Partnerships Award.

Environmental Effects

Alternative A Effects

In the 1985 forest plan, partnerships and volunteers are minimally addressed in relation to completing trail maintenance. Otherwise, they are not addressed anywhere else in the plan and no guidance is provided on how to implement and administer these programs or to what level of priority. Desired conditions in the forest plan aim to seek, build, and maintain relationships with partners and local communities and provide open communication. Partners and volunteers work effectively to increase capacity for managing forest resources, assist in communicating with and educating the public, and achieve restoration and sustainable recreation goals (FW-PV-DC-01)[9].

In alternative A, partnerships and volunteer programs would continue to operate as-is and there would be no direction on how to grow these programs or if priority should be given to expand them. Project work

[9] Refer to Chapter 3, Introduction section under Forest Plan Coding System for more information.

completed by volunteers and partners would be underutilized causing on-the-ground projects such as resource protection to go unfinished; Forest user satisfaction may decrease from the lack of field projects being completed and resources being protected; and the public's view of the Forest could potentially decline without quality partnerships and outreach for volunteers.

Effects Common to All Action Alternatives

Tonto National Forest partners and volunteers provide a wide variety of skills, knowledge, time, and resources to support the Forest's mission and meet resource objectives and goals. Alternatives B, C, and D all provide guidance for using partners and volunteers as a strategy to help manage the Forest's resources. Strong connections would exist between the Forest, partners, and local communities to increase capacity for managing forest resources, better educate the public, and achieve restoration and sustainable recreation goals (FW-PV-DC-01 and FW-PV-DC-05). In all action alternatives, conditions of all forest resources may improve with the help and efforts (e.g., physical field work, management planning and brainstorming) from partners and volunteers, including the relationships built between Forest managers and their partners, volunteers, local communities, etc.

Alternative B Effects

With a balanced approach of providing and managing both nonmotorized and motorized recreation opportunities, this alternative would provide the broadest set of opportunities for different partners and volunteers to participate and provide input on recreation management. When these relationships are formed and developed into successful, long-term commitments, the partners / volunteers and Forest both benefit. For example, by using volunteer work to conduct smaller maintenance projects and day-to-day tasks, the Forest can use limited funding on high-expense or elaborate projects such as dock replacement, restroom installation, parking lot asphalting, water system replacement, etc. And in turn, volunteers gain an understanding of how public lands are managed as well as the experience of making a difference on public lands. Partners and volunteers would also be used to implement large-scale projects, such as large sections of backcountry trail maintenance that Forest staff would not normally be able to achieve internally. Being able to complete these projects helps improve other resource functions as well, such as preventing negative effects such soil erosion by installing water bars on trails, and beneficial effects such as increasing overhead cover near popular recreation areas by planting native trees, or protecting cultural sites by installing educational signs and fencing around sensitive sites. There is a greater likelihood that partnerships and volunteers would help the Forest in achieving desired conditions – resulting in fewer negative effects and increased beneficial effects compared to alternative A.

Alternative C Effects

With an emphasis on nonmotorized and primitive recreation opportunities, alternative C places less priority on installing new recreation developments and infrastructure and calls for the decommissioning of low-use and unsustainable recreation features. Since a large portion of the work performed by partners and volunteers on the Tonto is currently related to projects and maintenance of developed facilities, system trails and roads, and water access points, this may result in less opportunities for partners and volunteers to provide support to the recreation department. Partners may also encounter stricter policies regarding maintaining or repairing existing facilities, especially related to motorized recreation. Less opportunities and more restrictions on the work that can be performed by partners and volunteers can hurt a long-standing relationship, leaving the Forest with less support to complete field tasks. Some existing partners and volunteers may decide to switch and focus their efforts on the Forest's priority of nonmotorized and primitive recreation projects, but for those who don't, the Forest may lose valuable relationships. This would result in field projects not being completed, such as the maintenance of developed facilities and motorized trails and the repair and replacement of educational kiosks and signs in developed areas. Without support from partners and volunteers to complete these projects and tasks, the Forest may see an increase in user-created motorized trails that cause soil erosion and compaction, vegetation overgrowth in developed areas, increased litter becoming a hazard to wildlife, and unsanitary restroom conditions that lead to public excrement at and near water sources.

On the reverse side, alternative C may lead to new and more opportunities for partners and volunteers to engage in nonmotorized and primitive recreation. With recreation management emphasizing these areas and uses, volunteer projects in these areas would increase, leading to improved conditions of other resources (e.g., less soil erosion from rehabilitated user-created nonmotorized trails and less damage to cultural sites due to additional public education).

Alternative D Effects

A large majority of the work performed by partners and volunteers on the Tonto is currently related to projects and maintenance of developed facilities, system trails and roads, and water access points. With an emphasis on motorized and accessible recreation opportunities, including installing new recreation developments and infrastructure and decommissioning low-use and unsustainable recreation features, alternative D would result in more opportunities for partners and volunteers to provide support to motorized and accessible recreation programs.

Additional support from partners and volunteers to complete field work such as maintaining motorized trails; installing and maintaining accurate signs and route markers; maintaining developed facilities including restrooms, picnic areas, and docks; and providing public education regarding responsible off-highway vehicle use and safe boating practices, would improve user satisfaction rates and potentially increase compliance in fee sites. Consistent maintenance and management of motorized and accessible recreation areas provided by partners and volunteers could also improve other resource conditions. For example, adequate route markers in off-highway vehicle areas may reduce the use of user-created motorized trails, resulting in less soil compaction and soil erosion. Range infrastructure may also see less vandalizing and damage from the public, improving range functions and reducing user conflicts.

On the reverse side, alternative D may result in less opportunities for partners and volunteers to engage in nonmotorized and primitive recreation programs. Less volunteer opportunities can hurt a long-standing relationship, leaving the Forest with less support to complete field tasks. Some existing partners and volunteers may decide to switch and focus their efforts on the Forest's priority of motorized and accessible recreation projects, but for those who don't, the Forest may lose valuable relationships. This would result in field projects not being completed, such as the maintenance of nonmotorized trails and the repair and replacement of educational signs and route markers in wilderness areas. Without support from partners and volunteers to complete these projects and tasks, the Forest may see an increase in user-created nonmotorized trails that cause soil erosion and compaction, vegetation overgrowth along trails and at trailheads, increased litter becoming a hazard to wildlife, and public excrement at and near water sources due to a lack of public education on Leave No Trace ethics.

Management Areas

Partnerships and volunteerism on the Tonto National Forest would not be affected by the different management areas as proposed in each alternative, with the exception of those described below.

With the proposed acres of recommended wildernesses, alternative B would provide additional opportunities for solitude and primitive recreation experiences. Visitation to these areas from the hiking and equestrian communities may increase, resulting in a demand for additional nonmotorized trails and recreation opportunities. Partnerships, volunteerism, and support from local businesses may grow to encourage the Forest to implement such recreation opportunities, addressing the desired condition "Recreational opportunities are successfully achieved through cooperative and collaborative engagement with the people we serve and our partnerships with individuals, organizations, and communities" (REC-DC-05). If new nonmotorized trails are installed following sustainable practices, other Forest resources such as soils, vegetation, wildlife, and watersheds within the recommended areas and eligible segments should see minimal to no negative impacts.

Alternative C has the most acreage of recommended wilderness of all the action alternatives. In this alternative, partnerships and volunteerism that focus on wildernesses would have the most opportunities to support the Forest in achieving desired conditions of all resources by performing field work and providing public education.

In alternative D, there are no recommended wilderness areas. Partnerships and volunteerism that focus on wildernesses may dissolve as these opportunities are focused on motorized recreation projects.

Partnerships and volunteering on the Tonto National Forest may slightly increase with the proposed botanical areas in alternatives B and C and the proposed research natural areas in alternatives A, B, and C; outside groups and individuals would likely be used to collect data within the areas.

The Lakes and Rivers Management Area in alternatives B and D should not affect partnerships and volunteers; the only predicted effect is a slight increase in opportunity with a potential for new "Adopt-a-Site" areas for partners and volunteers to help maintain, but this program already exists on the Forest and in the area of the Lakes and Rivers Management Area. With new Adopt-a-Site locations in the Lakes and Rivers Management Area, partners and volunteers can have a shared responsibility and stewardship of the land (FW-PV-DC-05) while improving conditions of recreation sites and other forest resources (e.g., cleaning restrooms to improve user satisfaction rates, picking up trash to reduce wildlife hazards, installing interpretive and regulatory signs to protect sensitive species areas or cultural resources).

Recreation

The Tonto National Forest is a recreational oasis for millions of visitors at the edge of the Phoenix Metropolitan area, one of the largest cities and fastest growing places in the United States. The Forest provides a place for visitors to escape from the busy urban environment into a diversity of year-round outdoor recreation opportunities. While there is easy access for intensive day-use activities, the rugged backcountry offers challenges and solitude accessible only by primitive roads and trails.

Year-round recreation opportunities are available to the Phoenix Metropolitan population and its two to three million visitors annually.[10] The Tonto offers spectacular opportunities including hiking, mountain biking, horseback riding, rock climbing, four-wheeling, motorized and nonmotorized boating, whitewater paddling, hunting and fishing, wildlife and plant viewing, scenic driving, developed and dispersed camping, backpacking, target shooting, back country aviation and much more. Every year, new forms of recreation emerge on the Forest. Snow sport opportunities rarely occur on the Tonto and thus are not specifically addressed in this analysis or the proposed forest plan.

The overarching goal for the Tonto National Forest recreation program is to provide sustainable recreation opportunities for its visitors. Sustainable recreation is defined as the set of recreation settings and opportunities on National Forest System lands that are ecologically, economically, and socially sustainable for present and future generations.

The developed recreation program on the Tonto consists mostly of sites that require a fee for use under the Federal Lands Recreation Enhancement Act[11]. These include developed campgrounds, developed boat launches, developed picnic sites and day use sites, special recreation permit, off-highway vehicle trail systems, and shorelines. Most, but not all of these sites, are found along the shorelines of Roosevelt, Apache, Canyon, Saguaro and Bartlett lakes and along the Lower Salt and Lower Verde Rivers. Developed recreation sites are characterized by high levels of development where each site contains an assemblage of amenities such as bathrooms, parking areas, trash service, running water, picnic tables and interpretive kiosks in day-use sites and tent pads, running water, fire rings, bathrooms, trash, recreational vehicle dump stations, and picnic tables in campgrounds. Boat launches are characterized by amenities such as paved ramps, vessel boarding docks, parking, bathrooms, trash service and more. The 1985 Tonto National Forest Land and Resource Management Plan (forest plan) identified service level standards at developed recreation sites based on available operation and maintenance budget levels.

Dispersed recreation, on the other hand, provides a variety of recreation opportunities that do not rely on developed facilities. Dispersed recreation is defined as recreation activities that occur outside of developed sites or concessionaire-operated facilities. The forest plan identified management areas where motorized and nonmotorized uses would or would not be restricted and if posting was required.

With six of the ten largest lakes and reservoirs in Arizona found on the Tonto National Forest, a variety of water-based and on-shore activities are available adjacent to rivers, streams and reservoirs. Activities include swimming, fishing, tubing, kayaking, canoeing, rafting, motor boating, jet skiing, water skiing, and wakeboarding. Water-oriented developed and dispersed recreation were identified as a management emphasis in the forest plan, especially in management areas containing large water bodies. It also allowed existing commercial public sites at Roosevelt, Apache, Canyon, Saguaro, and Bartlett Lakes and the Lower Salt River to continue and new requests or expansions to be evaluated on a case-by-case basis.

[10] Reference National Visitor Use Monitoring (NVUM) Survey, Tonto National Forest, 2016

[11] If the authorities found in the Federal Lands Recreation Enhancement Act is not extended, is amended, or replaced, the forest will comply as appropriate.

Recreational special uses were addressed in the forest plan with outfitter and guide authorization limitations and user day limitations. Maximum number of allowable authorizations and user day allocations existed per management area, with some confusion on how to track and administer permits from “grouped” management areas. The forest plan management areas did not appropriately separate recreation areas according to outfitter and guide operational areas and public demand.

Affected Environment

The Tonto National Forest currently offers a wide variety of recreation opportunities across all environments and ecosystems. Some programs are flourishing while others are falling lower on the priority list due to budget constraints. Technology and public behaviors have altered the demand for certain activities, requiring new approaches to managing recreation across the Forest. Below are descriptions of the existing conditions of several different types of recreation currently found on the Tonto National Forest.[12]

Developed Recreation

The Tonto National Forest has the largest recreation fee program of any national forest unit in the country. A majority of the Forest’s recreation funds come from fees collected at 57 developed recreation sites, as authorized by the Federal Lands Recreation Enhancement Act. Fees are collected under three categories including standard amenity fee, expanded amenity fee campgrounds, and expanded amenity fee use of highly developed boat launches.

Not all developed sites collect fees; the Tonto National Forest currently has 123 total developed recreation sites such as campgrounds, boat launches, and picnic areas. The Tonto National Forest uses developed recreation areas and sites to address recreation demands while minimizing resource impacts. Visitor impact studies of campsites and trails have shown that most resource impacts are related to visitor use levels in a curvilinear fashion (Marion 1998). The most effective management solutions to address visitor impacts include limiting types of use with higher impacts to specific areas, educating visitors regarding high impact behaviors and encouraging low impact behaviors, encouraging use in impact-resistant locations, and limiting use to existing or designated sites and trails. The Tonto National Forest has implemented many of these management actions, including providing developed recreation sites in locations where recreation demands are high, and will continue to do so with the expectation for visitor use levels to rise or at least remain the same in the near future.

Both day-use and overnight camping sites accommodate a large number of visitors along the reservoirs and dammed rivers, which receive high visitation seasonally. Some sites reach capacity and must be closed on busy weekends. This is especially a common occurrence on the Lower Salt and Lower Verde Rivers and Saguaro and Canyon Lakes during President’s Day, Easter, Memorial Day, Fourth of July, and Labor Day weekends where more than 7,000 visitors can be recreating per day[13]. Typical conditions during these busy times that cause management issues include traffic congestion, unsanitary conditions, trash accumulation, and alcohol consumption by visitors leaving sites and driving busy roadways. For more information specifically related to high-use recreation along the Lower Salt and Lower Verde Rivers and all six lakes, see the Water-Based Recreation section[14].

[12] Recreational shooting and wildlife-based recreation are addressed in separate sections of this environmental impact statement under their own headings.
[13] Reference National Visitor Use Monitoring (NVUM) survey, Tonto National Forest, 2016
[14] See the Water-Based Recreation section for more details on high-use recreation.

Developed group sites are available in remote locations to accommodate larger groups and stock trailers. Group sites are not available on all districts and some are only available to the public seasonally. Maintenance of most developed sites is performed by contractors and employees in the summer months and volunteers in the winter months. In years when volunteers and resources are scarce, developed sites are closed seasonally due to budget and staffing constraints. Sites that require the most maintenance and upkeep are closed during lower-use seasons and visitors are redirected to smaller, more sustainable developed sites with similar attributes.

The number of developed sites at Roosevelt Lake currently exceeds the public demand and the Forest's resources to maintain the sites. Several sections of existing developed sites have been decommissioned and more are scheduled for decommissioning to address this concern. Parking capacities at Saguaro and Canyon Lakes consistently reach their maximum nearly half of the year (on weekends), but due to the terrain and size of the reservoirs, constructing additional sites is not feasible and could cause unsafe conditions for boaters. The Pobrecito Boat Staging Area is used and staffed by Forest Service employees when Saguaro Lake reaches capacity. Visitors are directed to the staging area to wait in a parking lot until parking at the lake is available.

Dispersed Recreation

The majority of the Forest is open to dispersed recreation. Off-highway vehicle use, hiking, rock climbing and rappelling, canyoneering, equestrian, mountain biking, and target shooting are the most common activities and do not require the use of developed sites or facilities. In relation to the number of users, dispersed recreation areas are not patrolled by law enforcement officers or rangers as often as needed. Abandoned campfires, excessive picnic litter[15], and user-created trails are commonly found.

Dispersed recreation is split into two main categories: motorized and nonmotorized. Water-based recreation[16] and recreational shooting[17] are also considered to be in the dispersed recreation category. For information about recreational use of airstrips, see the Roads section.

Motorized Recreation

Off-highway vehicle (OHV) use is a very popular activity on the Tonto National Forest. Designated motorized trails exist for single tracks, two tracks, and 4x4s. All users are required to follow the Arizona Game and Fish Department's regulations for OHV use, including obtaining a permit or "tag" to operate on non-private lands.

Several staging areas located near the entrances to popular off-highway vehicle areas provide open spaces for vehicles with trailers to safely park and unload. These areas are designated with a boundary fence and information kiosks. Most staging areas do not currently provide services such as trash collection, toilets, or other facilities. These areas can reach capacity on busy weekends in the winter season resulting in additional vehicles parking on the side of busy roads and trails.

User conflicts are common between different off-highway vehicle recreationists; mainly between single-track vehicles, or motorcycles and dirt bikes, and larger full-size vehicles such as jeeps or utility terrain vehicles. There are few trails on the Tonto National Forest designated or designed for single-track use only; the majority of designated motorized trails on the Tonto are open to all motorized vehicle types. There are, however, a growing supply of user-created trails for single-track off-highway vehicles across multiple Districts. This is especially true on the Cave Creek and Mesa Districts. Most of these user-

[15] See the Partnerships and Volunteer section for details on trash collection in the Four Peaks area.
[16] See the Water-Based Recreation section.
[17] See the Recreational Shooting section.

created single-track trails have unsustainable designs which have led to resource damages such as erosion. These routes are also not signed which, in many cases, has led to trail widening and additional resource damages from larger vehicles attempting to use these paths. Undesignated single-track trails do not remain exclusively for single-track vehicles very long; two-track vehicles quickly take over those trails too, adding to the number of undesignated two-track roads on the Tonto National Forest.[18]

User conflicts are also common between motorized and nonmotorized recreationists. Many motorized trails see foot traffic due to a lack of nonmotorized trails in the surrounding area. This can be dangerous for both the pedestrians and motorists, especially when the road is narrow or curvy. There are also many nonmotorized trails that have seen resource damages from tire tracks. For areas where desirable destinations do not have fencing at the trailhead to restrict motorized use, or where the trailheads are miles into the backcountry, motorized vehicles are going past the trailheads and using the nonmotorized trails.

In October 2021, in compliance with the Final Travel Management Rule (36 CFR 212.51 Subpart B), the Tonto National Forest designated a forestwide system of roads, motorized trails, and areas for motor vehicle use (Travel Management). A total of 4,215 miles of motorized routes consisting of both roads and motorized trails were designated. Of this total, 1,544 miles are designated as roads and 2,671 miles are designated as motorized trails. Additionally, 166 miles of designated roads are restricted to administrative use only. Of the designated motorized trails, 406 miles are authorized only for administrative use. Designated routes are identified on the Forest's forthcoming Motor Vehicle Use Map. The Final Travel Management Rule requires forests to restrict travel to the designated routes system depicted in the Motor Vehicle Use Map. Travel Management also addresses the more than 700 miles of unauthorized (user-created) motorized routes.[19]

There are several high-use areas throughout the Forest with excessive amounts of user-created trails, both single-track and two-track, causing resource damages such as soil erosion and vegetation trampling. There is currently one off-highway vehicle permit zone implemented on the Forest; users are required to obtain a free permit before recreating in this permit area. Once in possession, the permit provides gate combinations with access to the permit area. Certain restrictions such as no target shooting and the requirement to remain on designated motorized routes identified in a user map are enforced within the permit area. Environmental effects and existing conditions common to other high-use recreation areas such as target shooting trash, abandoned campfires, user-created trails and associated soil erosion, and human-caused wildfires are less prevalent within the Bulldog Canyon off-highway vehicle permit zone on the Tonto National Forest. Additional off-highway vehicle permit zones were designated in Travel Management and will be implemented in a similar manner.

Nonmotorized Recreation

Nonmotorized activities are popular in the southern districts during the cooler months and in the northern districts during the warmer months. Numerous trails with desirable destinations or trailheads conveniently located near cities receive high visitation levels. Many of these trails are located within designated wildernesses, which impacts the solitude objective for managing wilderness areas. In the 2016 National Visitor Use Monitoring Survey report for the Tonto National Forest, the average designated wilderness

[18] See the Travel Management Final environmental impact statement Volume 1 and the Final Assessment Report of Social and Economic Conditions, Trends, and Risks to Sustainability, Volume 2, page 121.
[19] See the Travel Management Record of Decision for more information about specific route and area designations.

crowding rating from survey participants was 5.3.[20] See table 11 below for a comparison with other national forests in Arizona.

Higher visitation levels are trending at many trailheads, and parking lots are reaching capacity when weather conditions are desirable. Volunteers are used to maintain trailhead facilities and monitor parking levels in high-use areas. Districts rely on volunteer groups and crews to perform trail maintenance. Trail markers and signs are scarce and sometimes inaccurate due to vandalism, theft, and lack of maintenance; this can lead to user confusion and the development of user-created trails.

Table 11. Crowding report in designated wildernesses for local forests

Forest	Crowding Rating	Year of Survey
Tonto	5.3	2013
Prescott	3.5	2012
Coconino	4.9	2015
Coronado	4.6	2012
Kaibab	4.4	2015

Equestrian use, rock climbing and rappelling, and mountain biking are popular activities on the Tonto National Forest. Local clubs and activity groups have reached out to the Forest to request facilities, new trails, and access points, or to offer their services to help improve the quality of these activities. However, limited staffing and other district priorities have prevented these relationships and programs from growing.

User conflicts exist on many popular nonmotorized trails where hiking, equestrian, and mountain biking are desirable. The appropriate walk-throughs for locations where fences cross designated trails are not always available, preventing equestrian or mountain biking uses from continuing on a trail that is otherwise suitable for those activities. Parking capacities and access at trailheads is also a common issue for vehicles with trailers for horses or backpacking equipment. See the Motorized Recreation section for more information on user conflicts between motorized and nonmotorized recreationists[21].

Water-Based Recreation

Water-based recreation is the main recreation activity on the Tonto National Forest. Housing six out of ten of central Arizona's major reservoirs (lakes) and two dammed rivers adjacent to the Phoenix Metropolitan area, recreating near the water is a high-demand activity on the Tonto National Forest. Developed sites are provided for water access points, boat ramps and courtesy docks to accommodate motorized watercraft, and picnic sites provide facilities such as tables, ramadas, restrooms, grills, dumpsters, and in some instances running water. Fishing piers along shorelines at each reservoir are also provided in conjunction with the Arizona Game and Fish Department[22].

The 2018 to 2022 Statewide Comprehensive Outdoor Recreation Plan (SCORP) shows that motorized boating use has increased in Maricopa County (Bartlett, Saguaro, Canyon, and Apache Lakes) by 48 percent since 2012.[23] Motorized boating is a popular activity on the Tonto National Forest with extremely

[20] National Visitor Use Monitoring (NVUM) Survey, Tonto National Forest, 2016; Crowding rating. Survey respondents rated how crowded the site or area they were interviewed at was using a scale of 1 to 10 where 1 meant hardly anyone was there and 10 meant the site or area was overcrowded.
[21] See the Motorized Recreation section for more information on user conflicts.
[22] See the Wildlife-Based Recreation section for more information.
[23] Reference Arizona 2018 SCORP: Statewide Comprehensive Outdoor Recreation Plan (pp. 25-26) (2018). Phoenix, Arizona. Arizona State Parks Board.

high use at Saguaro, Canyon, and Roosevelt Lakes. There is one developed concessionaire marina[24] at each lake where the public can store their boat(s) long-term, launch, purchase fuel, food, and beverages, and most marinas provide watercraft maintenance services and restaurant services.

Developed and dispersed sites along all six lakes on the Tonto National Forest see heavy use beginning in early spring when the temperatures reach above 90 degrees until late summer when the temperatures fall below 90 degrees again. Depending on the year, this is generally from March through September and can begin early or extend late depending on weather and local school schedules. Holiday weekends also cause high demand for water recreation activities and opportunities.

Kayaking and stand-up paddle boarding have become popular activities in recent years, although the Forest does not have designated launching areas for nonmotorized watercraft. Areas on the lakes' surfaces restricted to nonmotorized watercraft only are rare but seem to be desired by the public. Kayaking and stand-up paddle boarding uses range from private individual with 1 to 5 people, to group meet-ups with 5 to 20 people, to guided corporate trips with 100 people. Stand-up paddle board yoga is also a common activity in areas with calmer waters. Some developed sites that are becoming more common to launch kayaks and stand-up paddle boards do not have the parking capacity to accommodate the rising number of users. Granite Reef Recreation Site, for example, reaches parking capacity early in the morning on weekends with desirable weather, and resulting in visitors parking along the busy Bush Highway or seeking other locations to launch their watercraft.

Tubing is a common activity on the Lower Salt River, seeing high visitation seasonally. During summer holiday weekends and other busy weekends with desirable weather, vehicular traffic on Bush Highway along the Lower Salt River and Saguaro Lake recreation areas results in road closures as determined necessary for public safety by Maricopa County and the Forest Service[25]. Developed sites reach capacity and the public is diverted to other sites with access to the water. During these times, the public may experience over-crowding, less than satisfactory restroom conditions, full dumpsters, and long walks from their vehicles to the desired recreation location during high outdoor temperatures (100 or more degrees). Forest Service staff and volunteers spend excessive amounts of time cleaning facilities and picking up litter after holiday weekends have concluded. Rafting is also in high demand on the Upper Salt River as the season and water levels allow[26].

Multiple annual swimming events occur under Special Use Permit. The lakes provide excellent conditions for swimmers to practice for open-water swimming competitions held off-forest.

Dispersed water-based recreation consists of fishing, camping, swimming, and sight-seeing at creeks and streams[27]. Several popular creeks such as Fossil Creek, Cherry Creek, and Tonto Creek receive high use when weather conditions are desirable, and dispersed recreation activities are causing extreme impacts and damages to natural resources including soil compaction, soil erosion, vegetation damage, water quality concerns and other riparian habitat concerns, illegal wood cutting, wildlife feeding, trash accumulation, and excessive human waste. The forest plan currently has no forest-wide restrictions for camping in proximity to riparian areas and creeks.

The Fossil Creek recreation area is a popular destination and receives high use for day picnicking and hiking and dispersed water-based recreation such as swimming and camping. These high-use activities result in an abundance of abandoned campfires and unauthorized campfire rings, trash accumulation,

[24] See the Special Uses section for more information on marina permits.
[25] See the Developed Recreation section for information on Bush Highway during high visitation.
[26] See Wild and Scenic River section for more information on the Upper Salt River.
[27] See the Wildlife-Based Recreation section for more information on fishing and other wildlife-related recreation.

excessive human waste near the riparian areas, and resource damages from undesignated parking adjacent to the main roads. Since 2013, recreation management of the Fossil Creek Wild and Scenic River that resides within the boundaries of the Tonto National Forest has been delegated to the Coconino National Forest[28]. Current restrictions include no overnight camping within 100 feet of Fossil Creek from the Fossil Creek Bridge downstream to the Stehr Lake area[29] with no overnight camping in the entire Fossil Creek Wild and Scenic River seasonally from April 1 – October 1[30]. The Coconino National Forest has recently (October 2021) changed the management process for dispersed recreation in the Fossil Creek Wild and Scenic River area, which consists of both Coconino and Tonto National Forest System lands and waters[31]. The majority of the high-use areas are within the Coconino's boundary, however, this change in management will affect management on the Tonto National Forest as well.

Special Uses

Recreational special uses are streamlined through a limited number of staff on the Forest to maintain consistency and accuracy. Commercial outfitting and guiding permits are in high demand, especially for hunting, hiking, water-based activities, and off-highway vehicle tours. Administration of outfitting and guiding permits attempts to follow the user day allocation limitations in the forest plan, but increased demand and differences of interpretation of the forest plan have caused some variance in administration over the years. In addition, the forest plan was amended in 2013 to adjust user day allotments based on increasing and demand.

Letters of nominal effects are used whenever possible to accommodate the public for events and activities with minimal disruption to other Forest resources. Multiple recreation events occur annually with new events being proposed every year. Annual events include the El Tour de Mesa bicycling event on the Mesa Ranger District with more than 1,000 participants, TriFamily Racing biannual triathlon on the Cave Creek Ranger District with approximately 100 participants each event, and the Zane Grey 50 Mile endurance run on the Payson Ranger District with approximately 150 participants, to name a few. Larger events such as these require coordination with other agencies and lands such as County Sheriff Offices and Tribes to ensure all permits are obtained and public safety is being addressed.

One privately-owned marina under special use permit exists at each reservoir to provide various services to the public. The 1985 forest plan restricts marina development to one per reservoir. There are also more than 50 recreation residences on the Forest, with the majority of them on the Cave Creek Ranger District.

Environmental Effects[32]

Effects Common to All Alternatives

All Recreation

As technology and public interests change, the Forest should be adaptive to changing trends and consider the latest science, technology, and management practices (REC-DC-03). Making these kinds of management adjustments can greatly improve user satisfaction which may lead to increased fee

[28] Reference Updated Delegation of Responsibility – Fossil Creek Area correspondence signed 6/3/2013 by Forest Supervisor Neil Bosworth.
[29] Reference Order # 04-17-28-R Special Restrictions
[30] Reference Order # 04-18-02-R Special Restrictions- Seasonal Parking Capacity and Reservation; Glass, Camping, and Fire Prohibition. See map and location description for more details.
[31] More information about management of Fossil Creek can be found in the Fossil Creek Comprehensive River Management Plan and corresponding record of decision.
[32] Assumptions and methods used for this analysis can be found in volume 4 of the environmental impact statement, appendix B.

compliance and better leave-no-trace ethics practices by the public. When the public is better educated about responsible recreation practices (for example through outreach events or on-site signs and interpretive kiosks), other resource impacts may also be reduced. Users may pack out their litter to prevent hazards to wildlife, they may stay on designated trails and in designated parking lots to reduce soil compaction, and they may even use carpooling or alternative fuel vehicles when travelling out to the Forest to minimize air quality impacts. These effects have the greatest impacts in alternatives B and D, with the least impacts in alternative A due to less emphasis on adapting to changing trends and technology, but these effects are present in all alternatives.

The Forest manages multiple resources outside of recreation, many of which have the same effects to recreation resources, regardless of alternative chosen for the revised forest plan. However, the intensity or extent of these effects may vary by alternative, which are discussed in each alternative.

Standards and guidelines in all alternatives allow for thinning and burning activities to be used to accomplish project or plan level desired conditions for vegetation and fire. In forested ecological response units, thinning and burning would reduce tree density and change the quality and setting of certain recreation opportunities available to Tonto National Forest visitors. Less-densely vegetated forest lands would provide more open areas for recreation activities including dispersed camping, picnicking, wildflower and wildlife viewing, hiking, equestrian, bicycling, off-highway vehicles, and some types of hunting. Some of these activities require wide-open spaces for their recreation equipment and vehicles (e.g., large recreational vehicles and trailers), large group gatherings, or scenic viewing. However, vegetative desired conditions for more open forests can be less appealing to some campers who may avoid dispersed sites with less shade and vegetative screening. As a short-term effect, some recreationists may avoid treated areas with views of freshly-cut stumps, vegetation piles, or blackened and burnt vegetation. This would reduce recreation visitation and decrease user satisfaction rates. User-created trails for bicycling, horseback riding, and hiking may also be a result of areas opened by fuel treatments or uncharacteristically high severity wildfires. These can lead to additional soil erosion and compaction from the formation of unsustainable trails, poor water qualities from water runoff, and other negative effects to riparian habitats.

Frequent and extensive vegetation treatments that elicit formal closures or cause recreationists to avoid these areas altogether can be frustrating to the public and special use permit holders and negatively impact their recreation experiences on the Tonto National Forest. Smoke produced from prescribed burns and wildfires can also be a nuisance to recreationists. Users may not be able to recreate in their location of choice due to extreme smoke and poor air qualities, or their activity (e.g., hunting, wildlife viewing) and the quality of their experience may be negatively affected. Users may use other areas nearby or locations off-forest completely. Commercial businesses such as outfitting and guiding companies under special use permit would have to use other authorized locations if they feel smoke would negatively affect the quality of their service, and they may lose revenue.

All alternatives include road objectives for decommissioning, maintaining, or constructing roads. More roads, as identified in Travel Management, and better-maintained roads would increase access throughout the Forest and expand dispersed recreation opportunities to more locations. Fewer roads, achieved via decommissioning, would improve fish and wildlife habitat, increasing the quality and quantity of opportunities for wildlife watchers, fishers, and hunters to participate in their activities. For all alternatives, the Tonto National Forest Travel Management Motor Vehicle Use Map depicts designated routes for motor vehicles uses.

All alternatives include riparian management direction (standards and guidelines) to maintain or restore natural streambank stability, native vegetation, and riparian, floodplain, and soil function. However, the standards and guidelines found in the 1985 forest plan would be used in alternative A. These factors are taken into effect when managing all types of recreation, and are the same regardless of alternative. Most recreationists would enjoy seeing a riparian system with functioning attributes and would support any minor changes to their activities such as the installation of a foot bridge over a sensitive stream or removal of invasive species in order to achieve desired conditions.

Requests for personal and commercial mineral material sales are considered in each alternative of the proposed forest plan, with limitations on authorizations in riparian management zones in alternatives B and D. Uses that are considered recreational such as small mineral sampling, gold panning, and metal detecting are not affected by this management, and are included in the analysis in the Dispersed Recreation- Motorized and Nonmotorized sections per alternative.

Recreation Opportunity Spectrum

The 1985 forest plan and all alternatives include plan guidance that direct management activities be consistent with the recreation opportunity spectrum, particularly for dispersed recreation such as trail and road development and maintenance. Implementing the recreation opportunity spectrum establishes that "opportunities are available for everyone regardless of socioeconomic status or individual ability" (REC-DC-10) and that "recreation opportunities support healthy lifestyles" (REC-DC-01) and that it is achieved through "cooperation and collaborative engagement with our partners, individuals, organizations, and the communities we serve" (REC-DC-05). The recreation opportunity spectrum is incorporated into plan components for all types of recreation and these plan components are not changing by alternative. Management areas specific to each alternative may affect recreational opportunities within and potentially adjacent to that management area. However, types of recreation opportunities in a given area will be influenced by more than only forest management described in plan components, such as the number and use of existing motorized routes in the area and proximity to private property or urban areas.

Developed Recreation

In all alternatives, some level of facility maintenance would be performed in developed recreation sites. The status of that facility maintenance[33] and condition of the infrastructure affects natural resource conditions. For example, an inadequate number of trash collection containers and servicing can result in excess trash on the ground and throughout the environment. This can be a hazard to wildlife, water quality, and scenic values. Weathering sidewalks and asphalt parking lots can lead to soil erosion, especially if users deter from using poorly-maintained surfaces and create new walking paths and parking areas. Damaged or missing fences and gates around recreation areas can disrupt grazing operations. In high-use areas, this can also lead to an expansion of the recreation area and the direct impacts humans and vehicles have on the ground. Restroom facilities that do not receive regular cleaning and maintenance can result in human waste being left outside of the facilities and in other Forest areas. This can degrade water qualities of local streams and rivers including soil compositions. Also, lack of proper and timely vegetation trimming in developed and high-use areas can lead to irreversible damages to vegetation and more human-caused wildfires.

Recreational Effects in Management Areas

Designated wilderness areas, designated wild and scenic rivers, eligible wild and scenic rivers, three research natural areas, inventoried roadless areas, national trails, significant caves, and the Apache Leap

[33] The condition of a facility can be directly affected by user satisfaction and fee compliance; see the assumptions section in Appendix B for more information.

Management Area remain the same in size and location for all alternatives. Recreation effects in these areas are listed below.

Table 12 indicates whether an alternative analyzes the effects for specific designated and proposed management areas that vary per alternative. Not all of the designated and proposed management areas listed in table 12 are proposed in every alternative and are represented as NA.

Table 12. Analysis of effects for designated and proposed management areas that vary by alternative

Designated and Management Areas	Alternative A	Alternative B	Alternative C	Alternative D
Recommended Wilderness	NA	Yes	Yes	NA
Proposed Botanical Areas	NA	Yes	Yes	NA
Proposed Research Natural Areas	Yes	Yes	Yes	NA
National Trails and Significant Caves*	No	Yes	Yes	Yes
Lakes and Rivers Management Area	NA	Yes	No	yes

*National trails and significant caves are the same per alternative, but effects will differ per alternative based on management emphasis.

Designated Wilderness and Wild and Scenic Rivers

All alternatives have eight designated wildernesses (Four Peaks, Hellsgate, Mazatzal, Pine Mountain, Salome, Salt River Canyon, Sierra Ancha, and Superstition) and two designated wild and scenic rivers (sections of Fossil Creek and the Verde River). Management of these areas would be the same per alternative because no changes are proposed. See the Management Areas section for more information.

Eligible Wild and Scenic Rivers

There are 19 eligible wild and scenic river segments in all alternatives. Depending on the classification for the eligible segment (wild, scenic, or recreation), some of these river segments may see an increase in restrictions on recreation and development to maintain the unique characteristics identified in each segment[34]. Motorized recreation would be restricted to existing roads and trails in accordance with travel management and open access to the river segments would decrease. Restricting motorized recreation, specifically off-highway vehicle use, to existing routes would improve soil conditions and riparian habitats as riparian areas would no longer be damaged by motorized activities (off-highway vehicles and mountain bikes). Some roads may be decommissioned and developed into hiking and/or equestrian trails, which would still improve soil conditions but not to the same extent as a road that is completely abandoned from all recreation uses. In addition, new infrastructure and developed recreation opportunities would not be implemented within eligible wild or scenic segments.

Research Natural Areas

All alternatives have the following designated research natural areas: Buckhorn Mountain, Bush Highway, and Haufer Wash. Recreation management of these areas would not be affected as research natural areas are not recreationally driven and no changes are proposed. To achieve the desired conditions of these areas, such as “Recreation uses and livestock grazing do not impair or degrade (high departure from reference conditions; measured by site potential, TEUI data or other suitable dataset) the ecology and unique plant communities within designated and recommended research natural areas and botanical areas” (RNBAMA-DC-06), all recreational access could be limited or restricted to maintain the research, education, and biodiversity values within the area. Both motorized and nonmotorized recreation are subject to restrictions or closures if the designated or proposed research natural areas are determined to be

[34] Segments eligible for recreation classification would have the least amount of restrictions on recreation activities compared to wild and scenic classified segments.

impaired or degraded. Specifically, motorized recreation may see roads decommissioned and dispersed recreation sites may be closed to all access. Restricting recreation access within these areas may also decrease user satisfaction, but those effects are expected to be minimal since these areas are small in acreage compared to the entire Forest. If these areas become closed to recreation, most users would likely use the open roads nearby, but a few may damage fences and continue to recreate in the closed area.

Inventoried Roadless Areas

All alternatives have thirteen inventoried roadless areas. Inventoried roadless areas contribute to social sustainability by providing opportunities for dispersed recreation, opportunities that diminish as open space and natural settings area developed elsewhere. Inventoried roadless areas’ desired conditions help support dispersed recreation opportunities (IRAMA-DC-04). Motorized uses are restricted to designated roads and motorized trails, and no new roads would be constructed in these areas. However, motorized trails may be considered if consistent with the travel management plan. Since the size and location of the thirteen inventoried roadless areas are not changing per alternative, effects to recreation are also not expected to change per alternative.

National Trails

There are four national trails (Arizona National Scenic Trail, Great Western National Millennium Trail, Highline National Recreation Trail, and Six Shooter Canyon National Recreation Trail) in all alternatives. These trails provide a variety of recreation opportunities including hiking, backpacking, mountain biking, equestrian, wildlife and nature viewing, and where appropriate (e.g., the Great Western Trail), motorized uses. Desired conditions for these trails include minimizing user conflicts, which is consistent with recreation desired conditions (NTMA-DC-02 and REC-DC-07), and preserving the nature and purposes of national scenic and national historic trails. Although the size and location of these (existing) national trails remains the same per alternative, recreation in these areas including expansion or changes to these national trails and construction of new national trails may be affected by alternative due to differences in emphasized resource management or types of recreation. See each alternative for more details.

Significant Caves

There are seventeen significant caves in all alternatives. These areas provide a unique dispersed recreation experience which may be affected by alternative, particularly related to access, due to differences in emphasized resource management and types of recreation (e.g., motorized and nonmotorized access). See each alternative for more details.

Apache Leap Special Management Area

The Apache Leap Special Management Area resides in all alternatives; management direction follows the Apache Leap Special Management Area Management Plan[35] and emphasizes protecting scenic and cultural/historic values. Overnight camping is not allowed in the Apache Leap Management Area, which may inconvenience visitors seeking to camp in the local area. Motorized recreation opportunities would be limited to designated locations identified in the motor vehicle use map[36]. These restrictions may result in higher visitation levels in dispersed recreation areas adjacent to this management area, resulting in increased resource impacts such as soil erosion and compaction, vegetation damage, human-caused wildfires, damage to cultural sites, and lower water qualities in creeks and streams in those adjacent locations. Other types of recreation would also be restricted if they negatively affect the desired

[35] Apache Leap Special Management Area Management Plan, sections 3.4 and 3.5
[36] See the Travel Management Motor Vehicle Use Map

conditions of the management area. This would cause minimal effects to recreation, with the primary effect being lower user satisfaction rates.

Alternative A Effects

Alternative A calls for the forest plan to continue to be the current and future document of management practices for the Tonto National Forest. Below in table 13 are descriptions of how each category of recreation would be indirectly affected if the Forest continues to use the forest plan for recreation planning and management to achieve the newly identified desired conditions.

Table 13. Alternative A indirect effects

Recreation Type	Highlight of Direction Provided in the 1985 forest plan	Relevant Desired Conditions in the Proposed Forest Plan	Effects
Developed	Developed sites should achieve full service level; decreased percentage service levels are listed based on percent budget changes.	Sites provide adequate and appropriate amenities and fees are consistent across the Forest. Compliance is near 100 percent.	Given service levels may not be attainable due to extreme budget decreases not predicted when the 1985 forest plan was written. Adequate amenities for current use levels may not be provided due to budget and staffing constraints, which in turn would likely result in much less than 100 percent fee compliance from the public. This would result in less money for achieving full service levels, including cleaning restroom facilities, removing litter, providing clean potable water, and fixing damaged infrastructure. Resource damages such as erosion and vegetation trampling may also increase without a high level of fee compliance to pay for new infrastructure.
Dispersed, including Motorized and Nonmotorized	In given management areas, off-highway vehicle use is prohibited unless posted as open. Day-use non-vehicular recreation is not restricted. Trail maintenance for certain high-visibility areas is specified. Other activities such as rock climbing and equestrian are not addressed.	Dispersed recreation opportunities are diverse and provide balanced opportunities for all activities. System trails are well marked and user-created trails are not evident. Trail maintenance and development are consistent Forest-wide to minimize resource impacts. User conflicts are minimized.	The Travel Management Motor Vehicle Use Map restricts off-highway vehicle use to a designated system. Trail maintenance, repair, and development would not be consistent across the Forest, leading to lower user-satisfaction rates and damages to soil, vegetation, and range infrastructure. Other activities and programs such as rock climbing and equestrian would continue to be neglected and underdeveloped; unauthorized rappelling anchors may continue to be installed by the general public, and resource damages from equestrian use such as soil erosion and vegetation scarring from tethering animals may increase. User conflicts would likely increase due to unbalanced opportunities.

Recreation Type	Highlight of Direction Provided in the 1985 forest plan	Relevant Desired Conditions in the Proposed Forest Plan	Effects
Water-Based	Most water-based recreation activities are covered by the developed recreation guidance. Otherwise, the 1985 forest plan provides minimal guidance on managing specifically water-based recreation activities.	Developments and facilities provide safe recreation opportunities while managing visitor levels to prevent overcrowding and long-term negative impacts to riparian areas.	Water-based recreation activities are in high-demand near the Phoenix Metropolitan area. Alternative A would continually increase safety concerns, over-crowding, resource damage, and user conflicts. Developed recreation sites would continue to be overcrowded and sanitation levels would be unacceptable during busy seasons. User satisfaction would decline and number of safety and emergency incidents may increase from unsafe conditions. Water quality may diminish from overuse and litter accumulation, affecting fish populations and other wildlife habitat. With alternative A, businesses located near busy water-related recreation areas may see an increase in profit, but maintenance and expansion projects may not be able to keep up with high levels of unmanaged use.
Special Uses	Commercial public sites at Roosevelt, Apache, Canyon, Saguaro, and Bartlett Lake and the Lower Salt River will continue. Outfitter and guide permit limitations and user day allocations are listed per management area and in grouped management areas.	Authorizations would be issued based on carrying capacity and public demand and would result in minimal user conflicts. Authorizations would address public safety and minimize resource damage.	Outfitter and guide user day limitations from the forest plan are confusing and permits may not be administered consistently across the Forest. Carrying capacities may be exceeded, increasing user conflicts, congestion, and causing excessive resource damages such as soil erosion, vegetation trampling, and human-caused wildfires. Equal opportunity for commercial businesses to compete would not be provided under alternative A.

Management Areas – 1985 Forest Plan

The 1985 forest plan is separated out into 46 management areas. Many of the boundaries for these areas have little to no connection to recreation management or user trends as they were not developed with a focus on recreation. For example, management area 3F, the Lower Salt River Recreation Area also has Saguaro and Canyon Lakes contained within the boundary. Outfitter and guide special use permit maximum user day allocations for all three waterways are lumped together in one allocation which has led to overuse at the Lower Salt River and Saguaro Lake Recreation Areas and underuse at the Canyon Lake Recreation Area due to high demand for commercial uses at the Lower Salt River and Saguaro Lake. This has increased safety concerns and user conflicts in these areas, as well as damaged riparian habitats and vegetation along shorelines. Also, recreation management for all Tonto National Forest reservoirs in the 1985 forest plan is the same, as well as all designated wildernesses; to achieve recreation desired conditions, there is no need to separate each lake or separate each wilderness into different management areas.

The separation of 46 management areas in alternative A can cause management deficiencies when multiple sections of the plan must be referenced and can also cause inconsistencies on how recreation opportunities are managed in the similar areas whose only difference is physical location on the Forest. For example, if the Forest decided to update trailhead kiosks at all trailheads, management would need to reference every management area with a trailhead to ensure there are no special restrictions for placement of signs (e.g., sensitive species habitat, sensitive or eroding soils, or cultural resources preventing burial of the sign post(s)), restrictions on sign materials (e.g., only wooden signs allowed in the wilderness, color restrictions to meet scenery objectives), or guidelines to provide specific infrastructure at trailheads (e.g., sign-in kiosks, interpretive kiosks, wildlife-resistant storage boxes).

The 1985 forest plan also has several natural areas/management areas: Blue Point Cottonwood, Fossil Springs Natural Area, and Sycamore Creek Natural Areas.[37] Additionally the 1985 forest plan includes the Three Bar Wildlife Area. The 1985 forest plan does not provide guidance on how to manage national trails to meet desired conditions and national objectives of these trails compared to other system trails.

Management Areas – Alternative A

Alternative A has two recommended research natural areas: Picketpost Mountain and Upper Forks Parker Creek. To achieve the desired conditions of these areas, such as “Recreation uses and livestock grazing do not impair or degrade (high departure from reference conditions; measured by site potential, Terrestrial Ecological Unit Inventory data or other suitable dataset) the ecology and unique plant communities within designated and recommended research natural areas and botanical areas” (RNBAMA-DC-06), all recreational access could be limited or restricted to maintain the research, education, and biodiversity values within the area. Both motorized and nonmotorized recreation may see a decrease in recreation opportunities if the designated or proposed research natural areas are determined to be impaired or degraded. Specifically, motorized recreation may see roads decommissioned and dispersed recreation sites may be closed to all access. While there would be a decrease in the available areas for motorized based recreation, there may be an increase in opportunities for other recreation experiences such as watchable wildlife (less noise and disruption to wildlife) and educational recreation such as botany fieldtrips, natural history studies, nature walks, etc. Overall, restricting recreation access within research natural areas may decrease user satisfaction, but those effects are expected to be minimal since these areas are small in acreage compared to the entire Forest. User satisfaction rates of motorized recreationists such as off-highway vehicle users, as compared to nonmotorized recreationists such as hikers, backpackers, equestrians, and rock climbers, are expected to decrease more.

The Salt River Horse Management Area is not included in alternative A. The current forest plan does not include specific management of forest resources where the Salt River Horses occur. This does not help the Forest address specific recreation needs that deviate from desired conditions which are needed as many feel that the Salt River Horses should take priority over other types of uses, including recreation. More information can be found in the Management Areas section of volume 2.

Recreation Opportunity Spectrum

Alternative A includes break outs of recreation opportunity spectrum settings by management area throughout the Forest. This alternative does not include any additional plan components to help the Forest be consistent with or achieve the desired recreation opportunity spectrum settings like alternative B, C, and D. The lack of additional direction would not help the Forest achieve recreation opportunity desired

[37] These areas were identified through the Arizona State Parks board Natural Area program which are referred to as “natural areas” but are in fact management areas in the existing plan. Natural areas are intended for demonstration and study purposes in a natural undisturbed setting. The natural areas described in the existing plan were proposed by the Arizona Parks Board, but never officially designated.

conditions and would continue some of the difficulties in current forest management. The total acres for each recreation opportunity spectrum classification for alternative A is listed in table 14 and shown in figure 7.

Table 14. Recreation opportunity spectrum settings for alternative A

ROS Classification	Acres
Primitive	596,702.8
Rural	41,247.3
Roaded Natural	514,230.0
Semiprimitive Motorized	1,088,835.1
Semiprimitive Nonmotorized	697,681.2
Urban	25,470.8

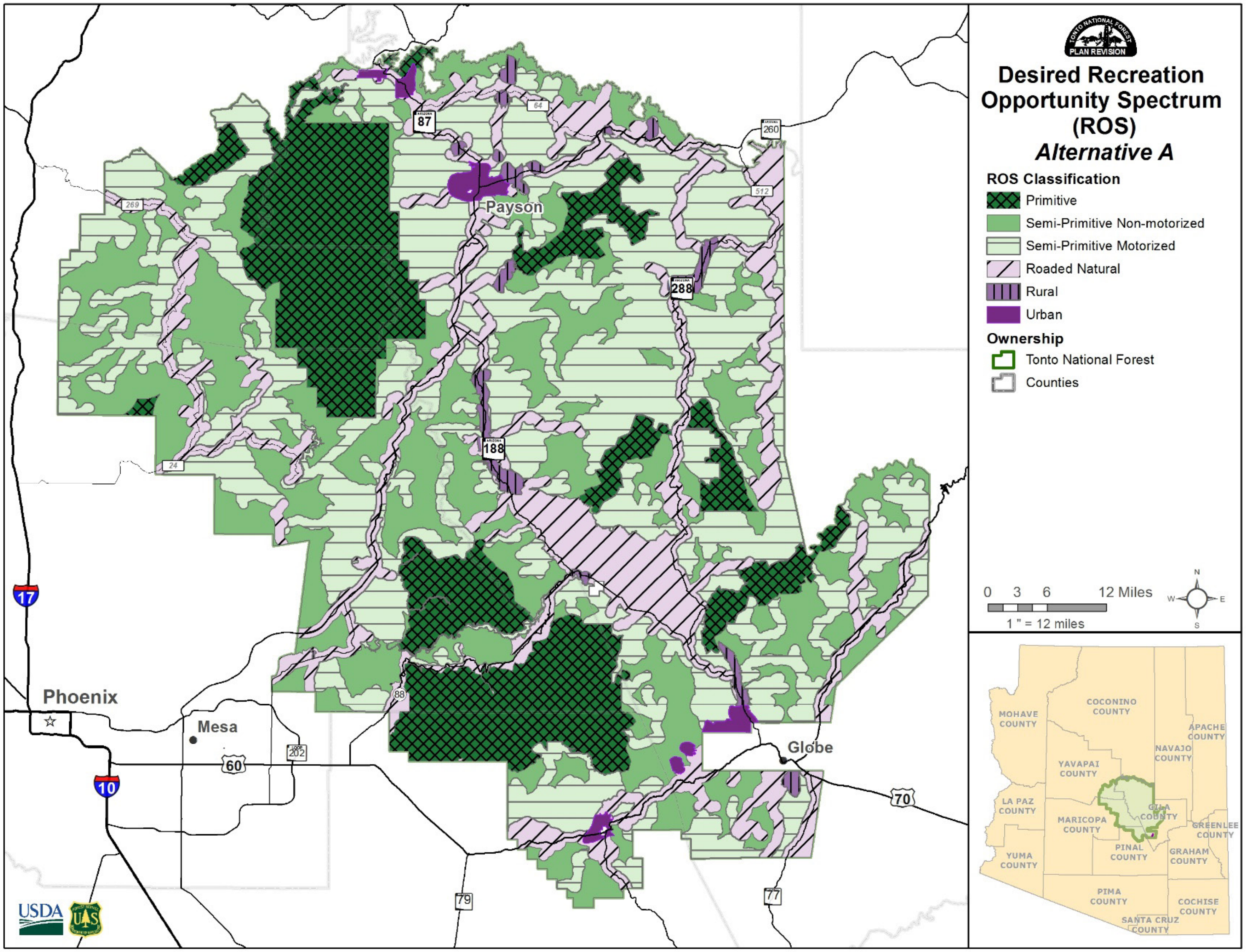

Figure 7. Recreation opportunity spectrum classifications for alternative A

Alternative B Effects

This alternative provides direction that emphasizes adaptive management to address changing conditions while managing for sustainable multiple uses. It would balance public demands for both motorized and nonmotorized recreation activities with natural resource desired conditions. It would also emphasize that recreation opportunities are relevant and responsive to changing user demands while achieving sustainability; roads and facilities would be maintained based on sustainability and user demands and decommissioning would be prioritized where infrastructure is not sustainable (e.g., conflicts with other resource desired conditions, unused); and the Lakes and Rivers Management Area would provide specific direction designed to prioritize recreation management over other select resources to accommodate high levels of recreation along the lakes and major rivers of the Forest.

Developed Recreation

Most developed recreation sites provide access to areas of value; alternative B emphasizes a balance between non-primitive recreation with increased access and primitive recreation. Management of developed recreation sites, and in turn, conditions of those recreation opportunities and the resources they affect, are expected to improve in alternative B compared to alternative A. The Forest would manage developed recreation opportunities based on current and predicted user demands, unsustainable facilities would be decommissioned and new or existing facility improvement projects would be prioritized based on sustainability and public demand (REC-DC-03). Management limitations such as personnel staffing and budget would be taken into consideration when moving towards sustainable practices in developed recreation. This would result in an increase in the associated beneficial effects of having a more sustainable developed recreation program compared to alternative A; user satisfaction would increase, capacities would not be exceeded, and resource damages would be mitigated.

With a balance of non-primitive recreation with increased access and primitive recreation opportunities and an appropriate number of well-maintained developed recreation opportunities available to the public, fee compliance is expected to increase and approach 100 percent. This would result in increased funding for future maintenance and improvements for public recreation sites[38], as well as higher user satisfaction rates.

Since the majority of the Forest's developed recreation occurs in the proposed Lakes and Rivers Management Area, alternative B would support recreation objectives such as "Designated water access points and amenities within developed sites reflect user demands, site capacity, and water accessibility" (REC-DIS-WB-DC-02) by providing critical direction for managing these areas, such as "User conflicts and public health and safety issues are infrequent" (LRMA-DC-03) and "Natural resources in the LRMA are adaptable to disturbances" (LRMA-DC-05). The Lakes and Rivers Management Area would enable the Forest to prioritize recreation objectives and address high use levels. See the management areas analysis for more information on the Lakes and Rivers Management Area in alternative B.

Dispersed Recreation – Motorized and Nonmotorized

Alternative B provides optimal conditions for dispersed recreation on the Forest. Both nonmotorized and motorized trails would be maintained based on sustainability standards and new access points, trailheads, staging areas, etc. would be designed and constructed as conditions and user demands change. Visitors would be provided with new facilities and services only when necessary to protect the resources and provide public safety. For example, restrooms may be installed at high-traffic trailheads to reduce the amount of human waste in areas that may have sensitive species and habitats. Unnecessary or under-used facilities would be decommissioned to return the area back to a primitive recreation experience.

[38] See the Effects Common to All Alternatives section for more information on effects of fee compliance.

Construction of new trails and routes that connect popular destinations, create desirable "loops," and provide increased access to diverse recreation opportunities while protecting the natural resources would be considered in coordination with local interest groups and partners (REC-DIS-NMO-DC-02 and REC-DC-05). There would be less negative impact (e.g., soil erosion, vegetation trampling from user-created trails, damage to cultural sites) from poorly maintained trails and neglected and underdeveloped infrastructure compared to all other alternatives. For these reasons, there would be an increase in the beneficial effects of user satisfaction at dispersed recreation sites compared to all other alternatives that do not provide a balance of motorized and nonmotorized recreation opportunities.

In alternative B, grazing allotments would be evaluated upon vacancy to become open or closed. For vacant allotments that become closed, users would see less livestock on the Forest and experience less manure. This may result in an increase in beneficial effects by improving user satisfaction in select areas where both recreation use and grazing are high. Users would also be inconvenienced less from the lack of fencing, cattle guards, water tanks, and other grazing related improvements. For vacant allotments that become open, recreationists may notice livestock, related improvements such as water tanks, and cow manure in areas where they were not seen recently. This may bother some recreationists; however, it is unknown how most users would react to the presence of livestock in a new area. Users may be inconvenienced by additional fencing and gates that are otherwise restricting access. Some off-highway vehicle users may not close gates when travelling on roads, affecting management of a given allotment by allowing livestock to cross boundaries unintentionally. For those allotments that are currently open and remain open, no effects are expected for recreation. This alternative includes both negative and beneficial effects described above, however it's not possible to quantify the magnitude of effects because it is not possible to predict the number of allotments that would become open or closed over the planning cycle.

Water-Based Recreation

Water-based recreation activities occur in and along shorelines of rivers, streams, and reservoirs. Types of activities include both motorized and nonmotorized, depending on the setting and location-specific restrictions. Alternative B provides a balance between both motorized and nonmotorized recreation opportunities, making it the ideal alternative to address changing user demands, user conflicts, and sustainable features related to water-based recreation. Resource protections would be addressed using sustainable practices, such as providing trail markers to encourage users to stick to limited paths and access routes to the water (REC-G-01), providing picnic tables or other developed features to minimize the footprint of both day use and camping sites, and providing restrooms to reduce the amount of human waste entering the water systems. These and other design features would minimize negative effects that are associated with water-based recreation including sedimentation, vegetation trampling and the spread of invasive species, and other effects to riparian areas. This alternative would minimize these negative effects more than alternatives A and C.

In addition to providing resource protections, recreation services and facilities such as restrooms, trash collection containers, designated picnic areas, and safe parking environments are also desirable by the public and can increase user satisfaction and visitation. This helps achieve desired conditions such as "Water based recreation provides social, cultural, and economic benefit to the public" (REC-DIS-WB-DC-01) and "Recreation contributes to enhanced quality of life for all of our visitors and the communities we serve…" (REC-DC-01). Although many of the water-based recreation opportunities on the Tonto occur in non-fee areas, a large portion of the water-based recreation activities occur in fee areas located within the Lakes and Rivers Management Area.

In alternative B, the Lakes and Rivers Management Area would play a vital role in managing water-based recreation in developed areas. Sustainable management of high-use recreation would be prioritized within this area, allowing for development of features such as water access points and ramps for kayaking and stand-up paddle boarding, both growing activities on the Forest. Management and growth of primitive recreation experiences within the management area would not be prioritized; minimal to no effects expected. See the Management Areas–Alternative B (proposed forest plan) section below for more information on the Lakes and Rivers Management Area.

Water-based recreation activities that occur outside of developed areas may be affected by grazing allotments that become open or closed. See the Dispersed Recreation- Motorized and Nonmotorized section for details.

Water-based recreation activities are in high-demand near the Phoenix Metropolitan area. Alternative B would better address safety concerns, over-crowding, resource damage, and user conflicts. Developed recreation sites would be better managed compared to alternative A and the Lakes and Rivers Management Area would better accommodate overcrowded and poor sanitation levels during busy seasons. Increased user satisfaction would result and there would be a potential for fewer number of safety and emergency incidents from unsafe conditions. Water quality conditions from overuse and litter accumulation would have a greater potential to improve compared to alternative A, benefiting fish populations and other wildlife habitat. Businesses located near busy water-related recreation areas may see an increase in profit, and maintenance and expansion projects would better manage high levels of use more efficiently than alternative A.

Special Uses

Alternative B would provide equal opportunity for all recreational special use events and services to apply for authorizations, while approving operating plans and actions that protect the natural resources and provide safety to the public (SU-DC-04 and SU-DC-06). An appropriate number of authorizations would be issued for each activity as needed by the public, which would improve and increase diversity of visitor recreation experiences compared to alternatives A, C, and D which do not allow for a wide variety of authorized activity types. This would also help reduce user conflicts as no activity would be given priority or preferred access over another. Resource conditions would be addressed for specific authorized activities at the management level. For example, soil compaction from numerous outfitting and guiding operations would be mitigated by authorizing strategic locations to prevent overuse of anyone camping area. Also, scenic impacts from marina and resort facilities would be addressed by planting native trees between the structures and visible areas such as highways and major trails and by painting facilities colors that complement the natural environment.

Management Areas – Alternative B

There are 43,204 acres of recommended wildernesses in alternative B (see volume 2, Management Areas and volume 4, appendix D). These areas would see an increase in restrictions on developed, motorized recreation and development to maintain the unique characteristics identified in each location. Primitive recreation opportunities will increase. Motorized recreation would be restricted to designated roads and trails (as identified in a travel management plan), which would improve soil conditions and riparian habitats as riparian areas would no longer be damaged by motorized activities (off-highway vehicles and mountain bikes). Some roads may be decommissioned and developed into hiking and/or equestrian trails, which would still improve soil conditions but not to the same extent as a road that is completely abandoned from all recreation uses. In addition, new infrastructure for motorized use and developed recreation opportunities would not be implemented within the recommended areas. This can have multiple effects; one possible outcome is a continuation of soil erosion, vegetation trampling, and human-caused wildfires that can sometimes be addressed with infrastructure for motorized use and developed recreation opportunities; on the other hand, a lack of new infrastructure and developments may improve conditions of natural resources due to a decrease in public visitation and environmental impacts. This alternative would lead to an increase in the beneficial effects associated with less motorized recreation compared to alternatives A and D, but less so compared to alternative C.

With the proposed acres of recommended wildernesses, alternative B would provide additional opportunities for solitude and primitive recreation experiences. Visitation to these areas from the hiking and equestrian communities may increase, resulting in a demand for additional nonmotorized trails and recreation opportunities. Partnerships, volunteerism, and support from local businesses may grow to encourage the Forest to implement such recreation opportunities, addressing the desired condition "Recreational opportunities are successfully achieved through cooperative and collaborative engagement with the people we serve and our partnerships with individuals, organizations, and communities" (REC-DC-05). If new nonmotorized trails are installed following sustainable practices, other Forest resources such as soils, vegetation, wildlife, and watersheds within the recommended areas and eligible segments should see minimal to no negative impacts.

Alternative B also has four recommended research natural areas: Dutchwoman Butte, Picketpost Mountain, Three Bar, and Upper Forks Parker Creek. Effects would be the same as listed in Research Natural Areas in the Effects Common To All Alternatives section. Having more research natural areas than alternatives A and D would increase the areas with restrictions to recreation activities. This would specifically impact off-highway vehicle and motorized recreation activities if the areas need to be withdrawn from motorized uses to achieve desired conditions (RNBAMA-DC-05). User satisfaction for off-highway vehicle and motorized recreation may decrease.

Alternative B has four proposed botanical areas: Fossil Springs, Little Green Valley Fen, Horseshoe, and Mesquite. Designated and recommended research natural areas and botanical areas have the same desired conditions; effects would be the same as listed above.

National trails and significant caves remain the same in size and location for all alternatives. However, alternative B would provide the best circumstances to maintain and manage both of these types of recreation opportunities, while providing necessary resource protections. Recreation management in this alternative emphasizes a balance of both motorized and nonmotorized opportunities, giving the program flexibility to provide maintenance, modifications, and expansions of national trails and access to caves as needed based on public demands and resource concerns. User satisfaction may increase and conditions for unique recreation opportunities on national trails and at significant caves may improve.

Alternative B proposes a unique management area: the Lakes and Rivers Management Area. The management area consists of portions of Roosevelt Lake, Apache Lake, Canyon Lake, Saguaro Lake, Horseshoe Lake, Bartlett Lake, the Verde River, and the Lower Salt River. The purpose of this area is to prioritize and manage high-use developed and dispersed recreational opportunities in and around the lakes and major rivers of the Tonto National Forest. It provides additional guidance in order to sustain and promote the high-use and enhanced recreation in the area, and supports the visitor impact studies (Marion 2013)[39] that showed one of the most effective management solutions to address visitor impacts is to limit types of use with higher impacts to specific areas. Desired conditions of this area, such as "The area attracts diverse user groups and is a highly desirable recreation destination for day use and camping throughout the year" (LRMA-DC-02), align with many desired conditions of recreation, including "The Forest offers a diversity of high-quality developed and dispersed recreation opportunities" (REC-DC-04).

[39] See the Affected Environment, Developed Recreation section.

The Lakes and Rivers Management Area (LRMA) also addresses resource conditions such as soil erosion and compaction, vegetation trampling, and watershed conditions through the desired condition "Natural resources in the LRMA are adaptable to disturbances" (LRMA-DC-05). Having this management area in alternative B provides an opportunity for recreation management to address issues and high-use impacts directly and early, rather than indirectly and reactively. Poor resource conditions may be prevented or mitigated through developed recreation features and infrastructure such as concrete boat ramps, paved parking lots with boundaries outlined by concrete curbs, designated and monitored staging areas when carrying capacities are met, and restroom facilities and garbage collection bins in visible, high-traffic locations. These features can improve visitor experiences and improve the local recreation economy through sales for a diverse set of recreation opportunities.

In alternative B, the Lakes and Rivers Management Area may also place additional fencing and gates around high-use recreation areas to prevent entry by the Salt River Horses. The purpose of this would be to provide public health and safety, achieving the desired condition "User conflicts and public health and safety issues are infrequent" (LRMA-DC-03). There are minimal to no resources for the Salt River Horses that lie within developed recreation sites or river access points in the Lakes and Rivers Management Area that are not also available outside of the high-use areas. Thus, minimal effects are expected to the Salt River Horses; the Salt River Horses would need to make minor changes to go around areas closed-off from their entry. The same is expected for the recreation resource; additional fencing and/or gates may cause a minor inconvenience for recreationists but access would not be restricted.

The Salt River Horse Management Area is common to all action alternatives. The plan components for this management area allow a deviation in the management of ecological response units from forestwide management. This deviation has the potential to impact the recreation opportunity spectrum setting of the area as the disturbance from horses could damage the landscape and therefore the recreation opportunity. However, the Salt River Horses draw wildlife-watching opportunities on the Forest and many forest visitors would consider them to add recreation opportunities to the area they reside. More information can be found in the Management Areas section of volume 2.

Recreation Opportunity Spectrum

All action alternatives (alternative B, C, and D) include many more specific recreation plan components that focus on maintaining or achieving the desired recreation opportunity spectrum setting, including a guideline that reads "All project-level decisions, implementation activities, and management activities should be consistent with or move the area toward the appropriate desired recreation opportunity spectrum (ROS)[40] class, or current protocol over the long-term[41]" (REC-G-10). These additional plan components better ensure recreation opportunity spectrum is used to manage recreation than in alternative A. The semiprimitive nonmotorized and primitive recreation opportunity spectrum classifications would slightly increase under this alternative.

The total acres for each recreation opportunity spectrum classification for alternative A is depicted in table 15 and figure 8.

[40] Recreation opportunity spectrum can be found on the Tonto National Forest website under Recreation at: https://www.fs.usda.gov/detail/tonto/landmanagement/resourcemanagement/?cid=fsbdev3_018770.
[41] Short-term and long-term timeframes are determined during project level, site-specific project planning.

Table 15. Recreation opportunity spectrum (ROS) settings for alternative B

ROS Classification	Existing Condition (Acres)	Alternative B (Acres)	Change (Acres)
Primitive	596,702.8	597,597.3	Increase of 894.5
Rural	41,247.3	41,247.3	No Change
Roaded Natural	514,230.0	512,157.4	Decrease of 2,072.6
Semiprimitive Motorized	1,088,835.1	1,072,670.5	Decrease of 16,164.6
Semiprimitive Nonmotorized	697,681.2	715,023.8	Increase of 17,342.6
Urban	25,470.8	25,470.8	No Change

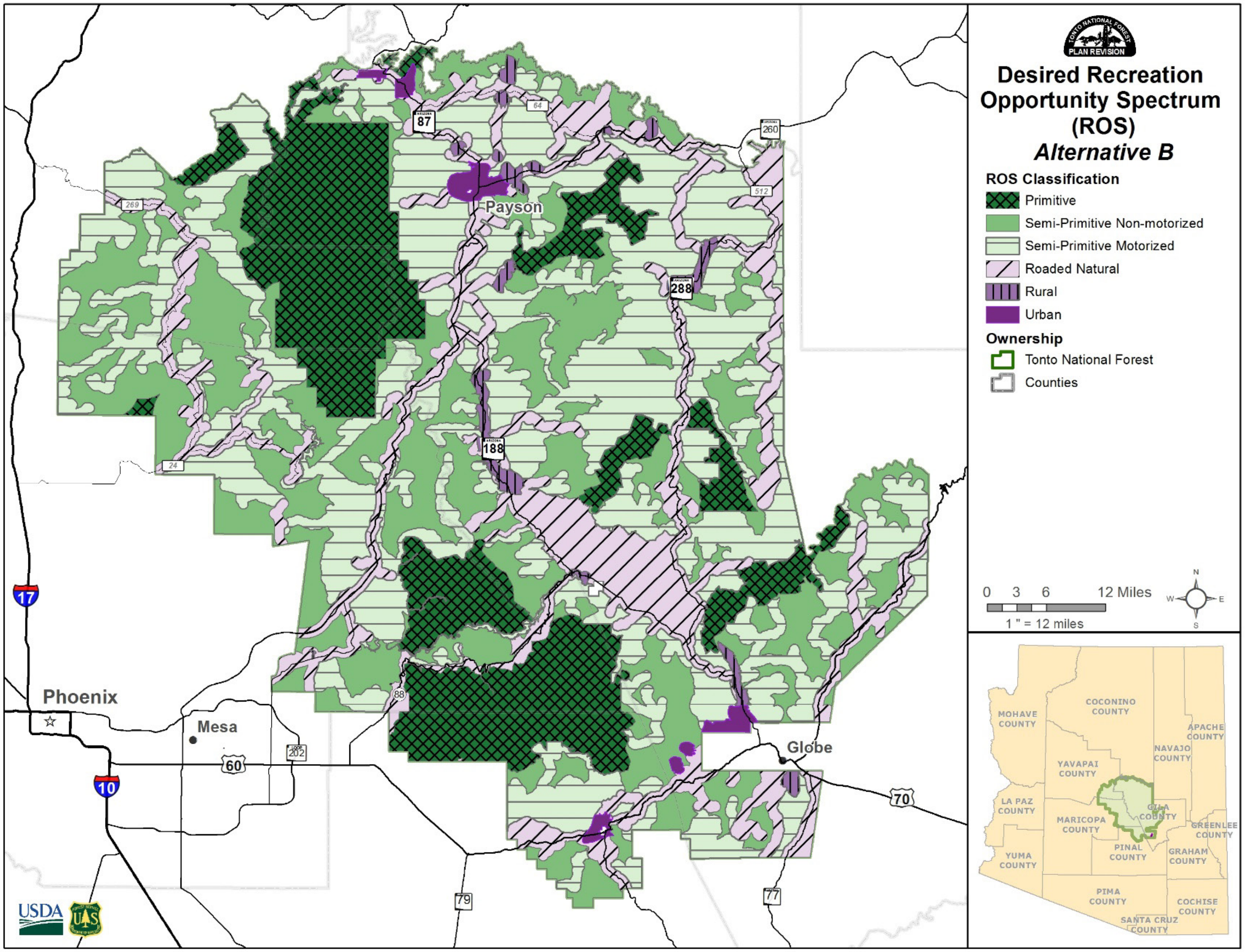

Figure 8. Recreation opportunity spectrum classifications for alternative B

Alternative C Effects

This alternative calls for components of the proposed forest plan to provide minimal human impacts to the forest. It emphasizes primitive recreation opportunities, increased protections to natural resources, use of natural processes for restoration, limiting some aspects of grazing, and prioritizing natural resources over some economic development opportunities.

Developed Recreation

Developed sites and facilities are generally constructed when certain areas, activities, and access are in high demand and resource damage is resulting from those high uses. Alternative C would restrict developed recreation opportunities to existing sites with minimal or no approval to construct new sites and facilities. Some existing sites that are low-use and/or unsustainable may also be decommissioned, decreasing the availability of accessible recreation opportunities on the Forest. This does not support recreation objectives, such as "Recreation serves as a gateway to connect visitors and communities across the forest... and provide accessible opportunities to all regardless of socioeconomic status or individual ability" (REC-DC-10).

As technology and public interests change, the inability to develop additional developed sites and facilities may lead to poor recreation experiences including unsafe and unsanitary conditions, over-crowding, and conflicting uses. Also, those areas already experiencing high visitation levels and resource damages that require developed sites to manage both recreational use and resource impacts would continue to degrade in alternative C. Areas with high foot-traffic would see a continual increase of soil erosion, dirt parking lots would continue to compact the soil and expose dust particles into the air, water access points would see vegetation trampling and increasing invasive weeds, and riparian habitats affected by hikers, campers, etc. would not reach desired conditions[42].

For those sites that are decommissioned, the funds and staff that were used to maintain those sites would become available to improve the remaining open sites. This may result in higher fee compliance and higher user satisfaction rates in the remaining sites[43].

Alternative C also emphasizes the use of wildland fire as a restoration tool over mechanical thinning. This may improve user satisfaction as recreationists are less affected by smoke, slash piles, and temporary area closures during prescribed burns. However, recreationists would still be affected by smoke during wildland fires, which may become more intense due to the lack of mechanical thinning. Smoke from wildland fire generally affects recreationists less in developed areas than dispersed areas, however, developed areas are affected similarly. See the Dispersed Recreation- Motorized and Nonmotorized section for more details. Developed recreation facilities that are damaged by wildfire are generally closed for extended periods of time until funding and resources are available for replacement or repair. This would greatly affect users as they would be displaced to other locations that may not have the capacity to support higher visitation levels. Additional resource damages such as soil erosion and vegetation trampling may result in those locations.

Dispersed Recreation – Motorized and Nonmotorized

For those dispersed recreationists seeking an outdoor experience of solitude in the natural setting, conditions may improve with alternative C. Activities such as hiking, mountain biking, horseback riding, rock climbing, and off-highway vehicle use may see less developments and facilities on the trails and in the general Forest. Those who prefer to see nature with the least amount of development and human

[42] See the Riparian section for more information.
[43] See the Effects Common to All Alternatives section for more information on fee compliance effects.

impact to the land would benefit from this alternative while others who prefer to have facilities and services (such as restrooms, boat ramps, and cabins) while recreating in dispersed recreation areas may be inconvenienced or seek other locations to recreate. Some recreation activities rely heavily on improvements, and alternative C may negatively impact the functionality of those recreation opportunities. For example, a lack of off-highway vehicle staging areas can cause an inconvenience and safety concerns for off-highway vehicle users, and a reservoir with muddy or sandy shorelines can make watercraft launching very difficult without concrete launch ramps.

Specific to motorized uses, this alternative would limit maintenance, modification, construction, and development of trails, trailheads, and staging areas. These types of developments and services are necessary for the motorized recreation program to be successful and recreation opportunities to be valuable to the public; thus, alternative C would negatively impact the motorized recreation program. This might lead to lower user satisfaction rates and motorized users seeking other lands outside of the Tonto National Forest. It may also lead to the development of user-created trails and staging areas that are unsustainable and cause resource damages such as soil erosion and compaction, vegetation trampling, and riparian habitat damages. Approval for new motorized trails would be rare in this alternative and desired conditions of dispersed recreation would not be met: "Motorized and nonmotorized trail systems provide diverse opportunities (e.g., interconnecting loops and connections to other destinations, varying lengths and challenges)" (REC-DIS-DC-04).

For nonmotorized uses, alternative C favors primitive recreation opportunities, which is consistent with the desired conditions for nonmotorized dispersed recreation. Maintenance, modification, and some construction and development of nonmotorized trails would be considered to improve primitive recreation opportunities.

Alternative C also emphasizes the use of wildland fire as a restoration tool over mechanical thinning. While this alternative includes the highest treatment objective, accomplishing restoration using mostly fire would be difficult due to environmental and logistical constraints (sufficient burn windows and capacity). As areas remain untreated, there is an increased potential for uncharacteristically severe fire which leads to undesirable effects for recreationists. After a severe wildfire, recreationists are less likely to use that area in the near future and will choose locations that lack wildfire evidence (e.g., blackened and burnt trees, other fire debris). Areas that are not annually treated with mechanical thinning may also become overgrown and less desirable for dispersed campers, hikers, backpackers, and equestrians. These undesirable effects for recreationalists would persist until the evidence of modification practices (e.g., stumps) are not prevalent and the vegetative desired conditions are restored. These negative/undesirable effects from uncharacteristically severe wildfires can be long lasting and may take long periods to revert back to more desirable conditions. For these reasons, these potential negative effects are highest under this alternative compared to other alternatives.

In alternative C, grazing allotments would be closed upon vacancy. Recreationists would see less livestock on the Forest and experience less manure. This may improve user satisfaction in select areas where both recreation use and grazing are high. Users would also be inconvenienced less from the lack of fencing, cattle guards, water tanks, gates, and other grazing related improvements. There is a greater potential for more allotments to become closed and therefore this alternative would provide the least negative effects to recreation associated with grazing compared to other alternatives.

See the Water-Based Recreation section for more information on restrictions in a nonfunctional riparian area.

Water-Based Recreation

Water-based recreation activities occur in and along the shorelines of rivers, streams, and reservoirs. Types of activities include both motorized and nonmotorized, depending on the setting and location-specific restrictions. Alternative C emphasizes nonmotorized and primitive recreation opportunities, limiting growth and development of high-use water-based recreation areas. Developed, high-use water-based recreation areas may exceed capacities without the opportunity to adjust to growing user needs and increasing resource impacts. User conflicts would increase, and overcrowding may result in busy areas such as Butcher Jones and Acacia Recreation Sites. Many recreation areas long the Forest's lakes and busy rivers currently reach capacity on holidays and busy weekends. Alternative C would not help achieve desired conditions such as "Conflicts among various recreation users and with other multiple uses are infrequent and easily resolved" (REC-DC-07) and "Visitation levels to not result in overcrowding and provide safety for visitors while remaining consistent with other resource desired conditions for the use area" (REC-DIS-WB-DC-02). User satisfaction rates in developed water-based recreation areas may decrease, lowering fee compliance and available funds to perform basic maintenance. Forest staff may not be able to maintain to standard restroom facilities and trash services. Other resources would continue to see direct impacts such as soil erosion, water sedimentation, hazardous food (trash) to wildlife, and vegetation trampling.

In alternative C, water-based recreation areas with a more primitive theme would receive active management to address user needs and resource impacts. Nonmotorized trails around water sources may receive more maintenance and trail markers. This would improve user satisfaction and trail conditions related to soils, vegetation, and water. Cultural resources are also commonly found near water sources; these sites may receive more protections from recreation and other human or environmental impacts. Resource protections would be addressed using sustainable practices, such as providing trail markers to encourage users to remain on designated paths and access routes to the water, providing educational signs to encourage responsible uses around sensitive cultural sites, and providing restrooms to reduce the amount of human waste entering the water systems. These and other design features can help minimize soil compaction and erosion, vegetation trampling, and other effects to riparian areas. Scenic values may also increase in these areas, as infrastructure and other developments would be less noticeable.

The biggest impact to water-based recreation in alternative C would be if a given riparian area is determined to be nonfunctional. In this case, the riparian management zone would be closed to all permitted and allowed uses until riparian recovery is achieved. Activities such as fishing, hiking, picnicking, overnight camping, and equestrian use would be affected the most. Recreationists would not have access to the nonfunctional riparian management zone and would likely seek other water-based recreation opportunities nearby. The closure would increase visitation and the resulting resource impacts (such as increased soil compaction, increased spread of invasive species, and damage to riparian habitats) to other recreation areas directly adjacent to the closed area, with decreasing effects being seen as you travel to other recreation locations farther away from the closed location.

Alternative C also emphasizes the use of wildland fire as a restoration tool over mechanical thinning. This may improve user satisfaction as recreationists are less affected by smoke, vegetation piles, and temporary area closures during prescribed burns. See the Dispersed Recreation- Motorized and Nonmotorized section for more details.

In alternative C, grazing allotments would be closed upon vacancy. Recreationists would see less livestock on the Forest and experience less manure. This may improve user satisfaction in select areas where both recreation use and grazing are high. Users would also be inconvenienced less from the lack of fencing, cattle guards, water tanks, gates, and other grazing related improvements.

Special Uses

Alternative C would emphasize management of special use activities that provide nonmotorized and primitive recreation experiences. Current authorizations for other recreation special uses such as off-highway vehicle would continue, but no additional authorizations would be issued and requests for additional locations or user day allotments would not be considered. The existing authorized services would not be able to meet growing public demands, resulting in lost opportunities for public education on safe and responsible recreation practices, local and Forest history, and watershed responsibilities for central Arizona.

Special use authorizations for primitive recreation experiences is not expected to have an impact on management or other Forest resources different from the other alternatives. However, there may be an increase in commercial nonmotorized requests. Authorizations would be issued based on carrying capacities, and operating plans would address specific actions required to protect the natural resources and provide safety to the public (SU-DC-01). Additional resource conditions would be addressed at the management level. For example, soil compaction from numerous outfitting and guiding operations would be mitigated by authorizing strategic locations to prevent overuse of any one camping area. Recreation events and filming/photography proposals may be denied or accepted with modifications (restrictions) if they do not emphasize nonmotorized and primitive recreation uses. These activities would likely find lands outside of the Forest to proceed or be cancelled altogether.

Proposals for new facilities and services such as marinas, resorts, and organizational camps, as well as proposals to expand existing permitted facilities and services, would rarely be approved. Local businesses and public service facilities would experience economic losses from this alternative.

In alternative C, if a given riparian area is determined to be nonfunctional, no permitted uses would be allowed to proceed or operate within the riparian management zone. It is assumed that existing permanent structures would be allowed to remain, unless they are directly related to the area achieving recovery. Operations at those facilities, however, would cease including sales, public services, maintenance, and expansion. Outfitting and guiding operations would be provided alternative locations to operate outside of the closure area or be forced to operate off-Forest. This may cause user conflicts and lower satisfaction rates, no longer meeting the desired condition “User conflicts between outfitting and guiding activities are infrequent” (SU-DC-05).

Management Areas – Alternative C

Designated wilderness areas remain the same per alternative. However, since alternative C focuses on nonmotorized and primitive recreation opportunities, more emphasis may be placed on maintaining and improving existing infrastructure such as trails, trailheads, signs, and facilities that support designated and recommended wildernesses. This infrastructure would only be managed to the extent that it would maintain or improve the wilderness character of the area or to address other Forest resource concerns (e.g., maintaining a trail to reduce soil erosion, replacing missing signs to prevent user-created trails that cause soil compaction and vegetation trampling). This may improve user satisfaction and increase visitation to these areas, as well as provide the public with additional educational materials about leave-no-trace ethics and responsible recreation in the wilderness. With more emphasis on managing nonmotorized and primitive recreation opportunities in these areas, other resources may also see improved conditions such as healthier soils resulting from visitors staying on designated trails, less damage to vegetation, less litter accumulation, and less damage to cultural sites. Partnerships and volunteerism that focus on wildernesses may also have more opportunities to support the Forest achieve desired conditions by performing field work and providing public education. Businesses that promote primitive recreation experiences may also see an increase in sales with this alternative.

There are 399,029 acres of recommended wildernesses in alternative C. The effects to recreation would be the same as alternative B, but at a larger scale due to the larger number of acres of recommended wildernesses. See the Management Areas–Alternative B section for more information on these effects.

Alternative C has four recommended research natural areas: Dutchwoman Butte, Picketpost Mountain, Three Bar, and Upper Forks Parker Creek and four proposed botanical areas: Fossil Springs, Little Green Valley Fen, Horseshoe, and Mesquite. Effects would be the same as alternative B; see the Management Areas–Alternative B section for more details on specific effects.

The number and location of significant caves remains the same per alternative. In alternative C, less management emphasis on providing motorized access, trails, or interpretive signage near their locations may improve conditions of significant caves by decreasing recreational visitation. However, this would reduce the availability of unique, accessible recreation opportunities on the Forest, resulting in decreased user satisfaction rates. On the other hand, alternative C also places an emphasis on improving primitive recreation experiences. This may result in new or improved nonmotorized trails leading to significant caves, resulting in increased visitation and, without proper education and prevention, damages to cave resources.

National trails remain the same in size and location for all alternatives. However, alternative C would not be as effective at providing quality recreation opportunities in these areas as alternative B. Recreation management in this alternative emphasizes primitive and nonmotorized opportunities. The Great Western National Millennium Trail and sections of the Arizona National Scenic Trail are currently designated for motorized uses; under alternative C, emphasis would be placed on maintaining the nonmotorized sections of national trails rather than motorized sections. Thus, the Great Western National Millennium Trail and motorized sections of the Arizona National Scenic Trail would not receive the maintenance and modifications they need to meet desired conditions of other Forest resources (e.g., to reduce soil erosion and the spread of invasive species, to minimize impacts to scenic resources) as efficiently as nonmotorized sections or to address user needs such as interconnecting loops, trailheads and accessible parking areas, and appropriate route markers. Maintenance, modification, and expansion of nonmotorized sections of national trails would also be limited in alternative C, however, not to the same extent as nonmotorized sections of trails. Nonmotorized sections of national trails may receive more maintenance to improve or increase primitive recreation opportunities on the Forest, but opportunities to expand or make major modifications to the trails may still be limited under this alternative. The result would be increased user satisfaction rates on the sections of nonmotorized national trails and decreased user satisfaction rates on the sections of motorized national trails.

The Salt River Horse Management Area is common to all action alternatives. The plan components for this management area allow a deviation in the management of ecological response units from forestwide management. This deviation has the potential to impact the recreation opportunity spectrum setting of the area as the disturbance from horses could damage the landscape and therefore the recreation opportunity. However, the Salt River Horses draw wildlife-watching opportunities on the Forest and many forest visitors would consider them to add recreation opportunities to the area they reside. More information can be found in the Management Areas section of volume 2.

Recreation Opportunity Spectrum

All action alternatives (alternative B, C, and D) include many more specific recreation plan components that focus on maintaining or achieving the desired recreation opportunity spectrum setting, including a guideline that reads “all project-level decisions, implementation activities, and management activities should be consistent with or move the area toward the appropriate desired recreation opportunity spectrum (ROS)[44] class, or current protocol over the long-term[45]" (REC-G-10). These additional plan components better ensure the recreation opportunity spectrum is used to manage recreation and greater effects related to using the recreation opportunity spectrum than in alternative A. Primitive recreation opportunity spectrum settings greatly increase under this alternative reflecting the emphasis on more primitive forms of recreation.

The total acres for each recreation opportunity spectrum classification for alternative C is depicted in table 16 and figure 9.

Table 16. Recreation opportunity spectrum (ROS) settings for alternative C

ROS Classification	Existing Condition (Acres)	Alternative C (Acres)	Change (Acres)
Primitive	596,702.8	785,300.3	Increase of 188,597.5
Rural	41,247.3	39,936.7	Decrease of 1,310.6
Roaded Natural	514,230.0	481,047.6	Decrease of 33,182.4
Semiprimitive Motorized	1,088,835.1	940,775.8	Decrease of 148,059.3
Semiprimitive Nonmotorized	697,681.2	691,635.9	Decrease of 6,045.3
Urban	25,470.8	25,470.8	No Change

[44] Recreation opportunity spectrum can be found on the Tonto National Forest website under Recreation at: https://www.fs.usda.gov/detail/tonto/landmanagement/resourcemanagement/?cid=fsbdev3_018770.
[45] Short-term and long-term timeframes are determined during project level, site-specific project planning.

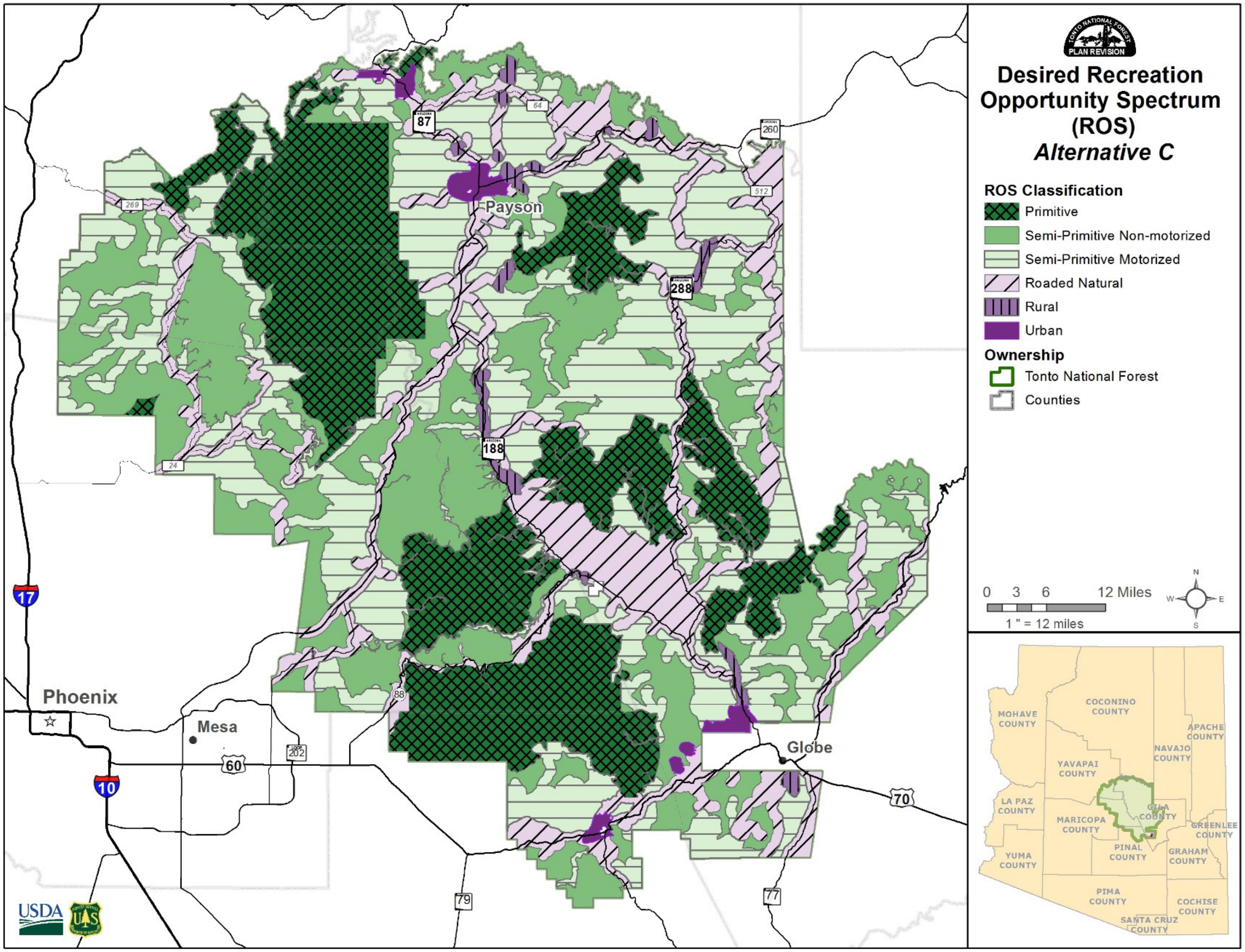

Figure 9. Recreation opportunity spectrum classifications for alternative C

Alternative D Effects

This alternative calls for forest plan components to focus on providing more accessible recreation opportunities that favor motorized recreation, having fewer restrictions on land uses, and excluding additional recommended wilderness acres.

Developed Recreation

Developed sites and facilities are generally constructed when certain areas, activities, and access are in high demand and resource damage is resulting from those high uses. Alternative D would provide expansion of existing recreation facilities and services, as well as encourage construction of additional motor vehicle routes where needed to access recreation opportunities. This supports recreation objectives, such as “Recreation serves as a gateway to connect visitors and communities to nature and each other” (RED-DC-9). And “Environmental programs, nature programs, and other guided services, are available locally to connect people with nature, teach new skills, provide challenge and adventure, and instill a lifetime appreciation for public lands and outdoor recreation. Opportunities are available for everyone regardless of socioeconomic status or individual ability” (REC-DC-10).

There are many areas throughout the Forest already experiencing high visitation levels and resource damages, or that will soon reach those levels; these areas may require developed sites to best manage both the recreational uses and resource impacts. Alternative D provides more flexibility to construct developed recreation areas to not only increase accessible recreation opportunities available on the Forest, but also to improve other resource conditions; high foot-traffic areas and dirt parking lots may be asphalted or concreted to prevent further soil erosion and dust issues; railings or other barriers may be installed to prevent areas experiencing soil compaction from both foot traffic and vehicles from expanding; boat ramps may be concreted to prevent further soil erosion that affects water quality; wildlife-proof trash collection containers may be installed to encourage visitors to dispose of their garbage in a manner that protects wildlife; restrooms may be installed in high-visibility locations at water access points to prevent human waste from entering the water systems; and fire rings may be installed in designated locations to reduce the number of human-caused wildfires caused by improper campfire placement and use. With more developed sites providing public accessibility to valuable recreation resources, the demand for these kinds of recreation may increase. Businesses may see more revenue generated from watercraft sales, picnic merchandise, and other recreation-related products popular for the developed recreation setting.

Dispersed Recreation – Motorized and Nonmotorized

For those dispersed recreationists seeking an outdoor experience of solitude in the natural setting, conditions may deteriorate with alternative D. Activities such as hiking, mountain biking, horseback riding, rock climbing, and off-highway vehicle use may see more developments and facilities on the trails and in the general Forest. Those who prefer to have facilities and services (such as restrooms, boat ramps, and cabins) available to them while recreating would benefit from this alternative, while others who prefer to enjoy nature with the least amount of development and human impact to the land may be inconvenienced or their outdoor experience diminished by the presence of facilities. Thus, it is unclear if alternative D would have a positive or negative impact to the dispersed recreation community. It is assumed, however, that nonmotorized recreation, and specifically primitive recreation, would be negatively impacted (more than motorized recreation) due to the lack of management emphasis to maintain these recreation opportunities and features in alternative D.

With this alternative, more off-highway vehicle trails and staging areas could potentially be constructed and additional accessible features and recreation opportunities may be provided. Specifically, alternative D would increase the number of facilities available to the motorized recreation community; additional parking/staging lots may be built, new kiosks and maps installed in the field, and new motorized trails built. These changes and additions would benefit the motorized recreation community by accommodating more users, providing new unique routes, and providing quality information and trail guides in the field. The addition of new motorized trails, specifically vehicle-restricted routes (such as single track versus two track and other full-size off-highway vehicle routes), may also decrease user conflicts.

In alternative D, grazing allotments would be opened upon vacancy. Recreationists may notice livestock, related improvements such as water tanks, and cow manure in areas where they were not seen recently. This may bother some recreationists; however, it is unknown how most users would react to the presence of livestock in a new area. Users may be inconvenienced by additional fencing and gates that are otherwise restricting access. Some off-highway vehicle users may not close gates when travelling on roads, affecting management of a given allotment by allowing livestock to cross boundaries unintentionally.

Water-Based Recreation

Water-based recreation activities occur in and along shorelines of rivers, streams, and reservoirs. Types of activities include both motorized and nonmotorized, depending on the setting and location-specific restrictions. Alternative D emphasizes motorized and accessible recreation opportunities, providing flexibility for the Forest to further develop water-based recreation facilities and environments. The Lakes and Rivers Management Area[46] would address most developed water-based recreation areas. However, rivers and streams that are not currently developed may see different kinds of effects.

In rivers and streams that receive low levels of recreational use, dispersed water-based recreation areas would likely receive less maintenance and active management in alternative D. Water access routes would become overgrown, existing trails would not be prioritized to be maintained to prevent soil erosion, and litter would accumulate. The overgrowth and lack of maintenance of these areas may also lead to additional human-caused wildfires. User satisfaction may decrease.

On the other hand, in rivers and streams that are currently receiving moderate to high levels of recreational use and visitation, additional accessible features and services such as paved parking lots, restroom facilities, walkways and developed water access points, and designated picnic and camping areas could be prioritized in alternative D. Resource protections would be addressed using sustainable practices, such as providing trail markers to encourage users to remain on designated paths and access routes to the water, providing picnic tables or other developed features to minimize the footprint of both day use and camping sites, and providing restrooms to reduce the amount of human waste entering the water systems. These and other design features can help minimize soil compaction and erosion, vegetation trampling, poor water qualities, and other effects to riparian areas.

In addition to providing resource protections, recreation services and facilities such as restrooms, trash collection containers, designated picnic areas, and safe parking environments are also desirable by the public and can increase user satisfaction and visitation. This helps achieve desired conditions such as "Water based recreation provides social, cultural, and economic benefit to the public" (REC-DIS-WB-DC-01) and "Recreation contributes to enhanced quality of life for all of our visitors and the communities we serve…" (REC-DC-01). Alternative D would emphasize management of special use activities that promote motorized and accessible recreation. Current authorizations for other recreation special uses such as backcountry hiking would continue, but no additional authorizations would be issued and requests for additional locations or user day allotments would not be considered. The existing authorized services

[46] See the Management Areas – Alternative D section for more information on the Lake and Rivers Management Area.

would not be able to meet growing public demands, resulting in lost opportunities for public education on safe and responsible recreation practices, local and Forest history, and leave-no-trace ethics.

An increase in special use authorizations for motorized recreation activities may result in additional resource impacts in off-highway vehicle areas; levels of dust particles in the air, soil erosion along unstable roads and trails, and road damages caused by high-use may increase. User conflicts and unnecessary resource damages from increased motorized recreation authorizations should be prevented with proper planning and utilization of carrying capacity studies (SU-DC-05). Operating plans would be used to address specific actions required to protect the natural resources and provide safety to the public (SU-DC-01). Additional resource conditions would be addressed at the management level. For example, extreme soil erosion and road damages from numerous off-highway vehicle outfitting and guiding operations would be mitigated by authorizing strategic locations to prevent overuse of any one trail or road.

Alternative D emphasizes proposals of new facilities and services and expansion of existing permitted services such as marinas, resorts, and organizational camps. Local businesses and public services facilities may see economic gain from this alternative, except in the case where there are too many authorizations issued. For example, for activities in high-demand such as guided nonmotorized watercraft trips, if 20 different businesses were authorized to operate at a given reservoir, some of the smaller businesses with less advertising might not be successful enough to continue operations.

Management Areas – Alternative D

Designated wilderness areas remain the same per alternative. However, since alternative D focuses on motorized and accessible recreation opportunities, less priority may be placed on maintaining and improving existing infrastructure such as trails, trailheads, signs, and facilities that support wildernesses. This may decrease user satisfaction and visitation to these areas, as well as increase resource damages including soil erosion from visitors not staying on designated trails, damaged vegetation near trails and dispersed camping areas in the wilderness, and damage to cultural sites from lack of public education. Partnerships and volunteerism that focus on wildernesses may dissolve as these opportunities are focused on motorized recreation projects.

Alternative D proposes a unique management area: the Lakes and Rivers Management Area. The management area consists of portions of Roosevelt Lake, Apache Lake, Canyon Lake, Saguaro Lake, Horseshoe Lake, Bartlett Lake, the Verde River, and the Lower Salt River. The purpose of this area is to prioritize and manage high-use developed and dispersed recreational opportunities in and around the lakes and major rivers of the Tonto National Forest. It provides additional guidance in order to sustain and promote the high-use and enhanced recreation in the area and supports the visitor impact studies (Marion 2013[47]) that showed one of the most effective management solutions to address visitor impacts is to limit types of use with higher impacts to specific areas. Desired conditions of this area, such as “The area attracts diverse user groups and is a highly desirable recreation destination for day use and camping throughout the year” (LRMA-DC-02), align with many desired conditions of recreation, including “The Forest offers a diversity of high-quality developed and dispersed recreation opportunities” (REC-DC-04).

The Lakes and Rivers Management Area (LRMA) also addresses resource conditions such as soil erosion and compaction, vegetation trampling, and watershed conditions through the desired condition “Natural resources in the LRMA are adaptable to disturbances” (LRMA-DC-05). Having this management area in alternative D provides an opportunity for recreation management to address issues and high-use impacts

[47] See the Affected Environment, Developed Recreation section.

directly and early, rather than indirectly and reactively. Poor resource conditions may be prevented or mitigated through developed recreation features and infrastructure such as concrete boat ramps, paved parking lots with boundaries outlined by concrete curbs, designated and monitored staging areas when carrying capacities are met, and restroom facilities and garbage collection bins in visible, high-traffic locations. These features can improve visitor experiences and improve the local recreation economy through sales for a diverse set of recreation opportunities.

In alternative D, the Lakes and Rivers Management Area may also place additional fencing and gates around high-use recreation areas to prevent entry by the Salt River Horses. The purpose of this would be to provide public health and safety, achieving the desired condition "User conflicts and public health and safety issues are infrequent" (LRMA-DC-03). There are minimal to no resources for the Salt River Horses that lie within developed recreation sites or river access points in the Lakes and Rivers Management Area that are not also available outside of the high-use areas. Thus, minimal effects are expected to the Salt River Horses; the Salt River Horses would need to make minor changes to go around areas closed-off from their entry. The same is expected for the recreation resource; additional fencing and/or gates may cause a minor inconvenience for recreationists but access would not be restricted.

National trails remain the same in size and location for all alternatives. However, alternative D would not be as effective at providing quality recreation opportunities in these areas as alternative B. Recreation management in this alternative emphasizes motorized opportunities. The Great Western National Millennium Trail and sections of the Arizona National Scenic Trail are currently designated for motorized uses; under alternative D, emphasis would be placed on maintaining the motorized sections of national trails rather than nonmotorized sections. Thus, the Great Western National Millennium Trail and motorized sections of the Arizona National Scenic Trail would be more likely to receive the maintenance and modifications they need to meet desired conditions of other Forest resources (e.g., to reduce soil erosion and the spread of invasive species, to minimize impacts to scenic resources). Motorized sections would address user needs such as interconnecting loops, trailheads and accessible parking areas, and appropriate route markers. Maintenance, modification, and expansion of nonmotorized sections of national trails would be limited in alternative D. Nonmotorized sections of national trails may receive less maintenance to improve or increase primitive recreation opportunities on the Forest. The result would be decreased user satisfaction rates on the sections of nonmotorized national trails and increased user satisfaction rates on the sections of motorized national trails.

The Salt River Horse Management Area is common to all action alternatives. The plan components for this management area allow a deviation in the management of ecological response units from forestwide management. This deviation has the potential to impact the recreation opportunity spectrum setting of the area as the disturbance from horses could damage the landscape and therefore the recreation opportunity. However, the Salt River Horses draw wildlife-watching opportunities on the Forest and many forest visitors would consider them to add recreation opportunities to the area they reside. More information can be found in the Management Areas section of volume 2.

Recreation Opportunity Spectrum

All action alternatives (alternative B, C, and D) include many more specific recreation plan components that focus on maintaining or achieving the desired recreation opportunity spectrum setting including a guideline that reads "all project-level decisions, implementation activities, and management activities should be consistent with or move the area toward the appropriate recreation opportunity spectrum (ROS) or current protocol" (REC-G-10). These additional plan components better ensure the recreation opportunity spectrum is used to manage recreation and greater effects related to using the recreation opportunity spectrum than in alternative A. However, this alternative is closest to the existing condition than alternatives B and C. The total acres for each recreation opportunity spectrum classification for alternative D is listed in table 17 and shown in figure 10.

Table 17. Recreation opportunity spectrum (ROS) settings for alternative D

ROS Classification	Existing Condition (Acres)	Alternative D (Acres)	Change (Acres)
Primitive	596,702.8	596,702.8	No Change
Rural	41,247.3	41,247.3	No Change
Roaded Natural	514,230.0	517,014.9	Increase of 2,784.9
Semiprimitive Motorized	1,088,835.1	1,086,225.8	Decrease of 2,609.3
Semiprimitive Nonmotorized	697,681.2	697,505.6	Decrease of 175.6
Urban	25,470.8	25,470.8	No Change

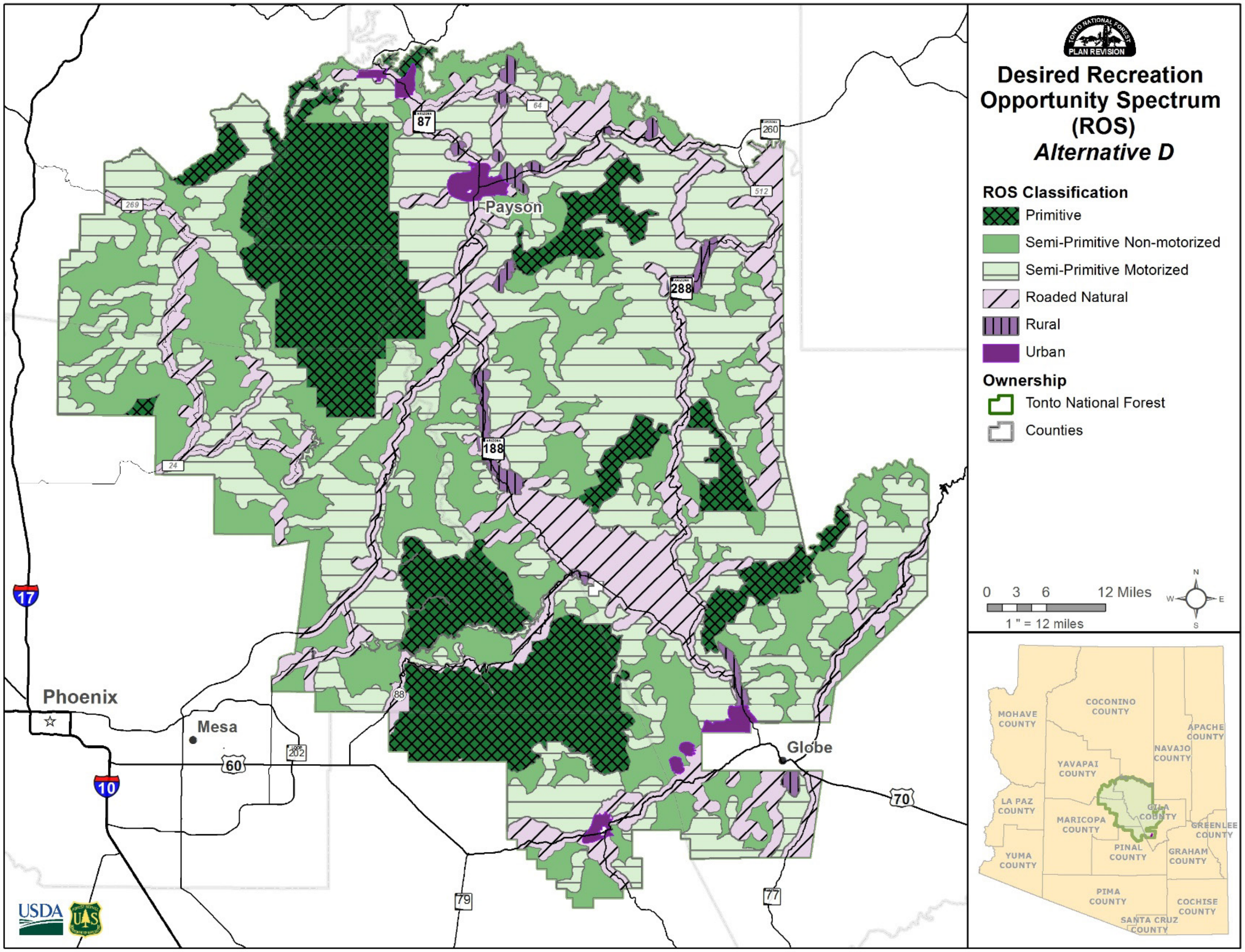

Figure 10. Recreation opportunity spectrum classifications for alternative D

Cumulative Effects

This cumulative effects analysis does not attempt to quantify the effects of past actions by adding up all prior actions on an action-by-action basis. In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current conditions (as detailed in the Affected Environment section) as a proxy for the impacts of past and present actions. This is because existing conditions reflect the aggregate impact of all prior actions and natural events.

This analysis is based on an evaluation of expected conditions for the next 10 to 15 years, or the life of the plan. Recreation demands, activities, and common practices fluctuate yearly and there are no reliable recreation trends available to show otherwise.

The analysis area for cumulative effects includes the Tonto National Forest and adjacent public lands including the Prescott, Coconino, Apache-Sitgreaves, and Coronado National Forests, Tonto National Monument, Bureau of Land Management lands, Arizona State lands, Tribal lands, and the numerous counties and municipalities that overlap or are located in the immediate vicinity of the Forest. These public lands provide a wide range of recreation opportunities in addition to the Tonto National Forest. However, differences in agency missions often result in different types of recreation experiences. The city and county parks tend to manage visitor activities more tightly than the Forest Service. They provide highly developed and managed visitor facilities with services based on a more urban setting and public demand. The Coconino, Apache-Sitgreaves, and Coronado National Forests provide opportunities similar to the Tonto National Forest, but with different landscapes. Arizona State lands typically consist of undeveloped lands or state trust lands, and offer related recreation opportunities such as off-highway vehicle use, camping, hunting, and other dispersed recreation activities. Many of these lands have restrictions on target shooting or require permits for entry. Multiple city and county campgrounds are located at or near the border of the National Forest and provide a variety of opportunities for recreational vehicles (RVs), tent and car campers, day picnickers, group events, and other special events. These areas are well developed with ample services and facilities and do not provide the “back country” experience found at campgrounds and popular recreation destinations on the Tonto (REC-DC-02 and REC-DIS-DC-03).

Management of the Tonto National Forest balances dispersed recreation with developed recreation. The Forest provides opportunities for a wide variety of recreational activities from primitive backcountry backpacking to motorized boating on reservoirs. Other lands in Arizona also provide a diverse set of recreation opportunities; 82 percent of lands in Arizona are managed by various Tribes, Federal and State agencies, many of whom are responsible for providing for both recreation opportunities and protection and preservation of the land for future generations (Statewide Comprehensive Outdoor Recreation Plan 2018-2022). Many of these lands receive similar recreation visitation to the Forest, and all public land agencies must address the impacts associated with increased visitations by employing additional recreation management actions or installing additional facilities to implement sustainable recreation and ensure its beneficial effects. On the Forest, doing so would not only help achieve desired conditions for recreation (e.g., REC-DC-01 through 04), but also for other natural resources managed by the agency (e.g., CUH-DC-01, SC-DC-04, FC-DC-02, FF-G-01).

All lands analyzed in this cumulative effects section have ongoing projects and the potential for upcoming projects that may affect implementation of the forest plan. Projects may include things such as adding new off-highway vehicle trails or restricting motorized use, adding new single-use trail systems for equestrian or mountain biking, or closing creeks to recreational use, just to name a few. In general, any change in land management on adjacent lands that increases recreation on those lands will likely decrease or minimally affect recreation on the Tonto National Forest. On the contrary, projects and changes in recreation management on adjacent lands that decrease recreation opportunities will likely increase recreation visitation and demands for public use on the Tonto National Forest. Increased visitation on the Tonto would immediately impact the recreation resource by increasing the need for facility maintenance (e.g., restroom cleaning and vault toilet pumping, graffiti removal, trash removal, potable water testing and filtration), increasing the need for accessible recreation opportunities (e.g., trailheads, parking lots), and impacting primitive recreation experiences (e.g., wilderness users may not experience solitude). If the Forest does not have the management resources to react to increased visitation, user satisfaction rates would decrease and safety concerns in the field may rise. Increased visitation on the Tonto would also impact other Forest resources, especially in areas with less development, and may include soil erosion and compaction, vegetation trampling, vegetation theft and damage, human-caused wildfires, riparian area damages, wildlife harassment, damages to cultural sites, and air quality concerns.

Within the planning period (the next ten to 15 years), human population growth, as well as growth and demand for a variety of recreation settings, experiences, and opportunities, is expected to increase. The population of the Phoenix metropolitan area, which overlaps with much of the western side of the Forest, grew at a rate of 28.9 percent between 2000 and 2010 (US DOC Bureau of the Census 2000 and 2010). This rate is expected to climb throughout the life of this forest plan, and as growing population places increasing demands on recreation, results would likely be increased human concentration and use at existing recreation areas, increased conflicts, increased number of recreational and off-highway vehicles, and reduced quality of recreation settings. The increasing use of recreational and off-highway vehicles, specifically, may result in increased conflict among motorized and nonmotorized user groups throughout the cumulative effects analysis area. As use increases, compliance with regulations could become a greater challenge as recreational participants increase and often compete for space and resources. This is likely to result in greater impacts on areas that offer semiprimitive and primitive recreation settings which emphasize solitude, challenge, risk, unmodified natural environments, and minimal encounters and/or signs of other users. Specific resource impacts may include reduced scenic, air, and water qualities, additional areas experiencing soil erosion, damages to range infrastructure, and an increase in human-caused wildfires.

As populations in Arizona, and especially Maricopa and Pinal Counties, increase, the demand for recreational opportunities and open space would likely grow. Land management agencies would continue to provide a variety of recreation opportunities but are not likely to be able to meet the demands for every activity desired. This is especially true for activities with growing technologies, ongoing accessibility and transportation developments, and constant changing trends. If the Forest cannot meet recreational demands of the public, visitation may decline, and personal values of the national forest may diminish.

All alternatives accommodate a mix of recreation opportunities and settings for recreationists. Alternative C provides the most nonmotorized and primitive recreation settings; alternative D provides the most motorized and roaded settings with recreation management focused on accessibility; and alternative B provides a balance between alternatives C and D.

Wildlife-Related Recreation

Many people hunt, fish, and view wildlife on the Forest. These activities, often important family traditions, can form long-term connections to the land and its wildlife. As such, habitat for hunting, fishing, and wildlife viewing has been identified as a key ecosystem service on the Tonto National Forest. Outdoor recreation contributes to social, cultural, economic, and ecosystem services. Activities, such as hunting, fishing, and fuelwood and plant gathering, provides food for and is part of the culture of many local communities. Hunting, fishing, and forest product gathering help maintain or control wildlife populations to improve forest and watershed health, an ecosystem service[48]. These activities help connect individuals and families to nature and contribute to tourism and the local economy. Fish- and wildlife-related recreation contributes significantly to local economies, while Federal Acts like the Pittman-Robertson Act and the Dingell-Johnson Act help to fund fish and wildlife conservation.

This section addresses the potential effects of the alternatives to fish- and wildlife-related recreation. Although water-based recreation could also be affected by the alternatives and considered part of fish and wildlife related recreation, it is covered in general recreation and is not part of this analysis.

Affected Environment

Arizona is rich in biological diversity, ranking among the top five states in the nation for the number of native bird, reptile, and mammal species; and in the top ten for overall diversity of vertebrates. Some nonnative species were established intentionally, as is the case with rainbow trout; while others such as quagga mussels have arrived as unwelcome or invasive species, and yet others appeared as they expanded their range. A few species, like the Mexican gray wolf and the California condor, were extirpated in Arizona but have been reestablished through reintroduction programs (Arizona Game and Fish Department 2012d).

The Tonto National Forest mirrors the state with rich biological diversity and numerous wildlife species which include 310 bird, 94 mammal, 55 reptile, 14 amphibian, 16 native fish, 28 nonnative fish, 3 special status invertebrates, and 24 special status plant species. Wildlife habitat within the Tonto National Forest can be divided into 15 wildlife habitat categories based on the Tonto National Forest's potential natural vegetation layer. These habitat types represent wildlife habitat that can generally be associated with particular wildlife species and include Colorado Plateau grassland, cottonwood willow riparian forest, desert communities, interior chaparral, Madrean encinal woodland, Madrean pine-oak woodland, mixed broadleaf deciduous riparian forest, mixed conifer with aspen, piñon-juniper chaparral, piñon-juniper grassland, ponderosa pine – mild, semi-desert grassland, sparsely vegetated, urban and other, and water. Tonto National Forest, managed under the principles of multiple uses, plays a vital role in Arizona by supporting crucial wildlife habitat and maintaining Arizona's wildlife heritage as well as providing significant opportunities for wildlife related recreation and associated economic effects of such.

The Tonto National Forest is adjacent to the northern edge of the Phoenix metropolitan area, which has a population of nearly four and a half million people (US DOC Bureau of the Census 2020). The city of Phoenix itself has a population of approximately 1.6 million (US DOC Bureau of the Census 2020), making it the sixth largest city in the United States. The Phoenix area is a popular destination for conferences, conventions, and tourism with its warm and sunny year-round climate, wide variety of business, cultural, and recreational offerings, serviced by many direct flights from most major U.S. cities. These factors combine to make the Tonto National Forest one of the most heavily-visited national forests, with approximately three million recreational visitors annually (USDA Forest Service 2016).

Pressure from the increasing human population has caused decreasing wildlife habitat which also results in loss of natural areas in which to recreate, concentrates human activity in existing recreation areas, increases human-wildlife conflicts, increases density of watercraft and off-highway vehicles, and may reduce the quality of habitat available for wildlife. Unmanaged recreation has been identified by the Forest Service as one of four key threats to the nation's forests and grasslands. The use of off-highway vehicles is seen as a major component of unmanaged use (USDA Forest Service 2005). During the past ten years, off-highway vehicle use has increased dramatically across the nation and on millions of acres of

[48] For more information see Wildlife, Fish, and Plants in a following section of this environmental impact statement.

public land in the Western United States. In Arizona, off-highway vehicle use has increased by 347 percent since 1998 (Arizona Game and Fish Department 2013), outpacing existing funding to manage that growth, protect natural resources, and maintain safe and reasonable recreational access. On the Tonto National Forest, motorized users (motorized trail activity, driving for pleasure, off-highway vehicle use) make up the largest percentage of recreational users at approximately 23 percent (USDA Forest Service 2012a).

Motorized and nonmotorized access to public lands is important in maintaining the hunting and fishing heritage for Arizona and programs that support wildlife conservation. Hunting and fishing are used as wildlife management tools and depends on the access provided to these public lands to meet identified objectives. Hunting on the Tonto National Forest includes: nine out of Arizona's ten big game species (elk, mule deer, whitetail deer, bighorn sheep, pronghorn, bear, mountain lion, turkey, and javelina), small game (quail, dove, tree squirrel, rabbit, and migratory birds), fur bearing mammals, and predatory mammals.

The Tonto National Forest contains rivers, lakes, creeks and ponds that offer diverse fishing opportunities. These include six out of eight of central Arizona's major reservoirs, two trout hatcheries, numerous coldwater fish streams, and two of Arizona's major rivers (Verde River and Salt River).

Furthermore, the biological diversity of the Tonto National Forest provides a wide array of wildlife viewing opportunities. Wildlife viewing continues to increase in popularity nationally. Wildlife viewing opportunities are everywhere and include a variety of animals, some as common as a hummingbird at a backyard feeder, some passing through only briefly on their seasonal migrations, and others so rare that dedicated wildlife watchers spend hours just to catch a glimpse. Wildlife viewing is a lifelong learning experience, and it can begin at any age and everyone can participate. Wildlife viewing provided more than $825 million in 2006 to Arizona and its communities (Arizona Game and Fish Department 2006). It can provide a fun and inexpensive activity for the entire family to enjoy together; it is a relaxing experience that provides a reconnection to nature with observers gaining a better understanding of how wildlife acts in their natural environment; seeing wildlife can leave a viewer with a positive, unforgettable, and personal experience that they will recall for years to come. Wildlife viewing experiences can help inspire conservation efforts to benefit wildlife through a heightened public awareness of the value of wildlife and habitat, and the need to conserve irreplaceable assets.

To determine the number of hunters that may hunt on the Tonto National Forest, the Arizona Game and Fish Department relies heavily on a well-established hunter questionnaire program to estimate how many hunters hunt in a particular game management unit and to provide information on game species harvest (Arizona Game and Fish Department 2008). In the case of big game hunting, these licenses or tags are distributed via a lottery draw and the numbers of people who wish to participate far exceed those that are allowed to participate due to the need to regulate the number of animals harvested. For example, in 2011 there were 1,503 applicants (people wishing to participate) for only six desert bighorn sheep tags (people who actually participated) in Game Management Units 22 and 24B on the Tonto National Forest. Most big game hunts have more applicants than the number of hunting permits available.

Although the Tonto National Forest receives the highest levels of expenditures for hunting of any National Forest in the southwestern region (American Sportfishing Association 2006), data derived from the National Visitor Use Monitoring report for the Tonto National Forest indicates that 2.5 percent of visitors to the Tonto National Forest are hunters (USDA Forest Service 2008). These figures may further represent that the Tonto National Forest is one of the most highly visited national forests in the United States with each recreational activity (e.g., hunting, hiking, and boating) contributing significantly to the number of visits and economic effects when reported separately as a distinct recreational activity. The following table demonstrates the public's consistent desire for big game hunting opportunity on the Tonto National Forest (table 18) (Arizona Game and Fish Department 2012c).

Table 18. Big game applications from 2007 to 2011 for game management units on the Tonto National Forest

Species	1st Choice Applicants in 2007	1st Choice Applicants in 2008	1st Choice Applicants in 2009	1st Choice Applicants in 2010	1st Choice Applicants in 2011
Elk	6,504	6,580	5,795	6,633	5,556
Whitetail Deer	4,027	3,811	4,187	4,368	4,917
Mule Deer	3,953	3,916	4,024	3,986	4,322
Total	14,484	14,307	14,006	14,987	14,795

Black bear is not included in table 18 because the majority of black bear hunts that occur on the Tonto National Forest do not require an individual to apply for a hunt, but rather the nonpermit-tag is available over the counter. The five-year average number of black bear hunters on the Tonto National Forest is approximately 1,680 hunters. This estimate is derived by taking the number of black bear nonpermit-tags sold statewide and multiplying by the percentage of black bear harvested on Tonto National Forest lands. This estimate assumes that the level of black bear harvest is directly proportional with the number of nonpermit-tags sold.

While the interest in participating in big game hunting has generally increased statewide, the same has not been observed with interest in small game hunting (Arizona Game and Fish Department 2017).

Although data for small game hunter participation on the Tonto National Forest is not available from the Arizona Game and Fish Department, an annual quail hunter check station has been in operation on the Tonto National Forest near Punkin Center for nearly ten years. Data from this check station demonstrates a decline of small game hunter participation on the Tonto National Forest that is consistent with the statewide decline the Arizona Game and Fish Department has been observing.

Angling participation on the Tonto National Forest is the highest of any National Forest in Arizona due to the diversity of fishable waters on the Tonto National Forest and their proximity to the Phoenix Metropolitan Area (American Sportfishing Association 2006; Pringle 2004). This includes the Mogollon Rim area streams (East Verde River, Tonto Creek, and Canyon Creek), the Salt River Lakes (Roosevelt, Apache, Canyon, and Saguaro) and the Verde River Lakes (Bartlett and Horseshoe) (figure 11).

These waters combined include a high diversity of sportfish species, including bass, trout, walleye, catfish, sunfish, and even opportunities to fish for native species, such as roundtail chub, Gila trout, and desert sucker. In 2001, the Arizona Game and Fish Department did a statewide survey of angler use. Numbers derived from that survey indicate that there were 1,252,663 angler-use-days on the Tonto National Forest, making it one of the most heavily used fishing destinations in Arizona (table 19 and table 20) (Pringle 2004).

Table 19. Estimated angler-use-days on lakes on the Tonto National Forest in 2001

Lake	Angler Use Days
Roosevelt Lake	317,973
Bartlett Lake	229,178
Saguaro Lake	216,714
Canyon Lake	184,874
Apache Lake	157,974
Total	1,106,713

Table 20. Estimated angler-use-days on other key waters on the Tonto National Forest in 2001

Other Key Waters	Angler Use Days
Salt River (Below Saguaro)	38,664
Verde River (Below Horseshoe)	18,660
Salt River (Above Roosevelt)	18,219
Canyon Creek	13,437
Horseshoe Reservoir	12,331
East Verde River	11,668
Christopher Creek	10,865
Tonto Creek	10,110
Verde River (Above Horseshoe)	9,123
Haigler Creek	1,777
Workman Creek	808
Spring Creek	159
Horton Creek	129
Total	145,950

On average Arizona anglers spent approximately 19 days fishing in 2001 (Pringle 2004) though based on decrease in fishing license sales since 2001, it is believed to be lower today. The major lakes on the Tonto National Forest (Roosevelt Lake, Bartlett Lake, Saguaro Lake, Canyon Lake, and Apache Lake) make up five of the top eleven lakes in the state for highest angler use days. Data derived from the National Visitor Use Monitoring report for the Tonto National Forest indicates that 9.5 percent of visitors to the Tonto National Forest were anglers (USDA Forest Service 2016).

The ability to adequately represent current public interests in wildlife is being tested by an ongoing societal shift in the way people value and interact with wildlife. Increasingly, fewer people are interested in hunting and fishing as a proportion of the entire population, yet there has been growth in other forms of wildlife-related recreation. Although valuable and contributory to local economies (US Fish and Wildlife Service 2011), wildlife viewing activities provide little direct revenue, but likely contribute significantly to local communities. Tied to these trends is the increasing interest in providing input in how wildlife is managed. People have many different preferences for wildlife related recreation programs and services. Greater diversity in viewpoints has contributed to increased conflict, as well as contradictory social values among stakeholders (Arizona Game and Fish Department 2012d).

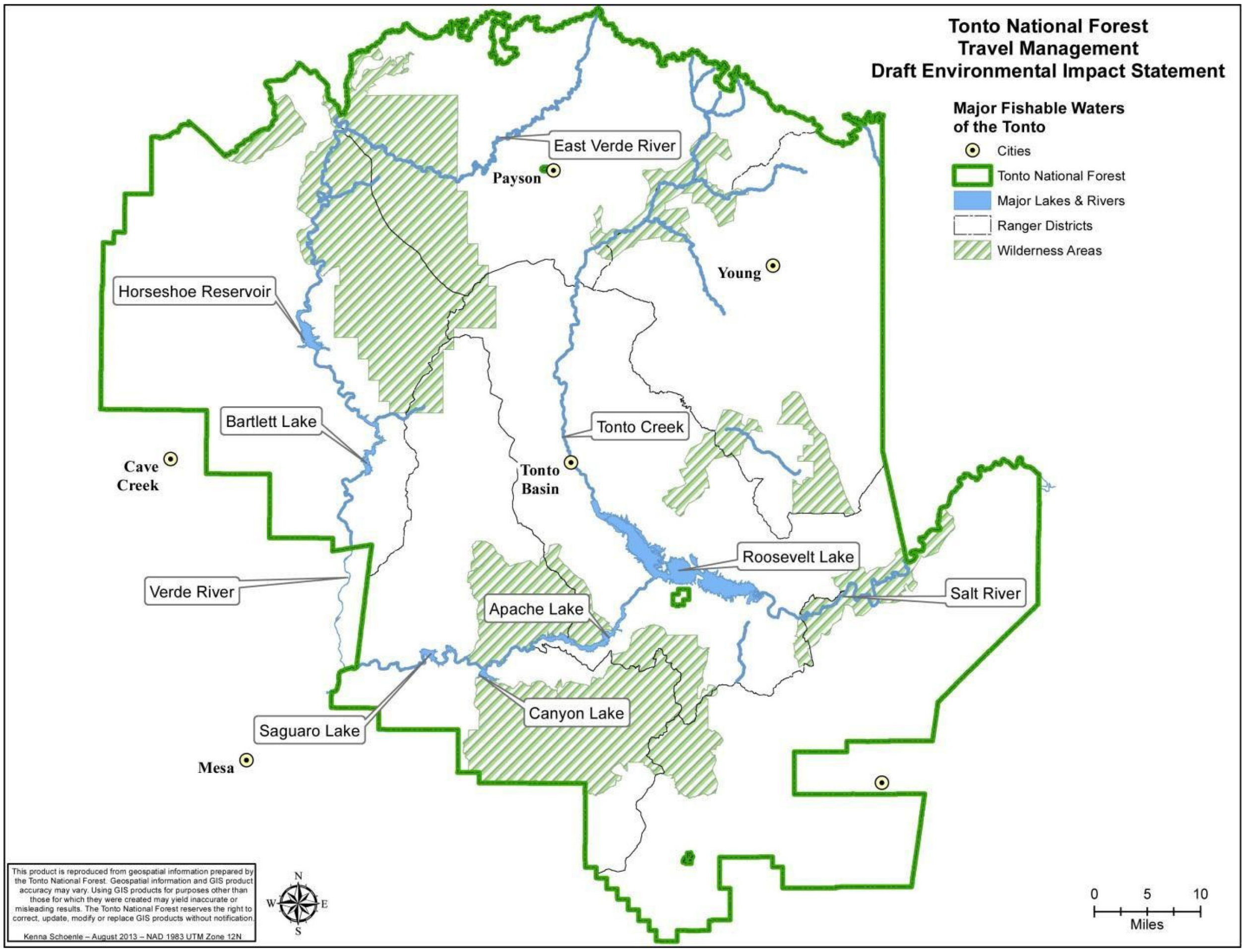

Figure 11. Fishable waters on Tonto National Forest

Although economic data for angling on the Tonto National Forest is not specifically available, the statewide economic effect estimates that anglers spent $830 million, and contribute $1.1 billion to the state's economy (Pringle 2004). Tonto National Forest angling economic data would be expected to be a high proportion of the statewide data based on the angling use days described above.

Fishing license sales over the years have had ups and downs due to many factors including: change in demographics of Arizona's human population, economic issues, prolonged drought and weather patterns, wildfires, land management agency actions (e.g., closures, restrictions, and fees), accessibility of waters and availability of sportfish (figure 12).

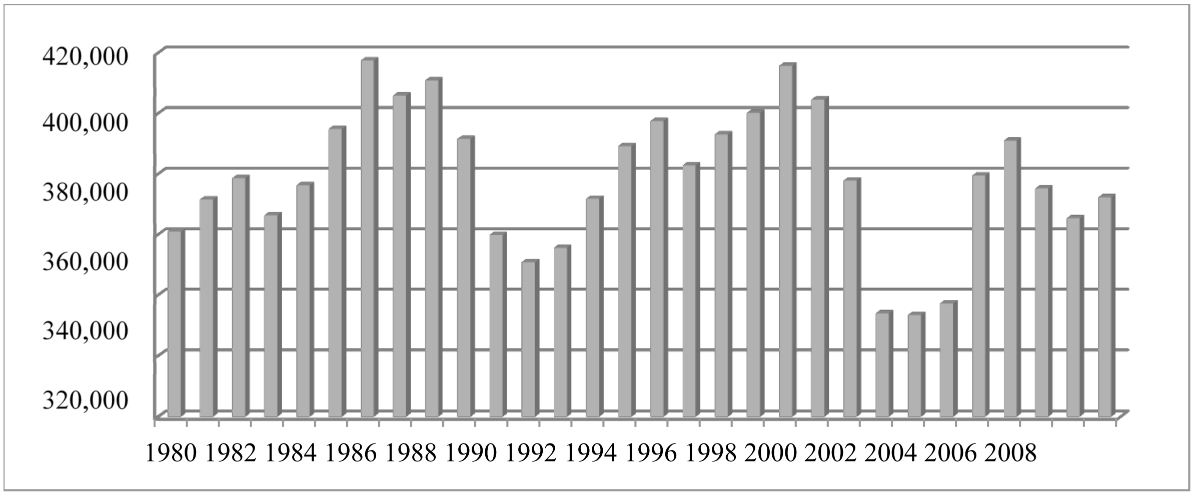

Figure 12. Arizona fishing license sales

A five-year comparison of estimates from 2011 to 2016 shows a 16 percent increase in the total number of people 16 years and older participating in wildlife-related recreation activities in the United States (US Fish and Wildlife Service and US DOC Bureau of the Census 2016). In 2016, 11.5 million hunters, 16 years and older, hunted on public land and/or private land. Of this number, 3.9 million, or 34 percent, hunted on publicly-managed lands compared to 9.7 million or 85 percent who hunted on privately-owned land. According to the Arizona Game and Fish Department's data for license sales from 2016 to 2017 the general increase for all hunting and fishing license sales increased by 2.1 percent (table 21).

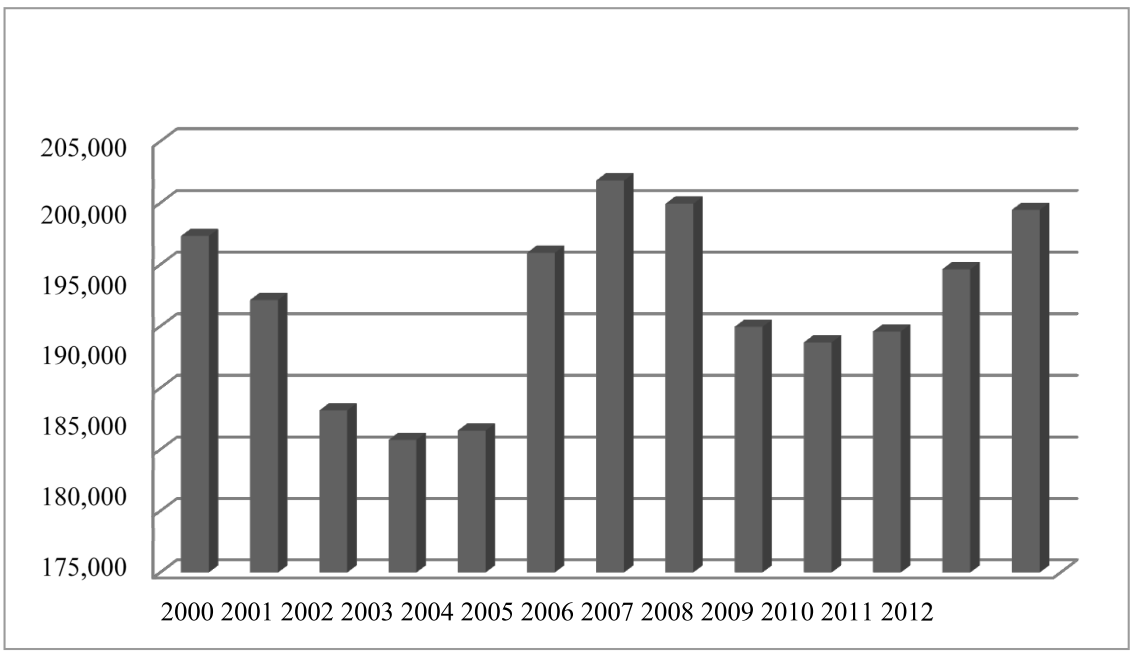

Figure 13. Arizona hunting license sales

Table 21. License sales for all dealers, regions, and online for January through December timeline

Type of License	2016	2017	Percent change from 2016 to 2017
Fish	169,220	169,366	0.1
Hunt	53,442	51,781	-3.1
Combo	125,893	130,456	3.6
Youth	69,999	69,856	-0.2
Community	6,020	6,017	0.0
Bird stamps	52,556	52,164	-0.7
Short terms	42,425	50,860	19.9
Totals	519,555	530,500	2.1

Much of the recreational activity on public lands qualifies as tourism, which is one of Arizona's leading industries and is the dominant industry in most communities (Arizona Department of Commerce 2003). Key reasons cited for tourism in Arizona are outdoor recreation opportunities and open space, which are prevalent assets in the plan area. A large portion of tourism in the rural communities originates from the greater Phoenix and greater Tucson areas (Arizona Department of Commerce 2003). Travel spending was estimated at 17.7 billion in 2010.

While all forms of recreation affect the current economic climate of the plan area, only a few have been closely examined for their economic influence. These include wildlife-related recreational activities (such as hunting, fishing, and wildlife viewing), off-highway vehicle use, and visiting cultural and historic sites. In 2001, there were 1.7 million Arizona residents and non-residents (16 years old and older) that fished, hunted, or viewed wildlife in Arizona and spent in excess of $1.6 billion in the state: $512 million on trip-related expenditures; $1.0 billion on equipment purchases; and $67 million on licenses, contributions, land ownership and leasing, and other items and services (US Fish and Wildlife Service and US DOC Bureau of the Census 2001). According to Bureau of Land Management estimates, $203 million was spent on wildlife-related recreation on public lands in Arizona in 2002, with $41.7 million being spent by hunters, $16.2 million by anglers, and $145.1 million by wildlife viewers (USDI Bureau of Land Management 2002). Southwick 2003 nonconsumptive and 2011 consumptive users' survey indicated for counties below, over 811.2 million was spent in total expenditures from fish- and wildlife-related recreation (table 22).

Table 22. Economic impacts by county

County	Fishing	Hunting	Nonconsumptive*	Total expenditures
Maricopa	366.9 million	42.2 million	226 million	635.1 million
Gila	34.2million	5.2 million	41.2 million	80.6 million
Yavapai	30.3 million	9.7 million	93.3 million	133.3 million
Pinal	13.2 million	6.8 million	12.3 million	32.2 million

*Nonconsumptive uses are generally considered to be those in which wildlife is watched, studied, or recorded without being killed.

Fishing and hunting recreation generates spending that has a powerful effect on Arizona's economy. The 2011 National Survey found state residents and nonresidents expended a total of $755 million, $338 million and $936 million from fishing, hunting and wildlife watching respectively (Arizona State Parks 2018).

The 2011 National Survey found 78 percent of wildlife watchers in Arizona enjoyed their activities close to home. The 732,000 people participating in away from home activities made up 47 percent of all wildlife watchers in Arizona. Arizonans spent nearly 7.7 million days engaged in away from home wildlife watching activities in the state. In addition, 39 percent of Arizonans who participate in around the home wildlife watching also enjoyed watching wildlife away from home (Arizona State Parks 2018).

Arizona's waterways, enjoyed by over 1.5 million residents each year, contribute $13.5 billion to the state's economy and support 114,000 jobs, according to a report released by Audubon Arizona in 2019. The study was completed with guidance from business, civic, governmental, outdoor recreation, conservation, and tourism representatives and conducted by economics research firm Southwick Associates. Water-based outdoor recreation as an industry ranks above mining and golf in terms of total economic output to the state. The industry contributes $7.1 billion to Arizona's gross domestic product, provides $4.5 billion in household income and generates $1.8 billion in tax revenues (www.audubon.org/AZRivers).

Environmental Effects[49]

Regardless of what alternative is chosen, implementation of the forest plan on the Tonto National Forest may result in positive and negative, short-term and long-term effects to the fish and wildlife populations, fish and wildlife related recreation, and the ability to manage wildlife on the Tonto National Forest for recreation. All alternatives have the ability to affect the satisfaction of those fish and wildlife recreational users as well.

Summary of Alternatives Analysis

The analysis involved an enumeration of the following resource features (dispersed campsites, roads, and highly valued areas) that were contained within the appropriate alternative components associated with spatial data and extents: (1) the number of dispersed camping sites; (2) linear miles of roads; and (3) acreage of highly valued areas as a result of the Sportsmen's Values Mapping Project (www.trcp.org/sportsmens-value-mapping) produced for each of 10 game species to capture input from local hunters and anglers to delineate the areas they value most for hunting and fishing. The management areas were grouped together for the purpose of this analysis with a few remaining pulled out (recommended wilderness, inventoried roadless areas, eligible wild and scenic). The 10 species were selected as those whose highly valued areas comprised a major portion of the Tonto National Forest. The percentage of resource features (dispersed campsites, roads, and highly valued areas) was also calculated as the quotient of the number, linear miles, or acreage of feature associated within an alternative and the total number, total linear miles, or total acreage of that resource within the Tonto National Forest. The components from the plan were also analyzed if they were driving changes in the alternatives.

Recommended Wilderness Areas

Similar to designated wilderness areas, recommended wilderness areas provide for primitive, undeveloped, and nonmotorized recreation opportunities that emphasize a visitor experience of solitude. Recreation management that includes fish and wildlife related recreation is a key objective in the identified recommended wilderness areas. However, if opportunity for future motorized access is reduced, motorized dispersed camping and other motorized uses would limit opportunity for users to participate in some fish and wildlife related recreation activities. Alternatives A and D do not include these areas.

[49] Information on the assumptions and methods used for this analysis can be found in volume 4 of the environmental impact statement, appendix B.

Alternatives B and C have different amounts of recommended wilderness acres, and the effects on fish and wildlife recreation would vary by proportion. Recommended wilderness would provide more opportunity to participate in nonmotorized, wildlife related activities. Motorized dispersed camping or other motorized uses would still occur on existing designated routes, but new motorized routes to accommodate increased demand would not be authorized in recommended wilderness areas.

Eligible Wild and Scenic Rivers

These river segments would affect fish and wildlife related recreation across all alternatives. Access, both motorized and nonmotorized, and dispersed fish and wildlife recreation would potentially experience a shift in management towards free-flowing conditions depending on the classification of the segment. These management changes would protect water quality, scenic integrity, areas of cultural or historic significance, and riparian habitats and provide opportunity for nonmotorized wildlife related activities depending on the segment and classification would determine the level and specific allowed uses. Conversely, the buffered area directing the management requirements may limit expansion of motorized dispersed camping and other motorized access and reduce opportunity for related wildlife activities.

Lakes and Rivers Management Area

This management area includes sustainable recreation as the primary emphasis for management. These high-use areas require additional guidance to minimize public health and safety issues, user conflicts, and impacts from invasive species. This management area does not exist in all alternatives, only alternatives B and D. The management requirements in this area would increase motorized access and highly developed recreation, increasing opportunities for fishing at developed lakes and rivers, but decreasing priority to provide dispersed recreation for other wildlife related activities.

Designated Areas

All alternatives include the currently designated areas: eight wilderness, two wild and scenic rivers, 13 inventoried roadless areas, three national trails, and three research natural areas. Since these are managed currently for their designation, there is no change in effect by alternative. These areas protect habitat that is important for wildlife and fish species. While there are restrictions to certain types of uses in these areas, opportunities for wildlife-related recreation are not restricted but are limited to the uses allowed in each of the designated areas.

Alternative A Effects

This alternative provides a baseline for evaluating the effects against the other alternatives and is analyzed with the desired conditions identified in the proposed forest plan. This alternative would maintain current management except for those few management and special areas that could be added under this alternative (Picket Post Mountain Research Natural Area and Upper Forks Parker Creek Research Natural Area). There are no additional components driving change in this alternative for analysis.

Healthy wildlife populations are intertwined with wildlife viewing, hunting and fishing visitation, and as such, expenditures for these activities (for example equipment, gas, and food) would not likely increase as a result of management actions under alternative A, having no impact on the local economy.

While hunting, fishing, and wildlife viewing would continue to be managed under current conditions, if increasing trends in the Phoenix Metropolitan area population continue, increases in demand would likely result in a negligible to minor increase in trip- and equipment-related economic contributions and employment attributable to recreation, camping, and tourism on public lands. Associated social effects, such as conflicts among uses, would continue and possibly escalate, having minor to moderate negative impacts on the satisfaction of recreation users as more users and fewer areas would create crowding and moving into areas of conflicting uses. In addition, increased use in areas may lead to more resource damages (e.g., soil compaction and erosion, vegetation trampling, poor water and air qualities, and damages to cultural resources), and cause users to move into other areas, indicating more needs for closures of areas to recreation.

Management Areas

There are two research natural areas proposed (Picket Post Mountain and Upper Forks Parker Creek) under alternative A that would require a change in management to a focus on research and the natural and cultural resources in these areas (see table 23). Proposed management in those areas could have negative effects to fish and wildlife-related recreation due to more restrictions being placed on access, dispersed camping, and other types of recreational activities permitted in those areas. The desired conditions for fish and wildlife-related recreation would be affected as less opportunity may be provided for those needing to access their favorite site using a motor vehicle. User accessibility and satisfaction and local economics could see lower numbers due to the user limitations and/or restrictions (REC-WR-DC-01 and REC-WR-DC-02). On the other hand, wildlife viewers could have more satisfaction if the condition of the natural environment improves, providing better scenic views and recreation settings.

The research natural areas and wild and scenic rivers are analyzed under all alternatives and would be the same across all of the alternatives, providing similar effects in general. Table 23 lists the wildlife-related desired conditions and effects for designated, recommended, and proposed management areas under alternative A.

Table 23. Wildlife-related desired conditions and effects for designated and recommended or proposed management areas (MAs) under alternative A

Relevant Desired Condition in the Proposed Forest Plan	Designated MAs*	Recommended and Proposed MAs*	Effects
Ecological and social conditions on the Forest support plentiful and diverse opportunities for hunting, fishing, and wildlife watching, and contribute to local economies.	Yes	Yes	Ecological conditions would continue to decline and contributions to economies would remain the same with likely no change in the social aspects
Access to a range of opportunities for hunting, fishing, and wildlife watching are available.	Not included in alternative	Not included in alternative	Would not increase the opportunity
Forest visitors have ample opportunities to view, experience, appreciate, and learn about the wildlife and fish resources of the Forest.	Yes	Yes	Would not increase the opportunity

*Proposed: Picket Post Mountain Research Natural Area, Upper Forks Parker Creek Research Natural Area, and designated management areas: Blue Point Cottonwood, Fossil Springs Natural Area, Sycamore Creek Natural Area, Three Bar Wildlife Area and areas 1A-6K

Alternative B Effects

Alternative B has forestwide desired conditions, objectives, standards, and guidelines to support the long-term persistence of species listed as threatened or endangered or species of conservation concern and to support key ecosystem characteristics for species of interest for hunting, trapping, observing, and subsistence. The close interrelationship of vegetation conditions and wildlife habitat is emphasized, and forest plan components related to vegetation conditions provide key ecosystem characteristics that support wildlife habitat needs and diversity such as species associated with old-growth forests, species associated with dead and defective tree habitat, and habitat connectivity. Management direction is proposed to address key aquatic and riparian ecosystem characteristics and their integrity and to improve resilience in light of the changing climate and the anticipated future environment. Along with fish habitat and water quality, wildlife habitat is emphasized in riparian management zones. Adaptive management would allow for managing for sustainable multiple uses. Recreation activities, including motorized and nonmotorized uses would be balanced to provide equal opportunities and reduce user conflicts. Recreational opportunities would be relevant and responsive to changing user demands while remaining stable (REC-WR-MA-04).

Restoration by mostly passive means and lack of specific decisions in this alternative to use native plants would slowly return damaged sites to natural conditions and may result in minor negative impacts in the social well-being of area residents who value natural ecosystems (e.g., esthetics in the area). This may slow the process to getting to desired conditions without more active management.

Vegetation and Wildland Fire

Alternative B incorporates a balance of mechanical and prescribed fire treatments across the forest for the management of vegetation and wildland fire. This alternative emphasizes restoring or maintaining conditions through mechanical thinning, prescribed burning in those areas within frequent-fire forested and woodland areas. The balance of mechanical and wildland fire management across the forest would reduce recreational access during the time of treatment and degrade wildlife habitat quality in the short term, causing wildlife related recreation to be unavailable on those lands. These effects would be temporary until treatment activities are completed and the system recovers. Economically, the unavailability of wildlife related recreation on those lands would either result in a loss of trip related expenditures or a displacement of them into different areas of the state. In the long-term, however, the areas that undergo treatment would be more open, less susceptible to extreme fire events, and likely have an overall increase in wildlife habitat quality. Once access for humans and wildlife habitat is restored, these areas would once again provide a supply of recreational opportunity. The long-term improvement of habitat quality would benefit wildlife species and may lead to an increase in recreational opportunity (REC-WR-DC-01) (REC-WR-MA-01a). As a result, the economic benefit of wildlife recreation would likely return to the area, and possibly increase (REC-WR-MA-04).

Riparian Areas

Management in alternative B includes the following treatment objective. Complete restoration projects on 200 to 500 acres of riparian areas rated as nonfunctional and functional-at-risk (proper functioning condition or similar protocol) during each 10-year period, with emphasis on priority 6th code watersheds (RMZ-O-01). This objective is focused on maintaining and improving riparian conditions by restoring function to nonfunctional and at-risk riparian areas, improving springs, and to maintain or restore natural streambanks, native vegetation, and riparian, floodplain and soil function. Improving or maintaining springs, at risk areas, perennial and intermittent riparian areas would benefit effects to all fish and wildlife by providing quality habitat. The management of these areas includes improving vegetation; however, does not lend to improving ecological integrity necessary to maintain quality and functionality for fish and wildlife. Short-term effects from activities (e.g., stream channel recontouring, vegetation planting, bank stabilization, relocating uses away from the channel) could displace wildlife and/or cause behavior changes in things like foraging during activities; however, long-term effects would be beneficial to all wildlife and fish and wildlife-based recreation as habitat quality and quantity would increase over time (REC-WR-DC-01).

Rangeland Management

Alternative B is similar to alternative A; all vacant allotments are assumed to be open to grazing. However, once it becomes vacant the Forest Service would work toward an evaluation to determine the need for a status change within two years. This is also similar to alternative D except that they would stay open after evaluated. At least one vacant allotment should be evaluated for either: conversion to forage reserves to improve resource flexibility; grant to current or new permittee, or close to permitted grazing part or in whole. If additional are waived without preference, they would then be evaluated for one or a combination of those options. Closing an allotment to grazing would benefit wildlife resources both short-term and long-term and would allow for recreational access. The habitat would recover over time increasing the quality and quantity of available cover and forage (REC-WR-DC-01).

Recreation

Alternative B incorporates sustainable recreation opportunities to balance public demand for both motorized and nonmotorized activities and natural resource desired conditions. This would include development of modification of systems of sustainability designated motorized and nonmotorized trails to provide for user groups; maintain to standard motorized and nonmotorized trails and to decommission unneeded motorized and/or nonmotorized trails. Development of systems for motorized and nonmotorized trails would be beneficial for providing access to fish and wildlife related recreation (REC-WR-DC-03); however, this could impact these species being recreated for through short-term disturbance and noise. The decommissioning of 10 miles every 5 years, depending on the specific location, could impact long-term fish and wildlife related recreation as it could restrict the routes available to access those resources but could have positive effects on the habitats for fish and wildlife (REC-WR-DC-03). Areas and trails that are desirable and consistently used by the public would not likely be decommissioned, so no effects to other resources (e.g., soil compaction and vegetation trampling) are expected.

Mineral Materials

Materials would not be removed from the riparian management zone without adequate engineering to protect the surface waters in this alternative. This would be beneficial long-term to fish and wildlife related recreation as it would assist in the protection of riparian areas and the waters associated. Water flow regime would allow for reliable sources for fish and wildlife, increasing the habitat quality and quantity (REC-WR-G-03).

Management Areas

The Lakes and Rivers Management Area would include specific management direction to accommodate the high levels of recreation they receive. These areas include the following lakes: Roosevelt, Apache, Canyon, Saguaro, Horseshoe, and Bartlett; as well as the Lower Verde and Lower Salt Rivers. The Lakes and Rivers Management Area management direction would have effects on desired conditions for nonnative species for sportfishing opportunities (REC-WR-DC-01, REC-WR-DC-02, REC-MA-01, and REC-MA-06).

This alternative includes 43,204 acres of recommended wilderness. This change would reduce the areas suitable for additional motorized vehicle routes within these areas. However, motorized and mechanized uses for management activities such as species management would be permitted (REC-WR-MA-02). This would potentially increase the availability and abundance of wildlife available to view, hunt, or fish.

Riparian management zones would include limiting dispersed camping and access to within a 100-foot buffer that would impact wildlife related recreationists near riparian areas (REC-WR-DC-03. REC-WR-DC-01). It is not clear as to more specific effects that would be anticipated at this level, and it would need evaluated per site. Short-term effects could displace wildlife and/or cause behavior changes such as foraging activities and animal distributions; however, long-term effects would be beneficial to all wildlife and fish and wildlife-based recreation as habitat quality and quantity would increase providing more forage and cover (REC-WR-MA-01a). Long-term effect could include the displacement or redirection of recreationists into other sensitive areas.

Eligible wild and scenic rivers would have effects to fish and wildlife related recreation if the management classification is not for recreation. Those segments managed for wild and scenic classifications, classified as wild would potentially limit motorized access due to the additional management restrictions. However, existing opportunities for fish and wildlife related recreation would remain. Dispersed motorized camping would be affected as it could be further restricted or limited depending on the classification of the individual segment. However, the extent is not known at this time and would need evaluated on a site-specific basis. Overall, satisfaction of hunters and anglers would likely decrease if motorized access and motorized dispersed camping was restricted or limited, although this dissatisfaction could be partially mitigated by informing of positive benefits over the longer term (REC-WR-DC-01). Those seeking more solitary or primitive encounters with wildlife may benefit.

Overall, in both recommended and designated areas and all management areas, the satisfaction of those who value motorized access and resource use would be greatest under alternative B. On the other hand, the satisfaction of recreationists who prefer solitary and quiet experiences would be less than any other action alternative and satisfaction would increase. Opportunities for hunting, fishing and wildlife viewing would be enhanced through increased access and hands-on management if permitted. While several of the considerations present in alternative B would address resource protection more than those in alternative A, in most cases only small acreage would receive actual protection. However, there would be less focus on recreation as an overall component within these areas (REC-WR-DC-01, REC-WR-DC-03). Table 24 lists the wildlife-related desired conditions and effects for designated, recommended, and proposed management areas under alternative B.

Table 24. Wildlife-related desired conditions and effects for designated, recommended, and proposed management areas under alternative B

Relevant desired condition in the forest plan	Designated	Recommended Wilderness (43,204 acres), Lakes and Rivers Management Area	Proposed MAs*	Effects
Ecological and social conditions on the Forest support plentiful and diverse opportunities for hunting, fishing, and wildlife watching, and contribute to local economies.	Yes	Yes	Yes	Those areas with restrictions on uses would benefit ecologically; however, depending on the restrictions could decrease the economic and social opportunities
Access to a range of opportunities for hunting, fishing, and wildlife watching are available	Yes	Not included in alternative	Yes	This would increase or decrease depending on the area restrictions
Forest visitors have ample opportunities to view, experience, appreciate, and learn about the wildlife and fish resources of the Forest.	Yes	Yes	Yes	No change

*Proposed management areas - Picket Post Mountain Research Natural Area, Upper Forks Parker Creek Research Natural Area, Dutchwoman Butte, Three Bar Wildlife Area, Fossil Springs, Little Green Valley Fen, Horseshoe and Mesquite Wash

Alternative C Effects

Alternative C addresses the desire to reduce human impacts on the forest, emphasizing primitive recreation opportunities, increased protections to natural resources, use of natural processes for restoration, limiting some aspects of grazing, and prioritizing natural resources over some economic development opportunities. Restoration by mechanized means would be more limited and other uses would be restricted. Grazing in desert ecosystems would become closed upon vacancy to allow for recovery of the system. There would be no increase in accessibility or infrastructure for recreational users. This alternative has the most acres recommended for wilderness.

Since the emphasis is on primitive opportunities, in general, this would limit the fish and wildlife related recreation due to its connection to motorized travel and a need for access and dispersed camping (REC-WR-DC-01, REC-WR-DC-02, REC-WR-DC-03, and REC-WR-MA-04). This would likely decrease the satisfaction for those users; however, this may also increase the overall satisfaction with those recreating who are seeking a more solitary experience. This alternative would allow for the most protections to natural resources.

Vegetation and Wildland Fire

Alternative C primarily uses wildland fire as a restoration tool and mechanical thinning would be used in limited situations. This would offer somewhat limited beneficial habitat restoration treatments for short- and long-term effects. The large acreage for wildfire and prescribed fire would have long term beneficial effects for habitat in forested and woodland areas. However, short-term effects may result in poor conditions for wildlife viewing as vegetation becomes overgrown and dense in some locations. This may provide additional coverage for game, providing a “safe” environment for repopulating, but may hinder hunting activities. These activities would have short-term displacement and changes in foraging by wildlife.

Riparian Areas

Improving or maintaining springs, at risk areas, perennial and intermittent riparian areas would benefit all fish and wildlife overall by providing quality habitat. Short-term effects could displace wildlife and/or cause behavior changes in things like foraging during activities; however, long-term effects would be beneficial to all wildlife and the associated fish and wildlife-based recreation (REC-WR-MA-01a, REC-WR-DC-01, REC-WR-DC-02, and REC-WR-DC-03).

If a riparian management area is determined to be nonfunctional, alternative C would restrict all access in the area until recovery is reached. This would impact fish and wildlife related recreation uses, displacing activities to nearby locations or off-Forest lands. This may be an especially noticeable impact if the riparian area is one of the few sources of water over many miles; recreationists would have to travel farther distances to find another riparian area open to public access where wildlife are abundant.

Rangeland Management

Allotments would be closed to grazing as they become vacant under this alternative. This can have short-term and long-term benefits to fish and wildlife related recreation. Closed allotments and a lack of fencing, gates, etc. can increase recreational access and improve the overall habitat quality and quantity for valuable wildlife watching (REC-WR-DC-01, REC-WR-DC-03). On the other hand, allotments tend to include additional water sources available to both cattle and wildlife (i.e., water tanks), and closing allotments would remove those sources for wildlife. Wildlife related activities would then be affected in terms of locations where wildlife gather for water.

Recreation

Nonmotorized and primitive forms of recreation are the focus under this alternative. Modification of only nonmotorized trails may benefit fish and wildlife related recreation for those users who prefer the "backcountry" experience and areas with less developments. Users who rely on accessible areas (high-clearance roads, parking areas, and restroom facilities) would be restricted to existing developed areas and motorized trails. Unneeded and unsustainable sites and motorized trails would be decommissioned, decreasing accessible fish and wildlife related recreation opportunities (REC-WR-DC-02 and REC-WR-DC-03). Those users would be forced to use accessible fish and wildlife related recreation opportunities on non-Forest lands, or not recreate at all.

Mineral Materials

Similar to alternative B, this action would have both short-term and long-term benefits in terms of maintaining and improving the quality of habitat for fish and wildlife related recreation in those areas (REC-WR-MA-01a, REC-WR-G-04, and REC-WR-DC-01).

Management Areas

Alternative C has more acres of recommended wilderness than the other alternatives totaling about 399,029 acres of recommended wilderness. This change would result in a large reduction in areas suitable for public motorized vehicle use on a year-round basis. This alternative includes a plan component that says that mechanized transport and motorized travel and uses would not be suitable in recommended wilderness area (RWMA-G-01). This plan component responds to the public concern that if existing mechanized transport and motorized travel and uses were allowed to continue, the social and ecological characteristics that provide the basis for the areas' suitability for inclusion in the National Wilderness Preservation System would not be protected or maintained, thereby reducing the potential of their being designated as wilderness. Management of roads and facilities would be focused on maintaining or decommissioning. Primitive or semi primitive nonmotorized recreational opportunities would be increased by identifying motorized and mechanized transport as not suitable in recommended wilderness areas. Desired conditions for increasing accessibility and infrastructure would not be met (REC-DC-10). This alternative would have the largest effects on the ability to manage for wildlife and related recreation, limiting access, meeting increased demands for recreation, enhancements to habitat and/or populations, control of undesirable species and overall decreasing the satisfaction of wildlife-based recreationists (REC-WR-DC-01, REC-WR-DC-03, REC-WR-MA-01a, REC-WR-MA-01b, REC-WR-MA-04).

Riparian management zones would include limiting dispersed camping and access to within a 100-foot buffer that would impact wildlife related recreationists near riparian areas. It is not clear as to more specific effects that would be anticipated at this level, and it would need evaluated at a site-specific level.

Eligible wild and scenic rivers would have effects to fish and wildlife related recreation if the management is not for recreation. Those segments managed for wild and scenic purposes would limit access; however, existing opportunities for fish and wildlife related recreation would remain. Dispersed camping would be affected; however, the extent is not known at this level and would need evaluated site specifically. Overall satisfaction of hunters and anglers may decrease if access and dispersed camping was limited. Recreationists would likely seek other locations for their activity, increasing human impacts in those areas.

Overall, the satisfaction of those who value primitive recreation and natural environments would be greatest under alternative C, while the satisfaction of recreationists who prefer highly developed and motorized accessible options would be less than any other action alternative and satisfaction would decrease. The quality of the natural environment for hunting, fishing and wildlife viewing would be enhanced through decreased development and emphasis on primitive experiences. While several of the management actions present in alternative C would address resource protection more than those in the other alternatives, in most cases wildlife related recreation activities would be minimally affected.

Table 25 lists the wildlife-related desired conditions and effects for designated, recommended, and proposed management areas under alternative C.

Table 25. Desired conditions relevant to designated, recommended, and proposed management areas (MAs) under alternative C

Relevant desired condition in the forest plan	Designated	Recommended Wilderness (399,029 ac)	Other MAs*	Effects
Ecological and social conditions on the Forest support plentiful and diverse opportunities for hunting, fishing, and wildlife watching, and contribute to local economies.	Yes	Yes		Yes
Access to a range of opportunities for hunting, fishing, and wildlife watching are available.	Yes	Yes	Yes	Less potential opportunities depending on the areas restrictions or designation of uses
Forest visitors have ample opportunities to view, experience, appreciate, and learn about the wildlife and fish resources of the Forest.	Yes	Yes	Yes	No change

*Picket Post Mountain Research Natural Area, Upper Forks Parker Creek Research Natural Area, eligible wild and scenic river segments, Apache Leap Special Management Area, Significant caves, Fossil Springs, Little Green Valley Fen, Horseshoe and Mesquite Wash

Alternative D Effects

Alternative D addresses the desire for easier motorized access and multiple use opportunities, fewer restrictions on land uses and no additional recommended wilderness areas. Emphasis is placed on active restoration in those areas at high risk or highly impacted to achieve desired conditions and provide more economic opportunities. There is an increase in priority for maintenance and development of roads and facilities to accommodate increased uses and public needs for accessibility.

In general, this alternative would provide the maximum amount of motorized access for fish and wildlife related recreation and would prioritize active restoration to meet or move toward desired conditions. This alternative could increase user conflicts and lessen the satisfaction of those users seeking solitude.

Vegetation and Wildland Fire

Primary use of only mechanical treatments for increasing the supply of forest products is limited to maintaining and/or restoring habitat and may increase impacts to diversity and overall quality of habitat for wildlife. In addition, not having fire as a primary driver may not have the restoration outcomes for meeting desired conditions for wildlife and wildlife related recreation. Effects to wildlife may include the short-term disruptions in behavior for things like foraging and may deter animals from the area due to the added noise and activities in the area. This may complicate or limit hunting activities, causing users to seek non-Forest lands to hunt or even affect their interest in hunting in the future. Long-term effects to wildlife may include the inability to return to the areas due to the amount of disturbance and lack of natural process for restoration (REC-WR-DC-01, REC-WR-MA-01a, and REC-WR-MA-04). This can also affect success and satisfaction of hunters and wildlife watchers, resulting in less of these activities occurring on the Forest. The public's values of the Forest may decline, decreasing all types of recreational visitation on the Forest and potentially leading to more destructive habits (REC-DC-01 and REC-DC-08).

Riparian Areas

Riparian areas are currently limited and threatened on the Tonto National Forest and under this alternative, focus is only on maintaining conditions. Fish and wildlife related recreation should not be affected.

Rangeland Management

Open and vacant allotments would stay open to grazing under this alternative. This would affect wildlife related recreation through potential access restrictions such as fencing and gates (REC-WR-DC-02, REC-WR-DC-03, REC-WR-G-02, REC-WR-G-04, and REC-WR-MA-04). Also, with a potential increase in grazed areas, the effects to wildlife resources would continue to deteriorate due to the lack of available cover and forage. Wildlife related recreation activities would then suffer from poor wildlife conditions and habitats; decreasing wildlife populations would affect the success of hunters and wildlife watchers. With the presence of extra livestock on the forest, hunters may also be leery to hunt in those locations and seek other lands.

Recreation

This alternative favors motorized and developed recreation with decommissioning of unneeded nonmotorized trails. For those recreationists who prefer motorized trails and developed sites for their fish and wildlife related activities, this alternative would increase their satisfaction and contain human impacts to already developed areas. Desired conditions related to minimizing user conflicts (RECWR-DC-02) and connecting visitors to distinct recreation opportunities (REC-DC-10) would be met. Visitation may increase and local businesses related to fishing and hunting sales may see an increase in profit. For those recreationists who prefer a "backcountry" or primitive experience, opportunities may be limited, and future development of infrastructure may impact their experience. Visitation may decrease or divert to non-Forest lands that can provide a better recreation experience with solitude. This would not achieve desired conditions to provide a variety of quality recreation opportunities for wildlife related recreation. (REC-WR-DC-01, REC-WR-DC-03).

Mineral Materials

There are no specific standards that make this alternative unique from the others and therefore, effects to the quality of the riparian management zones with mineral material (sand and gravel) withdrawal would continue to degrade.

Management Areas

In alternative D's designated areas and management areas, the satisfaction of recreationists seeking the most access, opportunity, and development would increase; while the social well-being of recreationists who prefer solitary and quiet experiences could decrease. Opportunities for fishing, hunting, and wildlife viewing would increase. However, the quality of these experiences would likely decrease as solitude would be more difficult to find. More people recreating on public lands would provide no means to manage wildlife habitat in response to growing population pressures. While most of the designated and management areas are not included in this alternative, the Lakes and Rivers Management Area is included and would have effects to desired conditions due to the confinement of recreationists to developed, high-use sites and areas (REC-WR-DC-02, REC-WR-MA-04). Table 26 lists the wildlife-related desired conditions and effects for designated, recommended, and proposed management areas under alternative D.

Table 26. Wildlife-related desired conditions and effects for designated areas and management areas under alternative D

Relevant desired condition in the forest plan	Designated Areas	Lakes and Rivers Management Area	Effects
Ecological and social conditions on the Forest support plentiful and diverse opportunities for hunting, fishing, and wildlife watching, and contribute to local economies.	Yes	Yes	Socially there would be an increase due to the ample opportunity and use of local merchants; however, a decrease in the stability of the ecological services due to the higher use may occur
Access to a range of opportunities for hunting, fishing, and wildlife watching are available.	Yes	Yes	Increase in opportunities
Forest visitors have ample opportunities to view, experience, appreciate, and learn about the wildlife and fish resources of the Forest.	Yes	Yes	There would be an increase in the opportunity

Cumulative Effects

This cumulative effects analysis does not attempt to quantify the effects of past actions by adding up all prior actions on an action-by-action basis. To understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current conditions (as detailed in the Affected Environment section) as a proxy for the impacts of past and present actions. This is because existing conditions reflect the aggregate impact of all prior actions and natural events.

For a thorough analysis of cumulative effects, see the Recreation section; effects to wildlife-based recreation would be the same as identified there. Additional cumulative effects specific to wildlife related recreation result from variances in management of wildlife (including fish), water management (e.g., reservoir dams), and hunting/fishing restrictions on adjacent lands[50]. The State currently manages hunting and fishing through a permit system, and these activities on the Forest default to the State's regulations; the Forest does not regulate the action of taking game or fish for private purposes. If the state's permit system were to change, the amount of hunting and fishing occurring on the Forest would be directly affected, but management of these activities would be minimally affected. A reduction in available permits or increased difficulties in obtaining a permit would decrease hunting and/or fishing activities on the Forest, reducing user satisfaction and impacting local businesses selling hunting and fishing equipment. On the other hand, an increased availability of permits and/or ease of obtaining permits would likely increase these recreation activities on the Forest. This may cause overcrowding in popular areas and users would not get the primitive or "outdoor experience" they seek due to a larger number of people hunting and fishing in available areas (REC-DC-01 and REC-DIS-WB-DC-02). Additional effects may be increased litter and human waste from additional recreationists being in non-developed areas, additional damages to cultural resources as more lands are explored by hunters and impacts to wildlife health and populations from additional hunting and fishing. Local businesses, however, would see an increase in sales related to these activities. Recreation areas on the Tonto that are closest to larger cities may be impacted the most, including Saguaro Lake, Canyon Lake, and general forest lands near the Town of Payson. Maintenance and sustainability of developed recreation sites (e.g., those with fishing piers) may

[50] See the Cumulative Effects section in Recreation for a list of what lands are included in this analysis.

not be obtained (REC-DEV-DC-01) and additional resource impacts may result from the lack of maintenance[51].

Related to fishing, the Salt River Project currently regulates water releases at the dams along the Salt River lakes chain and Verde River lakes. The Salt River Project works closely with the Arizona Game and Fish Department to address fisheries needs, but water releases as a result of demands in cities and towns beyond the Tonto's boundaries can directly impact the availability and health of fish in each reservoir and river. These seasonal needs and operations can cause a decrease in fish health and population, affecting user satisfaction of fishermen. Weather patterns such as excessive rain and snow in the higher elevations or droughts can also affect the water levels at each reservoir, as well as water quality for fish health. When fish health declines, fishing opportunities can be poor and fishing tournaments may even be cancelled. Visitors seeking water-based recreation activities may dislike the water conditions and presence of dead fish, resulting in less visitors at the Forest lakes. The Forest would lose recreation fees from less visitors and local businesses may see less sales in bait, fishing gear, and other water-based recreation equipment. Other Forest resources such as soils, vegetation, and air qualities would improve from the decrease in public visitation.

Changes in wildlife management and hunting/fishing opportunities on other agencies' lands, such as permits for a fee that are required on Indian reservation lands and State Trust lands, may limit types of recreation, and could result in both positive and negative effects to the Tonto National Forest. The Tonto National Forest could receive increased use from those who do not want to pay the fee for the permit and then come to the Tonto. If those types of recreational activities are limited on those adjacent lands, people would then come to the Tonto for those particular types of recreation, increasing visitation and associated human impacts[52].

Other agencies' management plans as it relates to things like travel management would also play a role in access to wildlife related recreation from those adjacent areas onto the Tonto National Forest. An example would include if a road was decommissioned or administrative access that connects a non-Forest land to the Tonto National Forest, the access would then be cut off to general users. Decommissioning or restricting access to roads would reduce recreational opportunity and displace users in the area and possibly reduce local economic spending.

Mechanical treatments for fuel management (prescribed burns) and wildfires on adjacent lands (e.g., Prescott, Coconino, and Apache-Sitgreaves National Forests) may also affect hunting activities on the Tonto[53]. These effects may be greater for hunting activities particularly since hunting relies on visibility to identify wildlife and a calm, safe environment for animals to behave normally.

All alternatives accommodate a mix of recreation opportunities and settings for recreationists. Alternative C provides the most nonmotorized and primitive recreation settings; alternative D provides the most motorized and roaded settings with recreation management focused on accessibility; and alternative B provides a balance between alternatives C and D.

[51] For more information on these types of impacts, see the Developed Recreation section of this environmental impact statement.
[52] For more information on impacts from increased visitation level, see the Recreation in a proceeding section of this environmental impact statement.
[53] For a detailed list of effects, see "Environmental Effects, Effects Common to All Alternatives" in the proceeding section of this environmental impact statement.

Recreational Shooting

Recreational shooting is defined in the forest plan as any shooting other than in lawful pursuit of game that is carried out in a safe manner, does not cause resource damage, and does not result in litter. This includes discharging a firearm, air rifle, or gas gun, including paint ball guns. Restrictions on recreational shooting does not limit one's ability to carry or possess a legal firearm. For the purposes of this section, recreational shooting will also include recreational archery or discharging any other implement capable of taking human life, causing injury, or damaging property.

Affected Environment

Recreational shooting, also known as target shooting, is considered an acceptable use of National Forest System lands. Currently, recreational shooting is allowed anywhere on the Tonto National Forest where it has not been closed with a forest order and is allowed when it complies with Federal and State laws. No specific study has been done to determine current public satisfaction with existing recreational shooting opportunities on the Forest. However, public outreach, as part of this forest plan revision process, and ongoing public contact with forest staff have indicated a wide range of opinions when it comes to determining an appropriate level of recreational shooting opportunities on public lands in general and on the Tonto National Forest. Recreational shooting also contributes to conservation efforts on public lands through revenue collected by excise taxes on firearms and ammunition sales under the Pittman-Robertson Act.

According to many forest users, recreational shooting is an important opportunity on the Tonto National Forest. However, currently the forest plan is silent regarding the management of recreational shooting and provides no guidance on how it should be managed. This recreational activity has grown in popularity since the forest plan was implemented in 1985 and the population centers around the forest have grown significantly. These factors, taken together, have increased the magnitude of effects from this activity on forest resources. The Tonto National Forest is less than an hour drive for four million people[54] and is free to use for this activity. Additionally, shooting is considered an important part of the local culture by many residents and is often a family activity.

Recreational shooting can result in resource damage, litter, conflict with other types of recreation, and public safety and are the main considerations when evaluating if and where recreational shooting is appropriate.

Resource damage occurs when shooters, either intentionally or accidentally, shoot at trees and cacti, heritage resources, caves, and other property such as signs, range improvements, and other administrative sites (e.g., restrooms and other buildings). When vegetated areas are repetitively used for shooting, these areas become denuded of vegetation and the soil becomes looser, barren, and damaged, increasing erosion. This creates shooting "lanes" or "pits" which can take years to naturally recover.

Another form of resource damage that can result from recreational shooting is wildfires. Bullets hitting steel targets or rocks in areas of dry vegetation can cause wildfires. This often occurs in desert areas where natural wildfire is uncommon and is not generally desirable for natural restoration processes. For this reason, recreational shooting is prohibited during fire restrictions, typically during May through July. The Forest responds to many human-caused wildfires every year, some attributed to recreational shooting. From October 2009 to May 2012, at least 23 wildfires were considered correlated with recreational shooting. In the first six months of 2017, there were 17 likely or confirmed target shooting caused fires on the Tonto National Forest. These fires burned 125 acres, and cost over $112,000 to suppress. The majority

[54] The population of Maricopa County in 2016 according to US Census Data.

(15) were started prior to the Tonto National Forest going into fire restrictions (which prohibits target shooting).

Litter, or “target trash”, consists of bullet casings and remnants of materials used as targets. Cardboard boxes, broken glass and cans, household appliances and other litter can be found across the forest as left behind targets of recreational shooting. This litter often collects in popular shooting areas, including areas of more concentrated use or dispersed sites across the forest. As the popularity of recreational shooting has increased, the proliferation of litter from shooting has also increased.

There is a temporary shooting closure in specific congested areas on the southern portion of the Forest which include areas along the Lower Salt River and Bulldog Canyon. The Tonto National Forest also instituted a Forest Order[55] in November 2017 to address litter left behind from recreational shooting. This order prohibits the possession of any refuse, such as old cars and refrigerators, for the purpose of target shooting and provides a list of acceptable target types. Volunteer organizations often organize regular clean-ups to remove litter in some areas of concentrated target shooting use. However, dispersed areas of the forest continue to accumulate litter.

The Mesa and Cave Creek Ranger Districts, closest to the largest population centers of the Phoenix Metropolitan area, are most affected by resource damage and user conflicts. Areas such as Hewitt Station, Lower Sycamore, and Sugarloaf on the Mesa Ranger District have become oversaturated with recreational shooters, particularly on weekends. Volunteer organizations reported removing nearly 24 tons of litter from these three sites alone in 2017. More than 33 tons were removed in 2016, and 65 tons were removed in 2015. These areas provide good shooting backstops, mostly sandy hills. However, these areas are also popular with off-highway vehicle use, hunting, sight-seeing, and recreational group events, leading to user conflict and the potential for serious injury to the public. The main conflict is with target shooters and off-highway vehicle users because there are user-created motorized trails that run very close to areas where shooters are concentrated. This is, in part, because most recreational shooters prefer to drive to the area they will use for shooting. Recreation staff and forest, state, and county law enforcement often respond to problems in these areas generally stemming from user conflicts. In addition to user conflicts, recreation shooting also impacts private landowners and grazing permittees that report target shooting noise and litter.

In the northern part of the Forest, especially in the Payson area, where the forest surrounds many communities and private property inholdings, public safety concerns are more often reported by residents. They indicate that recreational shooting is occurring in close proximity to their property or that property damage has occurred as a result of stray bullets and backstops not being used to stop bullets from traveling greater distances. The Forest has received the most reports from the communities of Strawberry, Pine, Whispering Pines, Verde Glen and Rim Trail, Christopher Creek/See Canyon, Diamond Point, and Ellison Creek.

Environmental Effects

Alternative A Effects

The analysis for this alternative evaluates whether the current direction, including standards and guidelines found in the existing forest plan, would move conditions toward the desired conditions for recreational shooting in the forest plan. The desired conditions for recreational shooting listed in the forest plan are as follows:

[55] Order number 03-12-00-18-317

- Desired Condition 1 - Recreational shooting opportunities are available and address user demand while minimizing public safety concerns, environmental impacts, resource damage, and litter.
- Desired Condition 2 – Conflicts with other uses are minimal.
- Desired Condition 3 - Approved target types and other restrictions are clearly communicated to forest users.
- Desired Condition 4 - The shooting of, or targets attached to, natural features (e.g., cacti, trees, and caves), cultural resources, range improvements, or other property of the United States (e.g., signs and structures) does not occur.
- Desired Condition 5 - Recreational shooting does not occur in areas where risks to public health and safety and conflicts with other National Forest uses are not able to be mitigated.

Alternative A would not provide direction in the forest plan that would move the Tonto National Forest toward desired conditions as described in the forest plan. There is no direction for recreational shooting in the existing forest plan. For this alternative, there are 977,116 acres open for recreational shooting. While this is the greatest number of acres among all the alternatives, current conditions show that these opportunities are not minimizing resource damage and user conflict at the scale of the Forest.

Currently, any management of recreational shooting is done through Temporary Forest Orders[56]. With the exception of forestwide orders for fire restrictions, forest orders that restrict recreational shooting generally address small, localized areas and generally prohibit recreational shooting in these areas altogether. Consequently, any reduction of resource damage, risk of wildfire, litter, or user conflict is also confined to that localized area. The nature and intent of closure orders do not allow creative solutions to providing safe and responsible shooting opportunities in these areas. The user conflict is generally resolved, if it is addressed at all, by excluding recreational shooters entirely from a particular area. These closure orders' temporary nature also do not allow consistency of management by area or forestwide.

The target type restrictions order has been moderately successful in reducing litter in areas where forest staff and law enforcement are able to easily access to educate shooters and patrol more regularly to cite those who ignore these posted restrictions. Shooters have been supportive of this effort to reduce litter from "trigger trash" and generally happily comply with the target type restrictions. There is some evidence; however, that those wishing to shoot unapproved target types have simply moved to more dispersed areas, thereby dispersing litter. Volunteer clean up events generally only take place in the most commonly used shooting areas and not in dispersed areas. Litter dispersed into areas outside of the most common shooting areas is less likely to be removed and would accumulate in dispersed areas over time, diminishing the scenic integrity for other forest users and degrading habitat quality for wildlife.

Alternative B Effects

In alternative B, 959,776 acres would be available for recreational shooting, the smallest area among the alternatives. However, this reduction would not be a significant loss as this only reduces the available area for recreational shooting by 17,340 acres or less than two percent from the current condition. Recreational shooting would be prohibited within the Lakes and Rivers Management Area and all four botanical areas proposed in the forest plan. Previous temporary closures overlap with much of the Lakes and Rivers Management Area, so this change would likely not be noticeable to most recreational shooters or to other

56 The John D. Dingell, Jr. Conservation, Management, and Recreation Act (Dingell Act) P.L. 116-9 was passed by Congress in 2019. This Act requires the Forest Service and other land management agencies to now follow a separate process before closing any additional areas to recreational shooting. Any new closure orders for recreational shooting would comply with the Dingell Act, along with forest plan components and other laws and regulations.

forest users from the current condition. Excluding recreational shooting from the Lakes and Rivers Management Area would reduce user conflicts and safety concerns in this area of more concentrated water-based recreation. This minimal reduction of available area would still provide extensive dispersed areas to shoot forestwide.

Recreational shooters generally use a motor vehicle to access a shooting site on the forest. Thus, the vast majority of recreational shooting occurs within 100 feet of a road, and more often than not, within a few miles of a paved road. This is not required, but most shooters do not choose to walk and carry their equipment further than this distance from their vehicle. Therefore, recreational shooters depend on a maintained road system to access the forest. New roads may allow recreational shooters access into new areas as user demand increases over time, which could decrease user conflict and increase safety. New roads would not be built within inventoried roadless areas and recommended wilderness areas though recreational shooting would continue to be allowed and existing roads would remain open. The restriction on new roads would limit the ability to adapt to increased user demand in the future within these areas. This could cause existing popular shooting areas to become even more crowded. Under this alternative, roads would be maintained based on user demand, including user demand from recreational shooters, and decommissioning would be prioritized where infrastructure is not sustainable. This may cause existing routes to be maintained more often as this user demand increases, but this increased maintenance would reduce the effects of erosion and vegetation removal of this increased use.

Alternative B allows for a more balanced use of prescribed fire and mechanical treatments for forest restoration. Recreational shooting would be prohibited in areas during prescribed burning activities, therefore reducing shooting opportunities during treatment times. Prescribed fire may also temporarily impact access on some roads and trails reducing access for shooters. Until access to these treatment areas is restored, shooters would be forced to use other areas, thereby potentially further concentrating use in popular areas, or dispersing use into new shooting sites. This could, in turn, increase litter and damage to vegetation, heritage resources, and forest property such as signs or range infrastructure in these new areas. Once new "shooting lanes" have been created, it is difficult to restore them unless use stops in that area so natural processes can restore them. Some resources, such as heritage, cannot be restored once damaged. Volunteer clean-up events generally only take place in the most commonly used shooting areas and not in dispersed areas. Litter dispersed into areas outside of the most common shooting areas is less likely to be removed and would accumulate in dispersed areas over time diminishing the scenic integrity for other forest users and degrading habitat quality for wildlife. Treatments using only mechanical means typically take less time than prescribed fire treatments so mechanical treatments could mean less disruption than prescribed fire treatments. This may reduce the dispersion of shooters into more popular sites or new shooting sites and reduce those associated effects. However, more treatment of areas used for recreational shooting, whether by prescribed fire and/or mechanical treatments, could result in the reduced risk of wildfires caused by recreational shooting in the long term. These vegetation treatments would occur in non-desert ecosystems, having more of an effect on shooting areas in the higher elevation, northern areas of the forest.

Alternative C Effects

In alternative C, 976,039 acres of the Tonto would be available for recreational shooting. This alternative does not include a Lakes and Rivers Management Area where recreational shooting would be prohibited. Therefore, aside from the current condition, this is the largest area available among the alternatives, virtually equal to the current condition. However, under the proposed guideline, "Recreational shooting should be restricted, or prohibited, in areas… [w]ithin the Lakes and Rivers Management Area and the Salt River Horse Management Area." Previous temporary closures overlap with much of the Lakes and Rivers Management Area, so this would likely not be noticeable to most recreational shooters or to other forest users from the current condition. Shooting would still be prohibited in all four proposed botanical areas under alternative C, totaling 3,949 acres. This negligible reduction would do little more than current management, at a forest scale, to balance user demand with public safety, minimize resource damage, minimize litter, and reduce conflicts with other uses of the Tonto National Forest. The minimal reduction of available area will still provide extensive dispersed areas to shoot.

As more primitive forms of recreation are prioritized under alternative C, this would disadvantage shooters seeking a more developed area, and potentially force shooters into more remote sites. This could, in turn, also increase litter and resource damage in more remote areas of the forest where these effects are currently minimal overall. Other recreationists seeking a more remote and tranquil experience could encounter more recreational shooters, increasing user conflict in these areas.

This alternative would prioritize maintaining current or decommissioning underused roads and trails. Recreation generally would be managed to promote more primitive recreation opportunities, with no objectives for increasing accessibility and infrastructure. New roads would be the least likely of all alternatives to be built across the forest to accommodate increasing user demand for recreation, including for recreational shooting. This could cause existing popular shooting areas, accessible by existing roads, to get even more crowded, increasing safety concerns. This crowding could cause some shooters to instead choose to further disperse into new areas. This could, in turn, increase litter and damage to vegetation, heritage resources, and forest property such as signs or range infrastructure in these new areas. Once new "shooting lanes" have been created, it is difficult to restore them unless use stops in that area so natural processes can restore them. Some resources, such as heritage, cannot be restored once damaged. Volunteer clean-up events generally only take place in the most commonly used shooting areas and not in dispersed areas. Litter dispersed into areas outside of the most common shooting areas is less likely to be removed and would accumulate in dispersed areas over time diminishing the scenic integrity for other forest users and degrading habitat quality for wildlife. New roads would not be built within inventoried roadless areas and recommended wilderness areas though recreational shooting would continue to be allowed and existing roads would remain open. The restriction on new roads would limit the ability to adapt to increased user demand in the future within these areas, to the greatest extent of all the alternatives.

Alternative C identifies prescribed fire as the primary treatment method for restoration. Mechanical treatments would only be used in limited circumstances. Recreational shooting would be prohibited in areas during prescribed burning activities, therefore reducing shooting opportunities during treatment times. The effects of this would be similar to or increased from those described in alternative B depending how many prescribed fire treatments actually occur. Prescribed fire may also temporarily impact access on some roads and trails reducing access for shooters. Since more prescribed fire would be used under this alternative, recreational shooting would be more affected by these closures than under other alternatives. However, prescribed fire would only occur in non-desert ecosystems, having more of an effect on shooting areas in the higher elevation, northern areas of the forest.

Alternative D Effects

In alternative D, 960,853 acres would be available for recreational shooting. This is only a 1.7 percent decrease in available area from the current condition. Recreational shooting would be prohibited within the Lakes and Rivers Management Area, the Salt River Horse Management Area, and all four botanical areas proposed in the forest plan. Existing temporary closures overlap with much of the Lakes and Rivers Management Area and the Salt River Horse Management Area, so this change would likely not be noticeable to most recreational shooters or to other forest users from the current condition. Excluding recreational shooting from the Lakes and Rivers Management Area would reduce user conflicts and safety concerns in this area of more concentrated water-based recreation. The minimal reduction of available area will still provide extensive dispersed areas to shoot.

Under this alternative, there is an increase in objectives for maintenance and development of roads and facilities to accommodate increasing use and needs for accessibility on the forest. Therefore, this would be the most likely of all alternatives to build roads across the forest to accommodate increasing user demands for recreation, including for recreational shooting. This could lead to greater user satisfaction. It may also discourage shooters from dispersing into new shooting areas where resource damages would be harder to control. Existing shooting areas would be more likely to be used, and may become more damaged, but clean-up efforts, education, and law enforcement efforts could be focused in these specific areas. Maintenance of existing roads already used by recreationists would provide more pleasant and reliable access to more popular shooting sites, as well as decrease the erosion, vegetation damage, and other effects associated with driving on poorly maintained roads.

New roads would not be built within inventoried roadless areas and recommended wilderness areas though recreational shooting would continue to be allowed and existing roads would remain open. Any restriction on new roads would limit the ability to adapt to increased user demand in the future within these areas. There are no recommended wilderness areas under alternative D. Therefore, new roads could be authorized within these areas to adapt to changing user demands, allowing this alternative the greatest ability to respond to increased user demand forestwide.

Alternative D identifies mechanical means as the primary treatment method for restoration. Treatments using only mechanical means typically take less time than prescribed fire treatments so mechanical treatments could mean less disruption than prescribed fire treatments, which means less time that recreational shooting would be restricted in these areas. The effects of this displacement of shooters would be reduced from those described in alternative B with the reduction of prescribed fire treatments. However, more treatment of areas used for recreational shooting, whether by prescribed fire and/or mechanical treatments, would reduce the risk of wildfires caused by recreational shooting in the long term. These vegetation treatments would occur in non-desert ecosystems, having more of an effect on shooting areas in the higher elevation, northern areas of the forest.

Effects of Recreational Shooting Plan Components

The standards, guidelines, and management approaches found in the Recreational Shooting section of the forest plan (shooting direction) provide direction for managing recreational shooting that is currently non-existent for the Tonto National Forest. The first standard, “Recreational shooting is prohibited in areas where risks to public health and safety and conflicts with other National Forest uses are not able to be mitigated, (forest plan, chapter 2, Dispersed Recreation, Recreational Shooting). This shooting direction provides succinct, forestwide direction for where recreational shooting would and would not be allowed along with the following guideline,

Recreational shooting should be restricted, or prohibited, in areas:

- Within a minimum of one quarter mile from developed recreation sites;
- Within a minimum of 0.25 miles from occupied private property, residences, or administrative sites;
- Within the Lakes and Rivers Management Area and the Salt River Horse Management Area;
- Within any designated off highway vehicle area, including “tot lots,” as identified through travel management;
- Within designated or proposed botanical areas.

This language is also flexible enough to allow for public safety under changing conditions, such as if additional developed recreation sites are constructed or areas become more concentrated with other public uses over the life of the forest plan where risks to public health and safety are not able to be mitigated. Residential areas, especially in the northern areas of the forest where the forest surrounds many communities and private property inholdings, would benefit from the prohibition of shooting within a minimum of one quarter mile from occupied private property, residences, or administrative sites. This guideline would address public safety concerns of these residents who report that recreational shooting is occurring in close proximity to their property and resulting in property damage from stray bullets and backstops not being used.

By excluding recreational shooting from the Lakes and Rivers Management Area, the Salt River Horse Management Area, and designated or proposed botanical areas, the forest would move toward the desired conditions within these areas: “Recreational shooting opportunities are available and address user demand while minimizing public safety concerns, environmental impacts, resource damage, and litter” and “Conflicts with other uses are minimal” (forest plan, chapter 2, Dispersed Recreation, Recreational Shooting.) In alternative B, recreational opportunities are relevant and responsive to changing user demands while remaining sustainable. This reflects the same desired conditions and would move the forest closer to them at the forest scale.

Recreational shooting direction in the forest plan also provides guidance for expanding shooting opportunities on the forest to adapt to growing public interest and needs including potential permitted and developed shooting ranges and other management tools where compatible with other National Forest uses.

Expanded shooting opportunities on the forest to adapt to growing public interest and needs is most likely to occur in alternative D; recreation management would focus on dispersed and developed recreation opportunities that are easily accessible to the public under the direction of this alternative. This would advantage recreational shooters seeking a more developed place to shoot and promote existing dispersed shooting areas rather than more remote locations. Litter and resource damage would be more likely to remain more confined to areas already affected instead of being driven to new, more remote areas of the forest. User conflicts among recreationists would still occur, similar to the current condition, with those recreating on off-highway vehicles, equestrians, and hikers. However, this conflict may be reduced in more concentrated recreation areas with the shooting direction prohibiting shooting within 0.25 miles of developed recreation sites (forest plan, chapter 2, Dispersed Recreation, Recreational Shooting).

The shooting direction also incorporates recently developed target type restrictions to address litter and resource damage: “The shooting of, or targets attached to, natural features (e.g., cacti, trees, and caves), cultural resources, range improvements, or other property of the United States (e.g., signs and structures) is prohibited” (forest plan, chapter 2, Dispersed Recreation, Recreational Shooting). This standard would prevent intentional or unintentional damage to these resources from bullets aimed at targets attached to them and save the money and staff time necessary to replace damaged property. It also supports the desired condition “Approved target types and other restrictions are clearly communicated to forest users” (forest plan, chapter 2, Dispersed Recreation, Recreational Shooting).

Cumulative Effects

This cumulative effects analysis does not attempt to quantify the effects of past actions by adding up all prior actions on an action-by-action basis. To understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current conditions (as detailed in the description of alternative A) as a proxy for the impacts of past and present actions. This is because existing conditions reflect the aggregate impact of all prior actions and natural events.

This analysis focuses on the cumulative impact of those reasonably foreseeable actions that are relevant in assessing the impacts of revising the forest plan.

The temporal boundary chosen for this analysis is the life of the forest plan, likely 10 to 15 years.

The spatial boundary chosen for this analysis is the full extent of the Tonto National Forest boundary, including private inholdings, and adjacent Federal, State, and Tribal lands where recreational shooting is currently permitted.

Ongoing and Reasonably Foreseeable Actions

In terms of reasonably foreseeable future actions, this analysis has attempted to include, specific to recreational shooting, projects for which upcoming actions are known and can be meaningfully analyzed. What will not be analyzed are projects that are inevitable and known, but which have not yet developed proposed actions.

Some of the user-created motorized routes currently being used to access recreational shooting sites were considered in the Tonto National Forest Travel Management Plan (travel management). Under the recent Travel Management Record of Decision, some of the existing user-created routes were designated as open for motor vehicle use and others were designated as decommissioned or only authorized for administrative use. Additionally, some areas of the forest were designated for motor vehicle use. The forest plan would prohibit recreational shooting in designated motor vehicle use areas, including the existing Bulldog Canyon Permit Zone. Additionally, changes to the Forest's motor vehicle route system would inherently change the areas accessible to recreational shooting (table 27). For this cumulative effects analysis, routes identified as open to motorized use in the Tonto National Forest Travel Management Plan Draft Record of Decision were used as the roads layer to base this analysis[57].

Table 27. Acres available to recreational shooting by alternative

Alternative	Acres available using current road system	Percent reduction from current condition	Acres available using travel management draft record of decision	Percent reduction from current condition
A	977,116	0	610,247	38
B	959,776	1.8	595,589	39
C	976,039	Less than 1	609,238	38
D	960,853	1.7	596,598	39

The Tonto National Forest is one of the only major land areas that is open for target shooting in central Arizona. Bureau of Land Management also allows recreational shooting on much of the land under its purview in the area. The Prescott National Forest and the Apache-Sitgreaves National Forest also allow recreational shooting. Recreational shooting is prohibited on adjacent Tribal lands for non-Tribal members. The State of Arizona has closed their land to shooting, which for most people, means that the Forest is the closest public land around that is open to shooting. No current or future projects have been identified to change recreational shooting areas on adjacent lands. However, if recreational shooting is

[57] For more information about specific route designations, see the Tonto National Forest Travel Management Plan Record of Decision.

prohibited on areas currently open for this activity on adjacent areas of Bureau of Land Management managed land or on adjacent National Forests, shooting on the Tonto National Forest is anticipated to increase.

If neighboring forests or the USDI Bureau of Land Management implement shooting restrictions or limit shooting areas in the future either outright or by limiting access to desirable shooting areas, shooting would become even more concentrated on the Tonto National Forest. Existing, popular shooting areas on the Tonto National Forest could become more heavily used, increasing safety concerns and user conflict among shooters and with other recreationists and further proliferating shooting lanes. This, in turn, could drive some recreational shooters to more remote areas of the forest to shoot, increasing “trigger trash” in areas currently less affected, and increasing user conflict with recreationists seeking a quieter, more remote recreational experience.

Any management on the Tonto National Forest which pushes recreational shooters from popular shooting areas could also encourage them to choose to shoot elsewhere, potentially on neighboring national forests or on USDI Bureau of Land Management managed lands, as those are the only public areas open to this activity. The same effects from concentrated use or use of more dispersed areas would occur on those lands. If recreational shooters lose interest in this activity altogether due to limited opportunities on public lands near them, this could decrease sales of shooting equipment by any local retailers that sell it. The percentage of shooting supplies and equipment sales by local retailers that are used on the Tonto National Forest are not known.

Cumulative Effects from Travel Management

Areas available for recreational shooting would be significantly reduced once travel management is implemented (table 27). Recreational shooters would likely notice the significant reduction of access routes in the near term.

The reduction of available routes with the implementation of travel management would not supersede the ability to adapt the route system to the changing needs of the public over time. However, the degree to which this designation is evaluated, the degree and manner different resources are considered when evaluating it, and the likelihood any changes would advantage recreational shooters would depend on Forest priorities set forth in the forest plan.

Safety concerns and existing types of user conflict, especially conflicts with other motorized recreation activities, would be further exacerbated as motorized use would be more concentrated along the new motorized route system. Existing, popular shooting areas along the new route system could become more heavily used, increasing safety concerns and user conflict among shooters and with other recreationists and further proliferating shooting lanes. This, in turn, could drive some recreational shooters to more remote areas of the forest to shoot, increasing “trigger trash” in areas currently less affected, and increasing user conflict with recreationists seeking a quieter, more remote recreational experience.

Under alternative A, recreation management under the existing 1985 forest plan would continue. The significant change in the motorized route system (travel management), combined with the absence of any direction in the forest plan, would significantly disadvantage recreational shooters and move the forest further away from desired conditions, particularly “Recreational shooting opportunities are available and address user demand while minimizing public safety concerns, environmental impacts, resource damage, and litter” and “Conflicts with other uses are minimal” (forest plan, chapter 2, Dispersed Recreation, Recreational Shooting). Shooting in designated areas for motor vehicle use, such as the existing Bulldog Canyon Permit Zone and others proposed in travel management, would be permitted to intensify safety, and reduce user conflicts within these areas unless addressed with temporary or permanent future closure orders. Recreational shooting near residential areas, especially in the northern areas of the forest would continue to occur and possibly increase with the lack of forest plan direction combined with the concentration of motorized use on the new designated route system. Additionally, no direction would be provided to increase shooting opportunities where compatible with other uses. Therefore, under this alternative, it would be unlikely additional shooting opportunities would be provided to relieve the increased pressure from the concentrated use and increasing user demand.

Under all action alternatives (alternatives B, C, and D), shooting in designated areas that place management emphasis on motor vehicle use, such as the existing Bulldog Canyon Permit Zone, would be prohibited by the shooting direction found in the forest plan (forest plan, chapter 2, Dispersed Recreation, Recreational Shooting). This would address user conflicts with motorized recreational users within these areas, as well as reduce litter and resource damage in support of the desired conditions. Recreational shooting near residential areas, especially in the northern areas of the forest, would be reduced with new shooting direction even though the concentration of motorized use on the new designated route system may increase motorized use adjacent to private property.

Under alternative B, roads would be maintained based on user demand and decommissioning would be prioritized where infrastructure is not sustainable. The designated route system would be likely to be maintained or further reduced, under this alternative, if the designated route system is not sustainable. However, since recreational shooting would be considered in evaluating user demand, any routes that are further reduced may not be routes commonly used by recreational shooters.

Alternative C would prioritize maintaining current or decommissioning underused roads and trails. Recreation generally would be managed to promote more primitive recreation opportunities, with no objectives for increasing accessibility and infrastructure. Similar to alternative B, the designated route system would be likely to be maintained or further reduced under this alternative, if the designated route system is not sustainable. However, the focus on more primitive recreation under this alternative, means that any routes that are further reduced may be routes commonly used by recreational shooters thereby further limiting their access.

Under alternative D, there is a higher emphasis for maintenance and development of roads and facilities to accommodate increasing use and need for accessibility on the forest. The designated route system would be maintained or likely increase routes over time to accommodate increasing recreational demand. The focus on recreation under this alternative may means routes that are added would be routes more desirable by recreational shooters.

Lands, Special Uses, and Access

Affected Environment

Managing National Forest System land includes survey and marking boundaries, acquisition, conveying and exchanging land, handling title claims and encroachments, acquiring rights-of-way, and authorizing and managing special uses to protect resource values and the interests of the Federal Government.

Adjustments to land ownership can occur through congressionally mandated conveyances, exchanges and acquisitions, or through Forest Service administrative activities.

The objectives of the Forest Service land ownership adjustment program (Forest Service Manual 5400 and 5500) are to:

- Achieve the optimum land ownership pattern to provide for the protection and management of resource uses to meet the needs of the nation now and in the future;
- Avoid land use conflicts with non-federal landowners by settling land claims equitably and promptly; and
- Provide resource administrators readily accessible and understandable title information affecting the status and use of lands and resources they administer.

Land occupancy and uses by private parties and other government entities are managed by issuing special use authorizations (Forest Service Manual 2700). Authorized special uses on the Forest include industrial or commercial uses, private uses, and a variety of recreational uses.

All occupancy, use or improvements on National Forest System lands not directly related to timber harvest, grazing, mining activities, and recreation are referred to as ‘Lands special uses.’ Lands special uses can include roads, utilities, storage facilities, communications sites, research, and commercial filming. Recreation special uses include resorts, ski areas, outfitter and guides, and a variety of uses that provide access to National Forest System lands by commercial ventures (such as outfitting and guiding).[58]

There are over 17 million acres within the four counties that make up the plan area; about 3 million acres are the administrative responsibility of the Tonto National Forest. This is the result of the original congressionally-designated lands and the conveyances (acquisitions, disposals and exchanges) that have occurred to date. The remaining lands within the plan area include private, local, county, state, and other Federal lands (figure 14).

The official acreage for National Forest System lands comes from the Forest Service’s Land Status Record System, and the Special Uses Database System is the current data source for number of special use authorizations. The number of acres of land currently administered by the Tonto and the number of special use authorizations currently active were compared to potential changes that might result from implementation of any of the alternatives considered.

[58] See the Recreation–Special Uses section for more information.

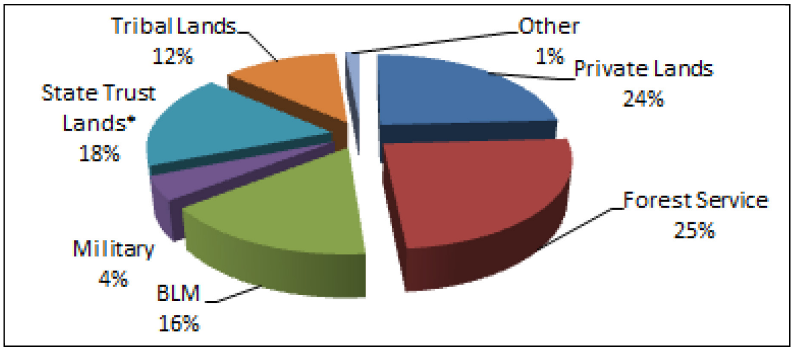

Figure 14. Land designation within the four-county area

Land

The 1985 Land Area Report states that the Tonto National Forest consists of about 2,873,261 acres (USDA Forest Service 1985b). The current Tonto National Forest administrative boundary minus private property is 2,864,080 acres. The reduction in acreage since 1985 suggests that over the life of the current plan, more National Forest System land was disposed of than was acquired. This is largely due to the Townsite Act, land exchanges, and special legislative sales around the towns of Payson and Globe.

Within the proclaimed boundaries of the Forest there are approximately 101,181 acres of non-National Forest System land. The vast majority of this land is held in private ownership and the remainder is owned by other Federal, State, and local government entities. Much of the private land within the proclaimed boundaries of the Forest is the result of homestead and mining patents.

Rights-of-way and easements affect both private and public lands throughout the plan area. The Forest continues to seek rights-of-way to safeguard public and administrative access to National Forest System lands.

Special Uses

All occupancy, use, and improvements on National Forest System lands that are not directly related to timber harvesting, grazing or mining activities are referred to as special uses. Special use authorizations (permits, leases or easements) are legal instruments whose terms and conditions are fully enforceable. The mission of the Forest Service Special Uses Program is to manage the use and occupancy of National Forest System land in a manner that protects natural resource values, promotes public health and safety, and is consistent with laws, regulations, policies, and the forest plan.

The Tonto National Forest administers approximately 457 lands special use authorizations. Land uses can include research, weather stations, commercial filming, railroad rights-of-way, roads, communications sites, water gauging, and electrical power storage and transmission.

The Forest regularly receives proposals for the use and occupancy of National Forest System lands. However, there has not been an obvious trend over time for more or fewer proposals. Census data has shown that population for the counties containing National Forest System land administered by the Tonto National Forest have remained relatively stable. Meanwhile, significant population growth within the Phoenix metropolitan area would suggest that change is coming and it is expected that the Forest will see an increase in proposals for special uses rather than a decrease.

Environmental Effects[59]

Alternative A Effects

This alternative reflects the 1985 revised forest plan, as amended to date, and accounts for current laws and regulations that have been issued since the original forest plan and the amendments that were adopted. Under management identified in the 1985 plan there would be minimal effects to the lands program when compared to existing. Proposals for acquisitions or land exchanges will continue to be analyzed at the project level. Decisions would continue to be based mostly in current laws, regulations, and policies without much direction from the plan. The special use program would operate much as it has barring the issuance of new laws, regulations, and policies.

Effects for All Action Alternatives

All action alternatives would identify criteria for acquisitions or exchanges without listing specific areas in the forest plan (LA-G-01). This would allow the Forest to be flexible and to make determinations based on the current needs of both the Forest and local communities. There would also be management emphasis to work with local communities to understand their community expansion needs, preserve open space and water, and retain access to National Forest System lands. Meeting the needs of local communities for increased Forest access would reduce user conflicts and enhance satisfaction in public ownership of National Forest System lands.

A desired condition in all action alternative states that landownership pattern supports forest land and resource goals and objectives, reduces future management costs, responds to urban and community needs, protects critical resource areas, increases recreation opportunities, and improves legal public access (LA-DC-02). Parcels identified for disposal and exchange are typically those that have become difficult to manage because surrounding ownership conditions have changed, or the lands have lost their forest character. These are often former administrative sites, isolated tracts, or scattered parcels, and rarely impact access for public use or administration. The disposal or exchange of these sites would help allocate resources to other areas of the Forest which were more useful or productive and in turn there could be a decrease in the backlog of maintenance. The action alternatives would also encourage cooperation with counties or local communities to identify lands to be included or excluded from consideration of future land exchanges and conveyances.

Under alternatives B, C, and D, there would be continued efforts to consolidate land ownership within the forest boundary and establish new rights-of-way, where needed, to benefit both private landowners and Federal land management. The purchase of small, isolated inholdings within the forest would simplify management activities and streamline public access. The need to acquire rights-of-way for road and trail access would be reduced with a consolidated land pattern.

By managing the lands program based on the management within all action alternatives, land ownership adjustments (e.g., purchase, donation, exchange) should improve management activities, including consolidating ownership, reducing wildlife-human conflicts, providing for wildlife habitat connectivity, improving public access, and retaining or acquiring key lands for wildlife and fish (LA-DC-01).

Effects of Management Areas

Land adjustments and special uses of National Forest System lands can be proposed anywhere within the proclaimed National Forest boundary. Such proposals need to be consistent with the Forest's land and resource management plan, laws, regulations, other policies, and suitable for the management area in

[59] Assumptions and methods used for this analysis can be found in volume 4 of the environmental impact statement, appendix B.

which they are proposed. For the purposes of this analysis, a comparison was made between alternatives that focused on the relative changes to management area acres. An increase in management areas with more limiting direction would be expected to decrease opportunities for conveyance or special uses of National Forest System lands. For example, an increase in proposed wilderness acres could result in fewer acres available for most types of special uses and the Forest would be less likely to dispose of or exchange land that was within recommended wilderness. That being said, an increase in recommended wilderness areas could serve to increase the Forest's interest in acquisition of private inholdings within newly recommended areas. Certain types of special uses (e.g., outfitters and guides) could benefit from an increase in recommended wilderness. Having a continuous land base has ecological benefits such as providing quality wildlife habitat and connectivity of travel corridors, protections for at-risk species, and maintaining naturally appearing landscapes.

The Forest compared the effects between alternatives by comparing the change in acres between categories of management that essentially reflect the management areas, specifically; recommended wilderness, inventoried roadless areas, and other identified management areas. An alternative with significantly more recommended wilderness, roadless areas or other identified management areas was considered to have the effect of being more restrictive to land conveyances and the majority of special uses.

The most significant change between alternatives is the introduction of management areas in alternatives B, C, and D, specifically recommended wildernesses in alternatives B and C. Alternative C proposes over eight times as many acres as alternative B, immediately suggesting that alternative C would be the most restrictive alternative relative to land ownership adjustments and special uses. Alternative D proposes no recommended wilderness areas, reflecting a more lenient alternative relative to some special uses, but with restrictions on land ownership adjustment actions.

In summary, there is significant difference between alternatives C and D relative to the land ownership adjustments and special uses programs. Alternative B could be considered slightly more restrictive than alternative D due to the acres of recommended wilderness and fewer opportunities for conveyance of land and fewer types of special uses viewed as suitable within a recommended wilderness area as a result. Alternative C appears significantly more restrictive than the other alternatives due to the greater number of acres of recommended wilderness as well as the greater number of acres in a specially designated area. As mentioned earlier, while an increase in acres of these more restrictive management strategies is assumed to result in fewer opportunities, there is also the effect of increasing the interest in acquisition of private parcels by the United States and the possible benefit to a subset of special uses.

Cumulative Effects

The cumulative environmental consequences are spatially bounded by an area larger than the Tonto National Forest's proclaimed boundary, generally the area immediately adjacent to the Forest. Continued population growth in the communities within and surrounding the forest, as well as the State of Arizona, influence land ownership adjustment cases, boundary issues, and the demand for special uses.

This cumulative effects analysis does not attempt to quantify the effects of past actions by adding up all prior actions on an action-by-action basis. In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current conditions (as detailed in the description of alternative A) as a proxy for the impacts of past and present actions. This is because existing conditions reflect the aggregate impact of all prior actions and natural events.

Continued population growth in surrounding communities and in the Southwest is expected and would add to the demand for additional lands for development purposes, especially infrastructure. Communities that have not planned for additional infrastructure needs would likely request acquisition of National Forest System lands. As private properties, especially inholdings, change from rural or undeveloped land to subdivisions or higher density uses, encroachment onto National Forest System land becomes more frequent, resulting in increased disturbance to the adjacent Forest resources and land survey needs. As communities grow and infill occurs, undeveloped lands and their open space values are converted to residential or commercial uses. This growth would likely result in continued pressures to maintain National Forest System lands for their open space values. This may also trigger the need to acquire right-of-way in places where public and administrative access is lost.

As further development occurs, residential encroachments onto the national forest are expected to occur more frequently and degrade wildland character and other resource values. Any of the surrounding jurisdictional land management plans (including local communities) being revised now or in the future have the potential to impact management of National Forest System lands, access, and special uses. For example, currently open roads could be closed or zoning designations could change allowing higher levels of development, density of population, or uses.

The Forest can expect requests for special use authorizations to increase. As more private land is subdivided and developed and the population increases, there will be an associated increase in requests for special uses such as roads and utilities. Utility maintenance and modification projects will continue as infrastructure ages and requires replacement. Requests for modification of existing and designation of new communication sites can reasonably be expected as technology advances and the desire for service increases.

Property owners within areas considered wildland-urban interface often make requests for access and utility infrastructure on National Forest System lands. When wildfires threaten large-scale destruction of private property, millions of dollars are spent defending these private lands and property. Additional pressure is placed on forest management to accommodate the rebuilding process, including road and other infrastructure reconstruction, after damage occurs. In recent years, the real estate industry has enforced tighter standards for marketable and insurable titles, which has resulted in a larger workload for lands and boundary management on the forest. In addition, the subdivision (fragmentation) of private parcels increases demands for utilities and access to the forest.

All communities adjacent to the Tonto recognize the open space and recreational and economic values the Forest provides and have developed goals and objectives in their plans to preserve these characteristics. Still, there will likely continue to be tradeoffs of resource values on the forest because of expanding communities and their needs. There will also likely continue to be tension between the desires to retain forest lands near communities and the need to provide land for infrastructure that serves the expansion of those communities. Local collaboration expectations with communities and their desire for open space may result in land ownership adjustments. However, all alternatives acknowledge community needs and the locations where land ownership adjustments are appropriate and minimize impacts to other resources. As such, these cumulative effects would be consistent among all alternatives.

The Pinto Valley Mine Plan of Operations was approved in August 2021. This plan approved an additional 526 acres that were authorized for mine operations. Approximately 229 of those acres are currently encroached upon. This change has minimal impact to boundary maintenance or management of the area.

As described in the affected environment section, the Tonto National Forest administers about 3 million acres of National Forest System lands. Adjustments in landownership will continue. In particular, the Forest will continue to pursue private inholding considered to have high resource values or that through acquisition will decrease administrative costs such as boundary survey. In this light, it would be expected that the number of acres administered by the Forest would increase. For example, the Forest is currently considering acquiring a number of parcels using the Land and Water Conservation Fund. Meanwhile, boundary marking will continue and additional encroachments are likely to be discovered through this process and other administrative actions.

The Resolution Copper Mine Land Exchange project is under review. If this land exchange is approved the total forest acres would be reduced by approximately 1800 acres. Access routes to the mine would be closed to the public and limited for forest service administrative purposes. The Forest would, however, gain three infill parcels in other areas of the forest making boundary maintenance and management easier. There would also be impacts to surrounding lands because of infrastructure changes and support facilities.

Energy Production and Delivery

Affected Environment

The major power transmission lines located within the plan area transfer power generated from the Navajo Generating Station, the Four Corners Generating Station near Fruitland, New Mexico, and the 995-megawatt Cholla coal-fired power plant in northeastern Arizona near Holbrook. An existing 345 kilovolt line connects power generated at the Cholla Generation Plant to the Pinnacle Peak substation, where it is transferred into the 500-kilovolt system for further transmission. The Navajo Generating Station transmits electricity through an existing 500 kilovolt line, ultimately delivering power to the Palo Verde transmission hub where it is distributed further west (APS 2014).

The Tonto National Forest has a long history of hydroelectric production beginning with the Salt River Project and the Childs/Irving Power Plants in the early 1900s. The forest also has the potential to host or facilitate the development of other alternate or renewable energy sources which may include solar, wind, and biomass. Construction and maintenance of facilities and transmission lines could provide employment while energy produced or transmitted provides direct benefits in power generation. Wind and solar energy are clean fuels which do not release hydrocarbons to the atmosphere and as such do not contribute to global warming.

Interest in exploring renewable energy development on public and private lands, including solar, wind, geothermal, woody biomass, and hydroelectric power at the local, state, and national level, has increased during the past 10 years. In 2006, the Arizona Corporate Commission approved the Renewable Energy Standard and Tariff. These rules require that regulated electric utilities must generate 15 percent of their energy from renewable resources by 2025. Each year, Arizona's utility companies are required to file annual implementation plans describing how they will comply with the Renewable Energy Standard and Tariff rules. The proposals include incentives for customers who install solar energy technologies for their own homes and businesses. This Renewable Energy Standard, along with Federal direction geared toward energy savings and climate change resiliency, have driven interest in exploring solar, wind, and woody biomass studies directly connected to National Forest System lands which might require development of additional transmission lines on National Forest System lands. Because the Arizona Corporate Commission is anticipated to update its renewable energy portfolio within the next 20 years, the Forest needs to consider potential renewable energy projects on National Forest System lands.

Environmental Effects

Effects of Alternative A

Alternative A does not include any standards and guidelines related to energy production and development. If these types of projects were to be authorized on the forest, they would comply with existing law, regulation, and policy, but there would be no additional parameters on where and how the projects are completed. For example, in the action alternatives there is a guideline that addresses burying powerlines to reduce scenic impacts. Under alternative A new powerlines related to these projects could impact scenic qualities as well as increased risks such as accidental fire associated with above ground powerlines.

On the other hand, by having less restrictions on the location and materials used in energy development, there is a greater potential for economic gain related to energy production on the forest. This is a result of fewer standards and guidelines dictating how the specific projects are completed.

Effects of All Action Alternatives

The action alternatives focus on allowing for exploration, development, production and transmission of renewable energy resources. This can contribute to ecological, social, and economic benefits to local communities by reducing air and water pollution, damage to public health, wildlife and habitat loss, water use, land use, and global warming emissions. These activities would be conducted in a manner that minimizes adverse long-term impacts to Forest resources and uses, ecosystem health, and watershed conditions.

Depending on their location, larger utility facilities can raise concerns about land degradation and habitat loss. One approach the plan takes to combat this is by including a guideline stating, "solar energy projects should give priority consideration to previously disturbed sites to prevent unnecessary environmental disturbance to wildlife and vegetation." By following this guideline, the impacts listed above from a utility scale solar field could be minimized (National Renewable Energy Laboratory 2012).

Impacts to the alternative energy production and delivery resulting from implementation of the alternatives could result in the limitation of some areas to each activity and increased operating costs (through limitations on road construction and use, facility placement, and operational constraints). These impacts may result from the requirements imposed by other resource programs. This estimate of impacts would be considered in conjunction with areas where solid mineral potential is known or suspected to exist, and where preferred locations for renewable and non-renewable energy may be located. Lands may be unavailable for each activity; however, if the resource does not exist, any possible impacts from limiting access to those lands may be minor or negligible.

Overall, all of the action alternatives would provide greater potential for sustainable energy development across the forest.

Effects of Management Areas

Under alternative A lands would remain available to the development of renewable energy keeping areas open and available that would not be under alternatives B and C. Effects of this development would be the same as those in alternative D.

Under alternative B, there would be 43,204 acres of recommended wilderness, as well as multiple other management areas, which would negatively impact the development of renewable energy due to the restricted access through recommended wilderness areas. Renewable energy, such as windfarms and solar arrays, would not be authorized in areas of recommended wilderness, to preserve the wilderness characteristics. Similarly, under alternative C, 399,029 acres would be recommended for wilderness inclusion and would be under the same restrictions as alternative B. An estimated 33,405 acres of special interest areas would also provide additional restrictions for renewable energy development. Alternative C would have the most adverse effects on access to and development of renewable energy due to the greatest amount of use restrictions. These adverse effects of both B and C include a possible reduction of economic viability for energy production with greater restrictions on land use, less use of energy potential that is beneficial for local communities, and greater ground disturbance in areas where energy development is allowed.

Because there is less land use restrictions in alternative D, this alternative could potentially increase the access to energy resources as a result of a decrease in restricted areas and greater access. As stated above, the possibility of more alternative energy development can reduce air and water pollution, damage to public health, wildlife and habitat loss, water use, land use, and global warming emissions.

Cumulative Effects

The cumulative environmental consequences are spatially bounded by an area larger than the Tonto National Forest's proclaimed boundary, generally the area immediately adjacent to the Forest. Continued population growth in the communities surrounding the forest, as well as the state of Arizona influences the demand for energy production on the Tonto National Forest.

Cumulative effects would result from a continuation of the same general restrictions on renewable energy development that existed in the previous plan as well as from the imposition of newer environmental laws and regulations. Bureau of Land Management and State lands in the surrounding area have seen an increase in the development of alternative energy facilities and infrastructure. Additionally, Comprehensive plans for neighboring communities identify the potential growth and demands for the future of their communities. As this growth occurs across the communities surrounding the Tonto National Forest, there could be a greater demand for energy production coming off the Tonto. These trends have increased demand for energy production, transmission, and distribution. Effects of this increased demand would increase the workload on Forest staff due to increased number of proposals, increased ground disturbance due to access needs and development of testing equipment and facilities. Renewable energy development is scattered and very specific to both physical and political conditions which means there is typically a greater need for testing locations for viability. As mentioned above this testing requires increased access and disturbance.

Utility maintenance and modification projects would continue as infrastructure ages and requires replacement. Requests for modifying existing communications sites and designating new communication sites can reasonably be expected as technology advances and the desire for service increases. These types of projects have similar impacts as new development.

Rangelands, Forage, and Grazing

Rangelands are grasslands, shrublands, forests and woodlands, wetlands, and deserts that can be grazed by domestic livestock or wild animals. Sustainable and productive rangelands are one of the key ecosystem services on the Tonto National Forest. Rangelands contribute to a traditional western way of life and are essential for the survival of many small ranching operations. Rangelands and the associated range improvements (e.g., ponds, troughs, fences, corrals, windmills) provide scenery and recreational (e.g., hunting, wildlife viewing) opportunities to the public and provide habitat for numerous species.

Affected Environment

Existing conditions of rangelands on the Tonto National Forest have been influenced by environmental conditions (i.e., climate, precipitation), historic use and management, and current range management[60].

Historic Uses and Management

Livestock grazing began on the area now known as the Tonto National Forest in the late 1800s. Heavy grazing occurred in the 1880s, and livestock numbers reached their peak about 1900, with an estimated 1.5 to 2 million head grazing the area now known as Tonto National Forest.

Mostly cattle grazed the Tonto, although some sheep, goats, and hogs have used the rangelands in addition to native ungulates. A harsh drought in 1904, followed by new supervision by the Forest Service in 1905, reduced the number of cattle by 80 to 90 percent to 150,000 to 200,000 head. Cattle numbers have continued to be reduced; approximately 25,000 cattle were permitted in 2013. Current levels of grazing are discussed below.

Many of the early accounts of the vegetative communities indicate early overgrazing substantially altered the composition of the plant communities now present. According to interviews and early diaries documented by Fred Croxen, in 1926, tall grass grew abundantly, and riparian areas were vegetated with woody species and maintained by beaver (Croxen 1926). There was little mention of gullying or erosion. Trees and woody shrubs were cut down with hopes of producing additional forage. Some areas have since recovered, while other areas were permanently altered due to soil loss. See the Riparian Areas section for more details.

In addition to overgrazing, climate has played a key role in the rangeland conditions on the Tonto National Forest. The University of Arizona described climactic trends in Arizona from 1895 to 2002. According to their study of existing recorded data, there were drought periods from the late 1890s to early 1900s, 1947 to 1976, and 1998 to present (McPhee et al. 2004). Wet periods were from 1925 to 1946 and 1977 to 1995. All of this appears to be tied into the Pacific decadal oscillation related to ocean surface temperatures. There is additional aridity in the Southwest due to the ongoing regional warming trend (Gutzler and Robbins 2010, Seager et al. 2007). Though there is agreement in temperature forecasts, there is uncertainty as to how that might affect precipitation in Arizona (Sprinkle 2014). When rainfall decreases, or when there is increased aridity due to warmer temperatures, some species go dormant or die off completely. Forage production and vegetation diversity is reduced.

[60] More information can be found in the Final Assessment Report of Ecological Conditions, Trends, and Risks to Sustainability (USFS 2017), Volume 1 which is incorporated by reference https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd598269.pdf.

Current Rangeland Management

The Forest Service uses a permit[61] system to administer grazing of National Forest System lands. Rangelands are divided up into logical grazing units called allotments.

Allotments

Allotment boundaries often follow topographical features such as ridgelines or creeks and may or may not be fenced entirely. Nearly the entire Tonto National Forest is within a grazing allotment with a few exceptions near Roosevelt Lake and the City of Payson. Currently, the Tonto is divided into 106 cattle allotments and one sheep driveway. The Heber-Reno sheep driveway starts on the Sitgreaves National Forest near Heber, Arizona and crosses the Tonto to allow sheep to be trailed to winter grazing areas near Mesa, Arizona. The Apache-Sitgreaves National Forest administers the driveway permit, which has seen reduced use in recent years. The cattle allotments range in size from 600 to 188,000 acres.

Permits

Grazing permit holders, or permittees, own the livestock and additional private “base” property and graze the same allotment year to year. The permits are held by individuals, families, corporations, and other legal entities established by state law. Most allotments on the Tonto National Forest have only one permittee each, although a few have more than one permittee sharing the same allotment. Allotments are further subdivided into pastures, and most allotments (except for very small allotments) follow some kind of rotational grazing system where cattle are moved through different pastures as the year progresses. Because central Arizona typically receives very little snow, livestock are able to graze on National Forest System lands year-round, unlike most other national forests where deep snow inhibits year-round grazing. Allotment and pasture boundaries can be changed administratively as needed. Many allotments have been merged or combined over the years, while other pastures have been split or exchanged between allotments.

There are currently 85 term grazing permit-holders. This number varies as permits are waived and reissued. Several of the permittees hold more than one grazing permit and run multiple herds or use one allotment for part of the year and move to another allotment later.

The types of livestock operations permitted on the forest are primarily cow-calf ranches, operations where a permanent herd of mother cows and bulls are kept by a rancher to produce calves for later sale. Some permits have yearling carryover (meaning additional forage is authorized once a calf has reached six months old but has not been sold yet) and/or yearling stocker options (when additional forage is available, the rancher may purchase additional young cattle to graze and grow. Some permits also include ranch horses or mules. As with most cattle operations in the west, Tonto National Forest ranch operations have operated since the late 1800s. All grazing permits are tied to a privately owned “base property,” which the Tonto National Forest has defined as at least ten acres of land with livestock handling facilities. Most permittees are dependent entirely on Federal grazing permits due to the scarcity of private lands in Arizona.

Allotment Management and Stocking

Ninety-seven of the 106 allotments are active, meaning they have a permit issued to a permittee. Eight allotments are vacant (the permit was waived back to the Tonto National Forest without preference, and a

[61] A grazing permit is an authorization to occupy and use National Forest System lands, given specific terms and conditions. This permit permits occupancy, not forage purchased. Occupancy is contingent upon compliance with the terms and conditions of the grazing permit. Permit administration is an on-going activity that is outside of the scope of plan revision, consistent with various federal laws and Forest Service regulations at 36 CFR Part 222.

new permit has not been issued). One allotment was formally retired from grazing and listed as closed in the current forest plan. Some active allotments have entire pastures or areas that are not authorized for use for various reasons, ranging from fire or drought to protecting endangered species. Other permits are authorized to stock fewer numbers than permitted (called non-use) for either permittee personal convenience or for resource benefit (e.g., drought preparedness or fire recovery) but are still permitted for grazing the entire allotment at reduced numbers allowed by the allotment management plan.

In some years, full permitted numbers are authorized, and other years reduced numbers are authorized to respond to changed conditions such as drought or fire. Meetings occur each year where annual operating instructions are developed to implement the next year's grazing system. The forest uses adaptive management to adjust livestock numbers, class (cow/calf, yearling, bull, dry cow), pasture timing, and grazing intensity to respond to changing environmental or social and economic needs.

Allotment Management Plan and Annual Operating Instructions

Allotment management is guided by a document called an Allotment Management Plan (AMP). The AMP is developed through a site-specific NEPA process. Ranchers apply for and may be issued term grazing permits. Grazing permits incorporate the AMP and may also include additional allotment-specific terms. Both the issuance of the permit and the development or amendment of an AMP that becomes a part of the permit is considered an administrative action that implements the NEPA-based decision (FSH 2209.13, chapter 90, section 94). Permanent grazing management modifications are authorized through the term grazing permit.

Each year, the district ranger sends each permittee Annual Operating Instructions (AOI) to implement the AMP and permit. Annual operating instructions allow for temporary adjustments while implementing the terms and conditions of a term grazing permit. Annual operating instructions do not constitute a permit modification and are not an appealable decision (36 CFR 214.4). Allotment grazing management modifications may be made through the AMP, term grazing permits, and/or annual operating instructions, all of which are done at the site-specific level and outside the scope of a forest plan.

Adaptive Management and Monitoring

The Tonto uses adaptive management to manage the rangeland resources. In general, the Tonto provides for sustainable and productive rangelands by managing grazing at conservative use levels. This grazing intensity (based on percent use of forage by weight at the end of the growing season) should provide for plant integrity, density, diversity, and sustainability and regeneration over time (Holechek and Galt 2000; Holechek et al 2011; Heady 1994). New or revised allotment management plans typically include new or modified fences, corrals, salt locations, and artificial water sources designed to make progress towards the desired conditions in the plan to promote healthy soil, watershed and riparian conditions, and consider wildlife interactions and wildlife movement.

Within the scope of the site-specific NEPA allotment grazing decisions, adjustments are made annually through the annual operating instructions to respond to changing conditions and move toward desired conditions. Authorized number of livestock, pasture season of use and timing, salt locations, and pasture rest periods may be adjusted as needed through the annual operating instructions.

The forest uses information from monitoring (known as Reading the Range[62]) such as frequency plots, canopy cover, pace frequency transects, photo points, and allotment inspections to inform appropriate adjustments. Other factors such as weather patterns, likelihood of plant regrowth, and previous years' utilization levels are also considered in annual operating instructions development. The forest has over fifteen years of data under Reading the Range and has an agreement to collect data each year with University of Arizona. Reading the Range data is incorporated by reference in this analysis.

If repeat monitoring indicates annual adjustments are not achieving the desired effects, further adjustments may be made to the allotment management plan or term grazing permit. Permitted number of livestock as well as grazing intensity may be adjusted up or down according to the grazing decision to move towards desired conditions.

Environmental Effects[63]

Effects Common to All Action Alternatives

Under all action alternatives, the forest would use the desired conditions and other plan components common to the action alternatives to balance grazing with other resources. Improved range condition reflected in desired conditions would increase ecological resiliency and function by restoring proper structure and function through rangeland restoration, thereby improving soil stability and condition, hydrologic function, and biotic communities.

There are multiple mechanisms to effectively maintain and make progress toward desired conditions in existing law, regulation, and policy. Livestock grazing can be used to manage rangelands by harvesting forage to produce livestock, changing plant composition, or reducing fuel loads. Using an adaptive management approach, management would be adjusted in response to fluctuations in available forage and changed conditions due to weather and other resource drivers and stressors. Stocking decisions regarding the amount of livestock grazing authorized for each grazing allotment are considered as part of the project-level National Environmental Policy Act analysis and is beyond the scope of this programmatic analysis for the forest plan. Project-level analysis would cover changes to authorized grazing through term grazing permits (subject to forestwide standards and guidelines), allotment management plans, and annual operating instructions.

When monitoring does not indicate progress toward desired future conditions, adjustments would be made through permit administration to manage toward the desired conditions and align with the sustainability requirement of the planning rule.

[62] The Reading the Range program is consistent with FSH 2209.13, chapters 20 and 30, and Southwestern Region's FSH 2209.13, chapter 40. The R3 supplement to 2209.13 Ch 90 states "Procedures for rangeland assessment and monitoring are not limited to procedures in the current edition of the Rangeland Analysis and Management Training Guide. Other sources of information related to appropriate procedures for rangeland assessments and monitoring for application with the Southwestern Region include the following sources, which are hereby incorporated by reference for use within the Southwestern Region." Number seven in the listed items is the CNVSP Field Guide (USDA Forest Service Southwestern Region Fire and Range Common Non-Forested Vegetation Sampling Protocol (CNVSP) Field Guide, November 2013). Reading the Range is essentially the "Common Non-Forested Vegetation Sampling Protocol (CNVSP)," which is commonly used for rangeland assessment in the southwestern United States. Reading the Range, as administered by University of Arizona, typically omits the fuels-related indicators and only collects the range-related metrics of CNVSP.

[63] Information on assumptions and methods used for this analysis can be found in volume 4 of the environmental impact statement, appendix B.

Eligible Wild and Scenic Rivers

Domestic livestock grazing would be managed to protect identified Outstanding Remarkable Values (ORVs) for river segments. Existing structures may be maintained. New facilities may be developed to facilitate livestock management so long as they maintain the ORVs for which a river was found eligible or suitable. The additional eligible segments are not expected to change currently permitted livestock activities in those areas. Some new facilities may require additional design criteria (type of materials, colors, screening) to maintain the ORVs.

Designated Wild and Scenic Rivers

Grazing is currently not authorized in the designated Wild and Scenic portions of Fossil Creek or Verde River, but the river plans allow for authorizing grazing. Livestock grazing and constructed range improvements within the river corridor, if authorized, would not impact the river segment's outstandingly remarkable values and would be consistent with the river segment's classification.

Designated Wilderness and Inventoried Roadless Areas

Designated wilderness would be managed according to current plan direction and would continue to allow grazing and construction and maintenance of range improvements following the Congressional Grazing Guidelines in the Wilderness Act. Designated wilderness does not affect livestock grazing.

Inventoried roadless areas allow for grazing to occur and livestock improvements may be installed and maintained within the process and constraints outlined for IRAs. Inventoried roadless area designation does not affect livestock grazing.

Existing Research Natural Areas

Grazing is currently not authorized in existing research natural areas. This management direction would remain in place under all alternatives, so there would be no difference in effects.

Apache Leap Special Management Area

Grazing is currently not authorized in the Apache Leap Special Management Area. This management direction would remain in place under all alternatives, so there would be no difference in effects. This area has only been grazed incidentally in the past due to topography. It is closed to grazing but has no effect to permitted livestock grazing due to the terrain and vegetative composition.

Alternative A Effects

Alternative A continues current management direction to balance livestock numbers with forage capacity. Under alternative A, there are no specific plan components for vegetation management forestwide. Due to this, there would most likely be no change in livestock management from current management practices. Because alternative A lacks emphasis on restoration, the range condition would be expected to continue to decline gradually through increasing tree encroachment of grasslands and increasing woody species canopy cover. Rangelands under alternative A would also continue to have altered fire return intervals and uncharacteristic fire intensities when fire does occur. Effects are summarized below.

- Existing grazing permits would continue to be reissued. Grazing levels would remain similar to current levels. There would be no immediate effect to ranchers, although over time if rangelands lose productivity, permitted numbers would be reduced.
- Proposed research natural areas would continue to restrict grazing in these areas. Grazing is not currently occurring in the areas so there would be no effect to permitted livestock grazing.

- Updated plan direction for other resource areas is similar to current plan direction or requirements found in site-specific allotment management and is not expected to change livestock management significantly.
- The Salt River Horse Management Area is not included in alternative A. The Salt River Horses are still on the landscape, but the current forest plan is silent on their management. The lack of plan components to provide guidance for the Salt River Horses means they lack needed management direction for natural and recreation related resources. There are currently no active livestock grazing pastures where the Salt River Horses occur. More information can be found in the Management Areas section of volume 2.

Alternative B Effects

Alternative B emphasizes adaptive management to balance livestock numbers with resource conditions. As allotments become vacant, they will be evaluated for conversion to forage reserve, closure, or grant to a current or new permittee (GRZ-O-02). Effects to grazing levels would remain similar to current levels; some changes could occur, as vacant allotments are permitted or closed, and some specific instances of livestock reductions may occur due to an increased emphasis on riparian health. Overall rangeland health should improve at the second fastest, but alternative C may provide for more rapid improvement as more livestock would be removed.

Effects to livestock grazing management are expected from the following resource areas:

Watersheds and Water Resources:

- Desired conditions for Watersheds and Water Resources support multiple uses including grazing. Current and future range management is expected to continue the stable to upward trend of watersheds related to livestock grazing. Guidelines concerning developing groundwater to support livestock needs should provide adequate water and help disperse livestock across uplands, improving overall rangeland conditions.

Riparian Areas and Riparian Management Zones:

- Increased plan direction for managing grazing in riparian areas should result in progress toward the vegetation desired conditions. Plan direction related to woody and herbaceous species is within the range commonly selected for site-specific allotment planning and should not increase or decrease currently permitted grazing levels across the Forest. "Livestock grazing does not impact the long-term health of riparian vegetation. Vigor and diversity maintains or moves riparian vegetation as represented by Terrestrial Ecological Unit Inventory site potential and other suitable references to low departure from desired conditions for riparian vegetation types" (RMZ-DC-04) and "In riparian management zones, projects and management activities should be designed and implemented to maintain or restore long-term natural streambank stability, native vegetation, floodplain, and soil function" (RMZ-G-03). Restrictions designed to maintain or restore riparian areas could result in changes to pasture use schedules, shorten duration of use, and reduce grazing intensity in some areas. These restrictions would have the potential to reduce currently permitted livestock numbers, but reductions may be mitigated by developing infrastructure (new water sources, fences) to use currently unused rangelands and spreading use outside focused riparian areas.

Vegetation and Wildland Fire:

- Plan components related to each ecological response unit would improve vegetative conditions, increasing the amount of forage available for livestock and other herbivores. Treating areas with fire also has the potential to increase forage following recovery, but wildland fire may destroy critical range infrastructure such as fences and water pipelines. Replacing infrastructure destroyed by fire can be expensive, and in some instances, pastures may not be usable until the infrastructure has been replaced.

Updated Plan Direction for Other Resource Areas

Plan direction for other resource areas is similar to direction in the existing forest plan or requirements found in site-specific allotment management and is not expected to change livestock management significantly. Plan direction for specific management areas may change permitted livestock grazing.

Lakes and Rivers Management Area:

- The Lakes and Rivers Management Area would restrict grazing within the management area where existing infrastructure or natural boundaries do not prevent livestock from accessing the rivers and lakes (LRMA-G-05). The Lakes and Rivers Management Area would not affect any currently open active allotments. Portions of five currently vacant allotments (Sears Club-Chalk Mountain, St. Clair, Bartlett, Superstition, and Reavis) would not be authorized for grazing unless the restriction above can be met. The allotments with the most potential to be impacted are along the Verde River. Without access to water, new waters might have to be developed to support livestock grazing. Currently rotations that cross the river would be prohibited unless specifically authorized in future National Environmental Policy Act analysis, which reduce management options (LRMA-G-06).

Recommended Wilderness Areas:

- Recommended wilderness areas would be managed similar to current plan direction for designated wilderness and would continue to allow grazing and needed construction and maintenance of range improvements.

Proposed Research Natural Areas and Botanical Areas:

- Proposed research natural areas and botanical areas would restrict grazing in these areas similar to already designated research natural areas. The two proposed botanical areas are in locations already excluded from grazing or are in areas with little forage potential. The management of these areas would have little to no effects on grazing. Many of the proposed research natural areas are similar to the areas in alternative A and grazing has already been excluded from those areas.

Salt River Horse Management Area:

- The Salt River Horse Management Area is common to all action alternatives (alternative B, C, and D). The plan components for this management area allow a deviation in the management of ecological response units from forestwide management and restricts livestock grazing. This area is not currently being grazed but has the potential to impact future livestock grazing within the Salt River Horse management area. It has no effect to current AUMs. More information can be found in the management areas section of volume 2.

Alternative C Effects

Under alternative C, currently vacant open allotments would be closed. As additional allotments become vacant, they would be evaluated for conversion to forage reserve, closure, or permitted to a current or new permittee.

Future authorized grazing levels would be reduced as vacant allotments are closed. Additional restrictions on riparian areas may necessitate additional reductions in grazing use levels. Overall rangeland health should improve fastest of the four alternatives due to closure of vacant allotments. Alternative C would cause the most ranchers to potentially reduce their herds or go out of business.

Updated plan direction for other resource areas is similar to current plan direction or requirements found in site-specific allotment management and is not expected to change livestock management significantly.

Additional effects to livestock grazing management are expected from the following resource areas:

Riparian Areas and Riparian Management Zones:

- Riparian areas identified as nonfunctional would be restricted from all uses, regardless of cause, until recovery is achieved. Entire pastures or whole allotments may be required to be rested from grazing to comply with new riparian restrictions. Depending on individual circumstances including geography and existing infrastructure, these restrictions could require reductions or in some instances complete removal of livestock from identified areas, reducing authorized AUMs and potentially causing some ranches to go out of business. It may be possible to exclude livestock from smaller riparian zones using fencing or other strategies rather than excluding livestock from large areas in some instances. In these cases, the effect to livestock numbers, timing, and rotation would be minimal.

Vegetation and Wildland Fire:

- An emphasis on using fire to treat vegetative communities could increase available forage to livestock and other herbivores but would be expected to produce a smaller increase than alternative B due to only using fire without mechanical methods[64]. Fire may also destroy critical range infrastructure such as fences and water pipelines. Replacing infrastructure destroyed by fire can be expensive, and in some instances, pastures may not be able to be used again until the infrastructure has been replaced, reducing authorized animal unit months.

Recommended Wilderness Areas:

- Although the acres of recommended wilderness would increase over alternatives A, B, and D, they would still be managed similar to current plan direction and would continue to allow grazing and construction and maintenance of range improvements, having little effect to grazing permit holders.

Wildlife:

- As allotments are closed, maintenance of range improvements would stop. Improvements would either be removed or decommissioned. Removal of or stopping maintenance of improvements, such as water developments that wildlife have become accustomed to, may result in less wildlife in specific areas.

Proposed Research Natural Areas and Botanical Areas:

- Proposed research natural areas and botanical areas would restrict grazing in these areas similar to already designated Research Natural Areas. The two proposed botanical areas are in locations already excluded from grazing or are in areas with little forage potential. The management of these areas will have little to no effects on grazing. Many of the proposed research natural areas are similar to the areas in alternative A and grazing has already been excluded from those areas.

[64] More information can be found in the Ecological Response Unit section.

Lakes and Rivers Management Area:

- There would be no Lakes and Rivers Management Area, so there would be no additional grazing restrictions in that corridor.

Salt River Horse Management Area:

The Salt River Horse Management Area is common to all action alternatives (alternative B, C, and D). The plan components for this management area allow a deviation in the management of ecological response units from forestwide management and restricts livestock grazing. This area is not currently being grazed but has the potential to impact future livestock grazing within the Salt River Horse management area. It has no effect to current AUMs. More information can be found in the Management Areas section of volume 2.

Alternative D Effects

Under alternative D, all vacant allotments would be granted to new or current permittees. This would increase the levels of permitted grazing on every ranger district. In addition, if an allotment becomes vacant in the future, the district would work to grant it and maintain current grazing levels. Permitted grazing levels may increase slightly over currently authorized levels as open vacant allotments are granted to new permittees. Some areas previously not grazed, such as Three Bar, could be authorized for grazing. Overall rangeland health would improve by achieving new desired conditions, but improvement would be slower than alternative B and C.

Updated plan direction for other resource areas is similar to current plan direction or requirements found in site-specific allotment management and is not expected to change livestock management significantly.

Additional effects to livestock grazing management are expected from the following resource areas:

Riparian Areas and Riparian Management Zones:

- An increased focus on improving riparian conditions will improve the rangeland resource, but slower than alternative B or alternative C. Restrictions designed to maintain riparian areas may change pasture use schedules, shorten duration, and reduce grazing intensity in some areas. However, these restrictions would be expected to have less impact on livestock grazing management than alternative B or alternative C. These restrictions would have the potential to decrease currently permitted livestock numbers, but it may be possible to mitigate any reductions in permitted livestock by developing infrastructure (new water sources, fences) to use currently unused rangelands and spreading use outside focused riparian areas.

Vegetation and Wildland Fire:

- Effects would be similar to alternative B but may increase available forage for livestock and other herbivores with additional mechanical restoration emphasis[65].

Lakes and Rivers Management Area:

- The Lakes and Rivers Management Area would restrict grazing within the management area where existing infrastructure or natural boundaries do not prevent livestock from accessing the rivers and lakes (LRMA-G-05). The Lakes and Rivers Management Area would not affect any currently open active allotments. Portions of 5 currently vacant allotments (Sears Club-Chalk Mountain, St. Clair, Bartlett, Superstition, and Reavis) would not be authorized for grazing unless the restriction above

[65] More information can be found in the Ecological Response Unit section.

can be met. The allotment with the most potential to be impacted are along the Verde River. By removing access to water, in order to reissue the permit, new water might have to be developed to support livestock grazing. Also, rotations that cross the river would be prohibited unless specifically authorized in future National Environmental Policy Act analysis, reducing management options (LRMA-G-06).

Proposed Research Natural Areas and Botanical Areas:

- Proposed research natural areas and botanical areas are not proposed in alternative D. Grazing could be permitted in areas where it is currently not authorized such as Three Bar, increasing the levels of permitted grazing.

Salt River Horse Management Area:

- The Salt River Horse Management Area is common to all action alternatives (alternative B, C, and D). The plan components for this management area allow a deviation in the management of ecological response units from forestwide management and restricts livestock grazing. This area is not currently being grazed but has the potential to impact future livestock grazing within the Salt River Horse management area. It has no effect to current AUMs. More information can be found in the Management Areas section of volume 2.

Cumulative Effects

The area for this level of analysis includes adjacent national forests, Bureau of Land Management, State, Tribal, and private land. It is reasonably foreseeable that livestock grazing would continue on these lands. The time boundary for this analysis is the expected duration of the revised forest plan, 10 to 15 years.

Fires from adjacent lands can escape and spread onto the Tonto National Forest. If they do, it could lead to temporary grazing exclusions and impact ranching operations by requiring the permittee to find new forage or remove all or part of the livestock.

Much of the adjacent lands accessible to grazing livestock are fenced or are subject to agreements that facilitate cross-boundary grazing. It is possible for unauthorized livestock (cattle, horses, sheep, and goats) to enter the Tonto National Forest, either through damaged fences, open gates, or unfenced boundaries. Any effect to Tonto rangelands would likely be minimal as unauthorized livestock should be removed promptly after identifying them.[66]

Ongoing and Reasonably Foreseeable Actions

In terms of reasonably foreseeable future actions, this analysis has attempted to include, specific to rangeland resources, projects for which upcoming actions are known and can be meaningfully analyzed. What will not be analyzed are projects that are inevitable and known, but which have not yet developed proposed actions.

It is likely that grazing will continue throughout the area. It is also reasonable to assume that there will be vegetative manipulations such as burning, prescribed cutting, and brush removal that will likely increase available livestock forage, and grazing opportunities for the local communities surrounding the Forest. It is also reasonable to assume that some amount of woody encroachment will also continue throughout the analysis area.

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[66] For additional cumulative environmental consequences, see the Socioeconomics section of this environmental impact statement.

Because of its negative impacts to herbaceous plant production, woody plant encroachment can be considered a threat to livestock production (Sholes and Archer 1997). If we work with our partners across boundaries to design and perform restoration treatments, more of the Forest and adjacent lands could be changed into a more open canopy condition, returning fire to a more natural regime, and increasing the quality and quantity of forage.

Cultural and Historic Resources

Heritage (or cultural) resources represent the tangible and intangible evidence of human behavior and past human occupation. These resources may consist of archaeological sites, historic-age buildings and structures, and traditional use areas and cultural places important to a group's traditional beliefs, religion, or cultural practices. These types of resources are finite and nonrenewable with few exceptions.

Affected Environment

The Tonto National Forest contains heritage resources (i.e., pit houses, cliff dwellings, masonry structures, quarries, rock art, farmsteads, ranches, administrative and recreation sites, and culturally modified trees[67]) that document almost continuous human presence for at least the past 12,000 years. American Indians ancestral to the contemporary Apache, Hopi, O'odham, Yavapai and Zuni have inhabited or used forest resources over much of that time. Europeans began to occupy the area over 400 years ago, and many of the historic sites reflect the use and occupation by Apache and Yavapai hunters, gatherers, and farmers; Anglo ranchers, stockmen, miners and prospectors; Basque and other Iberian and Latin American sheepherders; and the current land-managing agency, the USDA Forest Service. The heritage program of the Tonto National Forest is responsible for the management of cultural resources for the benefit of the public through preservation, public use, interpretation, and research. One of the program's many functions is to provide a variety of interpretive activity to stimulate and sustain visitor interest.

Even if archeological sites are protected from damage and removal, they are not terribly resilient to a decline of their condition. Archaeological sites containing architectural elements (i.e., pueblos, cliff dwellings, and historic sites), because they tend to include building materials that are susceptible to fire and decomposition, are much less stable and resilient without periodic maintenance. Historic sites are especially susceptible because they are found in all geographical locations, resulting in varying degrees of preservation.

The decision resulting in the final plan direction will affect heritage resources, but the degree and scope of this effect is contingent upon which alternative is selected. If alternative A is selected, overall management of heritage resources will not change. The 1985 forest plan does not mention heritage resources at all. An amendment to the plan in 1990 touches on the minimal requirements for cultural resource management on the Tonto National Forest. However, the current plan is difficult to understand and leaves cultural resource management and Forest compliance with Federal historic preservation laws and regulations open to interpretation. This can lead to disagreement between the line officer and the professional archeologist. If an action alternative (alternatives B, C and D) is selected, the overall management of heritage resources would change, subject to which alternative is selected in the final decision. Any of these alternatives would fix the ambiguity of the current forest plan by clearly stating the desired conditions for cultural resources, and articulating objectives, standards, guidelines, and management approaches that clarify the Forest's compliance with heritage preservation laws and regulations.

Archaeological Site Types

Heritage resources on the forest indicates a long and enduring human presence beginning in the Late Paleoindian (9500 to 6500 B.C.) period and up through the mid-20th century. Prehistoric sites on the Forest include such well-known examples as Sears-Kay Ruin and the Perry Mesa Archeological District

[67] This term describes the modification of living trees by indigenous people as part of their cultural and tradition. Modifications can include carvings or paintings but are more often traces of usage left by humans during the extraction of resources.

on Cave Creek Ranger District and the Shoofly Village Ruin near Payson. Known historic sites located on the Forest include the Apache Trail on the Mesa and Tonto Basin Ranger Districts and Pinal City and Cemetery near Superior. Most of the lands on the Tonto National Forest has not been surveyed for cultural resources; as of August 2017, it is estimated that only 8 percent (229,070 acres) of the forest has been surveyed. At the same time, the Tonto National Forest has roughly 12,000 recorded cultural resources within its forest boundaries. It is estimated that as many as 60,000 heritage resources are yet to be identified within the forest boundaries. The Tonto National Forest currently has 52 sites listed on the National Register of Historic Places (National Register), with 2,291 more sites that have been evaluated as eligible for listing. A total of 347 sites have been assessed as not eligible for the National Register, while the remaining 9,206 sites have not been formally evaluated against National Register significance criteria (36 CFR 60.4). There are 12 defined primary prehistoric site types[68] (table 28) and several historic site types associated with 11 categories of historic activities (table 29). It is anticipated that, as more of the Tonto National Forest is surveyed for cultural resources, the number known cultural resources will increase. While some cultural resources may be lost to project mitigation, the general trend will be that there will be more identified sites available for interpretation and heritage tourism over time.

Table 28. Archaeological prehistoric site types

Type	Description
Artifact Scatters	Artifact scatters can contain lithic artifacts, ceramic artifacts, or both. These scatters can be the result of activities at resource procurement sites, habitation sites with either ephemeral or buried structures, or by the reuse of sites by individuals with different artifact types at their disposal.
Petroglyphs and Pictographs	These are human-created images that are found on rock faces, often on rock outcroppings or in rock shelters. Petroglyphs are images pecked, incised, or carved into the rock's surface, while pictographs are painted images.
Agricultural Fields and Features	These include canals, check dams, grids, and terraces designed to control the flow of water and/or facilitate the retention of soil moisture for agriculture. These sites may or may not be associated with permanent or semi-permanent habitation sites or fields.
Shrines	Shrines are usually small circular or rectangular structures, often occurring at high elevation. Artifacts, such as beads or ceramics, are sometimes associated with these features.
Rock Shelters and Caves	Rock shelters and caves are naturally occurring cavities or overhangs in rock formations that were used by people primarily for habitation or burial. Many rock shelters or caves were used by groups or individuals of several cultural periods and have multiple, successive layers of occupation. These sites are a primary source of perishable artifacts such as basketry and textiles normally absent from open air sites.
Pithouse Sites	Pithouse sites are habitation sites that predominantly date prior to A.D. 1000 and may consist of a single pithouse structure or multiple pithouses organized as a village. These sites range in size, depth, and construction, but they are all structures dug into the ground with a superstructure of wood branches and/or beams and dirt or adobe walls.
Pueblo Sites	Pueblo sites are habitation sites constructed of above ground masonry that dominate the settlement system after A.D. 1000. Three different types of sites are categorized under the label 'pueblo': field houses commonly evidenced as a boulder pile over a small area; U-shaped structures with one or two rooms; and pueblos (room blocks) with four walls consisting of two or more rooms.
Cliff Dwellings	Cliff dwellings are habitation sites that are constructed in naturally occurring niches and caves in high cliffs of above ground masonry. Most of the examples on the Forest were constructed between 1250 and 1400 AD. Like other sites found in rock shelters and caves, these sites are a primary source of perishable artifacts such as basketry and textiles.
Great Kivas	Great kivas are large circular ceremonial structures commonly evidenced on the surface as a circular depression. Kiva sites may contain this feature type singularly or can be associated with a larger pueblo or pithouse village site.

[68] Plog 1981a, 1981b

Type	Description
Ballcourts	A ballcourt is an oval, bowl-shaped depression in the ground that can greatly vary in size. They are constructed by excavating the interior of the oval and piling the dirt up in a berm around the perimeter, providing a sloping wall up to nine feet in height. They were constructed and used over a 500-year period from about AD 750 to 1200, roughly corresponding to the Colonial and Sedentary periods (Hohokam).
Compounds	Compounds are walled enclosures measuring up to $100m^2$. The function of these sites is unclear, but they often have a very different artifact assemblage from neighboring sites.
Defensive Sites	Defensive sites are characterized by defensive walls and locations with restricted access such as a hilltop.

Table 29. Historic activities and possible site types

Historic Period Activity or Context	Site Types	Site Types	Site Types
Protohistoric occupation (Apache, Yavapai)	Temporary camps Fields	Ramadas/shades Sweat lodges	Storage pits Processing pits
Military	Forts Camps	Trails Battlefields	Blazed trees Way stations
Settlements	Houses Outhouses Barns	Graveyards Corrals Public buildings	Trading posts Dumps
Farming	Homesteads Outbuildings	Fields Irrigation	Fencelines
Shepherding	Sheep crossings Temporary camps	Sheep dipping vats Sweat houses	Water troughs
Mining	Camps Towns	Shafts Adits	Mills Processing Locations
Ranching	Ranch houses Barns Corrals	Outhouses Temporary camps Line shacks	Fencelines
Transportation/Utility Corridors	Roads Power Lines	Telephone Trees	Trails
Lumbering (Timber Harvesting/Logging)	Camps Landings	Railroad beds	Sawmills
Water Reclamation	Dams	Construction Camps	Reservoirs
Forest Service and Civilian Conservation Corps (CCC)	Cabins Fire towers	Campgrounds Ranger stations	Camps Recreation Areas

Heritage Tourism

The National Trust for Historic Preservation defines heritage tourism as "traveling to experience the places, artifacts, and activities that authentically represent the stories and people of the past and present, and typically includes interest in and visitation to cultural, historic, and natural resources"[69]. While exposure to different histories, cultures, and traditions has historically been a primary motivation of travelers, the term 'heritage tourism' or 'cultural heritage tourism' was not formally coined and defined until the mid-1990s. Since then, research has found that popular interest in cultural heritage tourism has steadily increased. This trend was recently reaffirmed in 2018 by the World Tourism Organization

[69] Unknown Author. "Heritage Tourism" found at the Advisory Council on Historic Preservation webpage, https://www.achp.gov/heritage_tourism#:~:text=The%20National%20Trust%20for%20Historic,in%20cultural%20and%2For%20heritage. Retrieved 1 November 2023.

(UNWTO) "as a major element of international tourism consumption, accounting for over 39 percent of tourism arrivals" (Richards 2018:13). It is anticipated that, as populations age and live longer, the positive trend for this type of visitor experience will continue to increase.

Simultaneous to the tourism trends happening external to the Forest Service, heritage professionals within the agency were beginning to note an increase in the public's interest to historical and cultural sites located on the lands they helped manage. One of the earliest Forest Service earliest attempts to harness this interest was the Passport in Time (PIT) program.

The formal idea for the program came from the Ontario Archaeological Society's "Passport to the Past" program. After the first successful year, Mike Beckes, then archaeologist for the Eastern Region of the Forest Service, convinced Forest Service leaders in Washington, D.C., that Passport in Time played a valuable role for heritage and the agency. Passport in Time officially became a national program in 1991 and is still ongoing.

At about the same time, the Washington Office of the USDA Forest Service began to have internal discussions regarding the identification of a national strategy for heritage. These discussions resulted in the 1992 Heritage Strategy, a directive that emphasized the protection of cultural resources within the context of forest planning and implementation. This strategy attempted to move the heritage program more firmly into the arena of site enhancement and public outreach, but was primarily non-site specific, owning to a lack of funding for development and interpretation. The 1986 General Management Review of the Southwestern Region identified as an issue the need for further development of cultural resource interpretation; however, "very few managers have given much thought to public interpretation opportunities…" and "[f]orest plans give little attention to the interpretive aspects of cultural resources" (National Forest Management Act Section 219.24).

It is within this environment that the Tonto National Forest Cultural Resources Assessment Management Plan and Overview (management plan) was prepared in 1989. The primary goals of the Forest as identified in the management plan included the reorientation of its management direction to emphasize the protection and enhancement of resources values while managing all resources without imparting the productivity of the land and protecting non-renewable resources to ensure their future availability (USDA Forest Service, Cultural Resources Assessment Management Plan 1989). The management plan proposed to "coordinate and integrate cultural resources management activities with other resource management objectives and concerns, and to initiate a quality interpretive program that will enhance the recreational experience of Forest visitors and contribute to their appreciation of the area's cultural history" (USDA Forest Service 1989). An undated Region 3 Cultural Resources Interpretive Action Plan appended to the Cultural Resources Assessment Management Plan identified specific goals from FY1988 through FY1990, but it is unclear in the management plan whether additional steps were taken to accomplish the goals identified in the management plan.

Further discussions at the regional and Washington offices of the Forest Service continued throughout the mid to late 1990s. Out of these discussions came the 'Heritage – It's About Time' National Strategic Plan. This strategic plan built upon the 1992 heritage strategy, further articulating the role of the heritage program in achieving the overall mission and vision of the Forest Service. The plan sought to clarify and define the heritage program in terms of three key components: stewardship, public service, and a context for nature resource management[70]. A Southwestern Region News book dated December 1998 identified 'Heritage – It's About Time!" as the then Regional strategy for the eleven National Forests in the Region.

[70] USDA. "Heritage – It's About Time! A National Strategy" on Forest Service website https://www.fs.usda.gov/recreation/programs/heritage/heritage_strategy.shtml. Accessed October 1, 2018.

The National Strategic Plan was adopted agency-wide in 2001, and some action items were identified under each component of the plan to guide efforts for the next three to five years. Presumably this strategic plan is still in place.

The direction provided in the Cultural Resources Assessment Management Plan and Overview and the National Strategic Plans of 1992 and 2001 indicates that the Tonto National Forest should actively manage its cultural resources in order to provide visitors historic experiences and educational opportunities. Attempts by the Forest to provide such experiences during this time period were highly disorganized. Interpretive plans for the Shoofly Village Ruins (1991), Sears-Kay Ruins (1992), the Rye Creek Ruins (1995), and the Roosevelt Lake Visitor Center (1998) were completed, but only the plans for Shoofly Village, Sears-Kay Ruins, and the Roosevelt Visitor Center actually saw some level of implementation on the ground. Interpretative plans for other sites, such as the Pinal Townsite, Silver King Town and Mine Site, and Perry Mesa Archeological District were discussed internally by the Forest but were never seen to fruition. Still other attempts to provide heritage tourism opportunities do not appear to have been well planned; and their implementation was in reaction to external pressures on archeological sites and the need for site protection measures (i.e., fence stabilization and interpretive panel at Pinal Cemetery and the Rededication of Roosevelt Cemetery (history and brochure)). For all these efforts, only Sears-Kay Ruins and the Roosevelt Lake Visitor Center continue to provide the public services envisioned in their interpretative plan. Sears-Kay Ruin is currently maintained through the Adopt-a-Site program with the Forest's Friends group, and Roosevelt Lake Visitor Center is run in tandem with the Tonto Basin Ranger Station. Shoofly Village Ruins, while still retaining its interpretative qualities for the public, is now a day-use area with no facilities, bearing little resemblance to the vision identified in its 1991 plan.

Environmental Effects[71]

Environmental effects to heritage resources from the forest plan revision process fall into two categories, effects to the archaeological sites themselves and effects to the Forest's ability to provide opportunities for heritage tourism.

Consequences to Archeological Sites

When the current forest plan was approved in 1985, it did not articulate desired conditions for heritage resources. An amendment to the 1985 forest plan dated May 3, 1995, introduced cultural resource management into the Forest plan and recognized "heritage (cultural) resources as equal in importance to other multiple uses" (Decision Unit 3 (DU3), replacement page 38). This amendment also added general standards and guidelines for site-specific project management. If alternative A is chosen, the Forest would continue current practices under the amended 1985 plan. As written, the 1985 plan is difficult to understand and leaves cultural resource management and Forest compliance with Federal historic preservation laws and regulations open to interpretation. This ambiguity often leads to disagreement between the line officer and the professional archeologist. The 1985 plan as amended does not reflect 30 years of change in economic, social, and ecological conditions, new policies and priorities, and new information based on monitoring and scientific research. There would be no change in current Forest management, and the 1985 amended plan direction will not achieve the desired conditions identified in the Forest's Needs for Change statement.

Effects to archaeological sites under alternative A will not change from those happening currently in the Forest. Heritage resources would remain secondary in the consideration of other uses on the forest.

[71] All assumptions and methods used for this analysis can be found in volume 4 of the environmental impact statement, appendix B.

Without any specific direction on how to improve ecological integrity through current vegetation management practices, archaeological sites would continue to be impacted by cattle, mechanical treatments, erosion, and fire. The lack of sustainable recreation practices within the current plan can also affect archaeological resources. As developed recreation sites expand and motorized vehicle use continues, the more likely archeological sites are to be disturbed or destroyed.

The high density of National Register-eligible and listed archaeological sites on the Tonto invokes the participation of the heritage program in projects at almost every level, which often results in impacts to other programs' objectives and project implementation. Vegetation management and stream restoration efforts are often complicated by the need to protect and preserve archaeological sites, primarily due to these projects' propensity to be located by and associated with perennial waters. Grazing efforts are also affected by the presence of archeological sites, given the need to use springs for water and large meadows for feed. Both developed and dispersed recreation opportunities can be affected by the presence of archeological sites. Prescribed fire programs also have to address archeological resource protection, specifically for fire-sensitive sites such as petroglyphs and cliff dwellings. Planning for National Register compliance and appropriate site protections and mitigation is a factor to all work conducted on the Tonto.

Alternatives B, C, and D (action alternatives) expand upon the desired conditions identified in the 1995 amendment to the forest plan and identify standards and guidelines that the Forest will use to implement the proposed forest plan. All action alternatives provide clear direction and removes ambiguity. The three action alternatives being considered represent different methodologies that work towards five desired conditions specific to heritage resources:

- CUH–DC-01. Historic properties, including traditional cultural properties, retain all of the characteristics that qualify the property for listing in the National Register of Historic Places and convey its historical significance, including any aspects of the property's integrity (i.e., location, design, setting, materials, workmanship, feeling, or association) that have been identified as supporting its eligibility.
- CUH–DC-02. Historic properties are not threatened by human disturbances.
- CUH–DC-06. Buildings and infrastructure listed on or eligible for the National Register of Historic Places continue to preserve any of the characteristics that qualify the property for listing in the National Register of Historic Places (e.g., the property's location, design, setting, materials, workmanship, feeling, or association), while also fulfilling their roles as administrative and recreational facilities and other infrastructure functions.
- CUH–DC-07. Cultural resources (including artifacts) are preserved in place.
- CUH-DC-08. The Forest has been inventoried for cultural properties at a level that meets current professional standards.

The differences among alternatives B, C, and D do not lie in whether these desired conditions are achieved, rather they are the length of time in which these desired conditions are accomplished.

The standard identified in the proposed forest plan follow the intent of the current amended forest plan by ensuring compliance with the National Historic Protection Act; the proposed plan states that "historic properties will be managed in accordance with the National Historic Preservation Act and other applicable laws" (CUH-S-01.).

Guidelines within the proposed plan that are specific to the management of archeological sites include:

- CUH-G-01. Sites listed in, nominated to, or eligible for the National Register of Historic Places and American Indian sacred sites should be managed for avoidance or protection during undertakings, where practicable.
- CUH-G-02. When cultural resources cannot be preserved in place, artifacts and records should be curated following current professional standards.
- CUH-G-03. When human remains or other cultural items, as defined under the Native American Graves Protection and Repatriation Act, are encountered during cultural resource investigations, affiliated communities should be notified and appropriate actions taken.
- CUH-G-05. Forest activities (e.g., dispersed and developed recreation, road construction, and range improvements) should be managed to minimize adverse impacts (e.g., disturbance, damage, movement of, alterations, or removal) to cultural and historic resources, as directed by the National Historic Preservation Act as amended.
- CUH-G-06. When adverse effects to historic properties occur, known affected communities should be involved in the resolution of adverse effects.

Additionally, five management approaches have been identified in the proposed plan that pertain to the archaeological sites:

- CUH-MA-01 Collaborate with American Indian Tribes and other traditional[72] communities (e.g., descendants of Basque sheepherders, Chinese immigrant laborers, Latin American miners) to manage cultural and historic resources while conserving anonymity of such sites where appropriate, and to identify design elements for such properties.
- CUH-MA-02 Work with partners and volunteers (e.g., American Indian Tribes, Arizona Site Steward Program, Arizona Preservation Foundation, Arizona Archaeological Council, National Trust for Historic Preservation, National Park Service, Bureau of Indian Affairs, Bureau of Land Management, U.S. Fish and Wildlife, and local museums) to identify, study, protect, and monitor archaeological sites and artifact collections.
- CUH-MA-03 Prioritize baseline Heritage program work, and focus National Historic Preservation Act Section 110 survey considering the following: areas where eligible cultural resources are threatened or on-going impacts are unknown and need to be assessed; areas indicated to have high cultural value or high density of cultural resources; areas of importance to traditional communities; and areas where additional survey will contribute to a greater regional understanding of a specific area.
- CUH-MA-09 Consider incorporating repair or restoration actions as part of adjacent project-specific work or as part of annual Heritage program administration where human and/or natural caused disturbances (e.g., flooding) have damaged historic properties.
- CUH-MA-10. Consult with the Arizona State Historic Preservation Officer in the management of historic properties, using any applicable programmatic agreements.

Anticipated effects to archaeological sites under alternative B would be an increased likelihood of archaeological sites being disturbed through both mechanical treatments and burn over through an increased use of fire. Maintenance and improvement of riparian areas could improve archaeological site

[72] "Traditional" is used here in the manner described in National Register Bulletin 38: Guidelines for Evaluating and Documenting Traditional Cultural Properties, which states: "'Traditional' in this context refers to those beliefs, customs, and practices of a living community of people that have been passed down through the generations, usually orally or through practice."

preservation and protection, provided that these activities do not involve ground disturbance. Closing vacant allotments to grazing would reduce effects on archaeological sites by reducing both the number of cattle travelling across the landscape and the disturbing activities associated with constructing and maintaining improvements within those allotments. Right-sizing sustainable recreation opportunities would also lead to less on-the-ground impacts to archaeological sites. An increase in the number of trails and roads that may result from future travel management planning may increase impacts to archaeological sites through ground disturbance and increased visitor visibility. Reducing mineral material permits in riparian areas would also reduce disturbance, vandalism, erosion and other impacts to archaeological sites, since prehistoric sites tend to be identified in these areas.

Anticipated effects to archaeological sites under alternative C would be an increased likelihood of archaeological sites being burned over though the increased use of fire, which would be especially adverse for fire-sensitive sites. With the total closure of nonfunctional riparian areas from other uses, archaeological sites would see increased protection and preservation in situ. Closing range allotments as they become vacant would also limit further degradation of archeological sites caused by cattle within those allotments. developing nonmotorized and primitive recreation opportunities has the potential to either reduce or exacerbate ground disturbance and erosion on archaeological sites; the effects would be dependent upon the site-specific location of any proposed recreation activities. Removing mineral material permits in riparian areas would also reduce disturbance, vandalism, and erosion to archaeological sites, since both prehistoric and historic sites in a desert environment tend to be identified in these areas.

Anticipated effects to archaeological sites under alternative D would be the increased likelihood that archaeological sites would be disturbed by mechanical treatment. Maintaining riparian areas to current conditions would likely involve ground disturbance, which could result in increased disturbance to or destruction of archaeological sites. Continuing use of range allotments for cattle grazing would result in trampling archaeological sites and ground disturbance through constructing and maintaining improvements. Increasing recreation opportunities that favor motorized and accessible recreation would impact archaeological sites in two ways: a) through ground disturbance caused by construction projects, and b) through the increased access the general public would have to archaeological resources which tends to result in vandalism, ground disturbance, and erosional problems. Authorizing mineral material permits within riparian areas would also likely cause increased disturbance and destruction to archaeological resources, since these usual involve the use of heavy equipment in locations where archaeological sites are typically located.

All three action alternatives would have similar effects to other resources. Roughly 12,000 archaeological sites have been identified to date on the Forest. These sites are often found in the same locations where the drivers dictate the use of Forest resources. The need to protect and preserve archaeological sites should be viewed in the same light as stewardship efforts towards vegetation management, wildfire suppression, prescribed burning, and stream restoration efforts, specifically because all of these resources share proximity to each other due to their association with perennial rivers and springs. Rangeland management also sometimes conflicts with archeological sites, given the need by cattle to use springs for water and large meadows for feed. Both developed and dispersed recreation opportunities often share physical space with archeological sites or can be the impetus of the public's interest. Prescribed fire programs are required to commit to archeological resource protection, specifically for fire-sensitive sites such as petroglyphs and cliff dwellings.

Additional effects to archaeological resources and other resources would consist of increased site vulnerability to the general public, in the form of looting and site destruction. Only under alternative C would effects be notably reduced through decommissioning roads and trails and the proposed approximately 399,029 acres as recommended wilderness. While alternative B proposes approximately 43,204 acres of recommended wilderness, this designation would only affect those archaeological sites that are located within those areas, which would be less than in alternative C because of the acreage difference. Since no acreage for recommended wilderness is identified in alternatives A and D, it would be expected that there would be an increase of site vulnerability for these alternatives when compared to alternatives B and C.

Consequences to Heritage Tourism

Consequences to heritage tourism opportunities are dependent upon which of the alternatives are ultimately chosen. Under alternative A, the 1985 forest plan and Amendment 21 (dated May 3, 1995) states that interpretive opportunities for the heritage resources on the Forest “should be pursued as a high priority when opportunities arise”. Current implementation of this plan has resulted in a ‘catch as catch can’ situation, where resource needs are not always taken into consideration, and are contingent upon the judgement of the decisionmaker and as budgets allow. Several resources identified as potential candidates for heritage tourism opportunities were identified in the 1985 plan but were never implemented.

Potential effects to heritage tourism under alternative A would be no different than those already occurring on the Forest. Heritage tourism is not a Forest or heritage program priority, and the few opportunities that are being suggested are only proposed at the district level on an ad hoc basis. Without forestwide direction or guidance, heritage tourism opportunities on the Forest are completely dependent upon the availability of Forest resources and current public interest. Public interest is often inconsistent, can change not only by ranger district but by individual archaeological sites (based on past requests and the documentation associated with the Forest’s ability to meet those requests). The lack of sustainable recreation direction within the current plan also affects the Forest’s ability to construct and maintain heritage tourism opportunities long-term. Under this alternative, there is no direction for forestwide consistency or priority placed on heritage tourism, which has been shown to negatively impact this program across the forest.

The forest plan expands upon the desired conditions for heritage tourism identified in the 1995 amendment of the forest plan, and identifies standards and guidelines that the Forest will use to implement the proposed forest plan. The three action alternatives being considered represent different methodologies that work towards three desired conditions specific to heritage tourism:

- CUH-DC-03. Access and use of cultural resources important to living communities are available to those communities for cultural practices.
- CUH-DC-04. Heritage-based recreation opportunities are available (e.g., exploration and interpretation opportunities) and continue to provide an ecosystem service on the Tonto. The public has opportunities to learn about, appreciate, and understand cultural resources, as well as resources significant to living communities.
- CUH-DC-05. Heritage programs, interpretive presentations, publications, and interactive learning opportunities provide the scientific community and the public with opportunities to learn about, understand, appreciate, and experience the Forest’s prehistory and history. Five management approaches have been identified in the proposed plan that pertain to heritage tourism:
- CUH-MA-04 Find teaching opportunities, both internally and externally, to educate employees, permittees, contractors, and public groups on identifying, managing, impacting, and protecting significant cultural resources.

- CUH-MA-05 Work with stakeholders to determine priority heritage assets, heritage tourism opportunities, educational needs, and other benefits to the public. Work with state and local governments, historic preservation groups, historical societies, and other interested stakeholders to identify best management practices and design elements to minimize adverse effects to historic properties, promote cultural awareness, and strengthen local economies.
- CUH-MA-06 Maintain the Passport in Time (PIT) program or develop similar opportunities for the public to assist the Forest in the protection, management, and documentation of significant cultural resources.
- CUH-MA-07 Consider restoration of select significant historic structures for appropriate recreation or interpretive use (e.g., Rooms with a View cabin rental program).
- CUH-MA-08 Consider maintaining and updating existing interpretive sites (e.g., Sears-Kay Ruin, Shoofly Ruin, Rye Creek Ruin) to enhance visitor experiences and educational opportunities.

In the case of heritage tourism, the differences among the action alternatives include the length of time in which these desired conditions are accomplished and how heritage tourism opportunities might manifest.

Alternative B provides the most flexibility in how the Forest can move towards the desired conditions. Because alternative B seeks to strike a balance between adaptive management to address changing resource conditions and managing the Forest for sustainable multiple uses, this alternative allows the heritage program to explore a wide variety of heritage tourism and educational experience types, which can either be place-based (i.e., site visits, interpretive signs, educational tours) or virtual (digital media, mobile applications, virtual reality). Key components of alternative B that can also provide prospects for heritage tourism include the addition of the Lakes and Rivers Management Area in this alternative, and the focus of recreation towards relevant and sustainable opportunities. Under alternative B, with its balance between resource needs and sustainable public access, options for heritage tourism opportunities are at their most flexible. For example, if it was determined that increased visitor use was feasible for the site, the Forest could decide to install interpretive signage at the site and provide the public information on-site or digitally. This potentially allows for a more rapid and adaptive response to the following questions: Are there opportunities to work in partnership with a local archeological group and provide monthly or annual educational tours to the site? Are there mobile applications that would encourage the public to physically come to the site, or would it be better for site protection purposes to provide information via mobile applications that would reduce overall visitation and reduce physical impacts to the site? Overall, the state of the forest would move towards the desired condition, at a moderate pace.

Alternative C seeks to reduce human impacts on the Forest, focusing instead on recreational opportunities that are more primitive and have less impact on the environment. Under this alternative, the Tonto National Forest heritage program would emphasize heritage tourism opportunities where physical public access to historic properties would be limited. The interpretation of archaeological sites and other educational experiences would ideally be delivered through digital media (i.e., virtual reality tours, mobile applications, videos) to discourage human-caused impacts to archeological sites.

Alternative D seeks to provide easier access and multiple-use opportunities on the Tonto National Forest by emphasizing active restoration techniques to achieve desired conditions and provide for more economic opportunities on the forest, including focusing on grazing and mining. Under this alternative, the Tonto National Forest heritage program would focus on providing heritage tourism opportunities that are “on the ground”. Public visitation to historic properties would be encouraged, and the primary focus of the heritage program will be on place-based opportunities (i. e. site visits, interpretive signs, tours), to decrease impacts that might arise from easy access by a likely increase from forest visitors. The inclusion of the Lakes and Rivers Management Area in this alternative would also provide opportunities for heritage tourism.

Effects by Alternative

In order to better analyze how the alternatives would differ from each other in the Forest's management of heritage resources, the key components of each alternative and how they would apply to an existing situation on the forest, described below:

> On the northern edge of the Tonto National Forest, there is a historic railroad tunnel. The only one of its site type on the Forest, the site consists of a partially constructed railroad tunnel, at least one historic rock structure, and an artifact scatter. In the early 1880s, the Arizona Mineral Belt Railroad made plans to construct a freight railway from Globe to the Atlantic and Pacific Railroad in Flagstaff for the transportation of ore. The plans called for the excavation of a tunnel through the Mogollon Rim. Construction was halted twice due to the lack of funding, and the effort was finally abandoned in 1887 at a length of 75 feet. While several hiking trails do exist within the vicinity of the site, reaching the tunnel is considered a difficult hike. There are currently no other means of reaching the site. The Mineral Belt Railroad Tunnel site has not been interpreted and the little information available is through the Town of Payson website.

Alternative A

The amended 1985 plan has no articulated desired conditions for forest resources. It does not reflect changes in economic, social, and ecological conditions, new policies and priorities, and new information based on monitoring and scientific research; therefore, plan direction likely would not achieve desired conditions and archaeological sites would continue to be disturbed and destroyed. Managing cultural resources under this alternative would not change from that identified in the 1985 forest plan and its Amendment 21 (dated May 3, 1995). These documents establish the following standards and guidelines (under Decision Unit (DU) 3) that are applicable throughout the Forest regarding the management and protection of prehistoric and historic archaeological sites and other historic properties.

On the 4th page of DU3, the 1985 plan states that the Forest "will initiate feasibility studies and environmental analyses for providing on-site or other suitable cultural resource interpretation to" the historic Mogollon Rim Railroad Tunnel. Nothing else in the current forest plan directs or compels the Forest to focus on this and other sites for protection, monitoring, and/or interpretation. As of November 30, 2018, no such feasibility study or environmental analysis has been located within the heritage program records to indicate that this direction ever took place. While the site is not located in a designated wilderness, the remoteness of the site makes it difficult to monitor or assess. One of the tools for the current management of heritage resources to use for management is the Arizona Site Steward Program, which provides trained individuals to monitor sites on the forest for vandalism and other signs of visitor use. The railroad tunnel is not currently being monitored by the Arizona Site Steward Program; most of their volunteers in this program are retirees or older individuals and cannot physically get to the site. While the railroad tunnel is but one example on the forest, there are numerous other site types that are currently in similar situations.

Alternative B

Alternative B is the forest plan and includes plan direction that allows for adaptive management to address changing conditions while managing for sustainable multiple uses. Key components of this alternative that directly affect historic resources include:

- Vegetation management in frequent-fire ecosystems and ecological response units focuses on restoring fire as a key ecosystem process. This is accomplished through a balance of mechanical treatments and wildland fire.
- Objectives to restore grass and herbaceous cover are established for highly departed ecological response units (pinyon-juniper grass and juniper grass) with the emphasis on using wildland fire with some mechanical thinning. Depending on the ecological response unit, a variety of other treatments, such as invasive species treatments and reseeding native species, may be necessary to meet plan objectives.
- Objectives are established for desert ecosystems. Fire is actively suppressed, and restoration is primarily focused on reducing disturbance to sensitive soils and treating invasive species (specifically exotic and invasive grass species).
- Grazing allotments are evaluated (granted to new permittee or closed) as they become vacant to ensure for healthy and productive rangelands.
- Recreation opportunities are relevant and responsive to changing user demands while remaining sustainable.
- Roads and facilities are maintained based on user demand and decommissioning is prioritized where infrastructure is not sustainable (e.g., conflicts with other resource desired conditions and unused).
- The Lakes and Rivers Management Area provides specific direction designed to accommodate high levels of recreation along the lakes and major rivers of the forest.
- Approximately 43,204 acres are analyzed as recommended wilderness.

Under the proposed plan, two desired conditions specific to the base concepts of heritage tourism—providing the public with opportunities to appreciate and understand cultural resources; and implementing heritage-based recreation opportunities to the general public—are clearly identified. To attain these desired conditions, a treatment or interpretive plan would need to be created for the railroad tunnel that identifies management options and outlines the steps necessary to minimize erosion, reduce vandalism, and redirect the public to recreate in a way that is not destructive to the archaeological site.

All action alternatives are similar in that they provide clear direction and remove ambiguity for heritage tourism management as compared to the current plan, alternative A. Defined management of archaeological sites to provide heritage tourism opportunities and implementation of treatment plans would minimize natural (i.e., erosion and rock fall) and human caused (i.e., vandalism and looting) processes. The differences between the alternatives lie in how these conditions are obtained. Under alternative B, with its balance between resource needs and sustainable public access, options for heritage tourism opportunities are at their most flexible. Instead of attempting to monitor via Arizona Site Steward Program as attempted in the past, there are other methods available that could allow for monitoring the Mogollon Rim Railroad Tunnel site (i.e., trail camera, LIDAR). If the treatment plan determined that increased visitor use was feasible for more remote sites like the Tunnel site, the Forest could decide to install interpretive signs along the trails and provide the public information on-site. This alternative allows for greater flexibility to address the following question: Are there opportunities to work in partnership with a local archeological group and provide monthly or annual educational tours to the Tunnel site? Are there mobile applications that would encourage the public to physically come to the site, or would it be better for site protection purposes to provide information via mobile applications that would reduce overall visitation? The state of heritage resources forestwide would move towards the desired condition at a moderate pace.

Alternative C

Alternative C was developed in response to public comments that expressed a desire to reduce human impacts on the forest through increased protections to natural resources, use of natural processes for restoration, limiting some aspects of grazing, and prioritizing natural resources over some economic development opportunities. Key components of this alternative include:

- Vegetation management in frequent-fire ecosystems/ecological response units relies on wildland fire as the primary restoration tool. Mechanical thinning would only be used in limited situations (e.g., wildland urban interface areas or invasive species treatments). As a result, fewer commercial forest products would be available, and fewer suitable timber acres would be treated.
- Objectives to restore grass and herbaceous cover for highly departed ecological response units (pinyon juniper grass and juniper grass) are similar to alternative B; however, mechanical thinning would only be used in limited situations (e.g., wildland urban interface areas or invasive species treatments).
- Objectives for desert ecosystems are the same as alternative B. Fire is actively suppressed, and restoration is primarily focused on reducing disturbance to sensitive soils and treating invasive species (specifically exotic and invasive grass species).
- Restoration of riparian areas will emphasize the management of invasive species in disturbed or high-risk areas, while limiting or restricting other uses that impact these ecosystems, such as grazing, mining, and recreation.
- Grazing is not authorized in desert ecosystems and any allotments that becomes vacant will be closed.
- Recreation is managed to promote more primitive recreation opportunities, with no objectives for increasing accessibility and infrastructure.
- Management of roads, trails, and facilities focuses on maintaining current or decommissioning underused infrastructure.
- No emphasis on authorizations for new personal and commercial mineral material sales.
- A wildlife management area promotes wildlife connectivity between the Four Peaks Wilderness and the Mazatzal Wilderness.
- Approximately 399,029 acres are analyzed as recommended wilderness.

As noted above, all action alternatives are similar in that they provide clear direction and remove ambiguity. Defined management of archaeological sites to provide heritage tourism opportunities and implementation of treatment plans would minimize natural (e.g., erosion and rock fall) and human caused (e.g., vandalism and looting) processes. The difference among alternatives lie in how these conditions are obtained. Under alternative C, with its primary focus on resource needs, options for heritage tourism opportunities would be oriented towards those opportunities that limit visitation to the railroad tunnel site and provide interpretation via other means. Could the Forest set up an exhibit at a local historic museum that features the railroad tunnel and its history? Are there ways to encourage public engagement through mobile applications that would provide a ‘virtual’ trip? Treatment plans could also assess the feasibility of reducing management’s footprint on the site. The railroad tunnel site is typically monitored through physical visitation (e.g., Arizona Site Steward Program, Passport In Time program, Forest Service employees); are there remote electronic options (e.g., video via drone, satellite photography, or LIDAR) that would allow vegetation to take root and reduce erosion at the site? Any of these options would increase overall site protection and preserve cultural resources for future generations, but may require more focus on prioritizing a few sites across the forest at the exclusion of other sites due to the lack of funding and other Forest resources. If these tools were used, the state of the forest would move much faster towards the desired condition in this alternative (as opposed to alternative B).

Alternative D

Alternative D was developed to address public comments that expressed a desire for easier access and multiple-use opportunities, emphasize active restoration techniques to achieve desired conditions and provides for more economic opportunities on the forest including grazing and mining. Key components of this alternative include:

- Vegetation management in frequent-fire ecosystems/ecological response units focuses on restoring conditions primarily through mechanical treatments and focuses on increasing the supply of forest products. Fire is still managed to meet resource objectives; however, prescribed burning is mainly focused in areas that have been previously thinned.
- Objectives to restore grass and herbaceous cover for highly departed ecological response units (pinyon juniper grass and juniper grass) are similar to alternative B, however there are fewer treatment objective acres (more treatment objective acres are allocated to forested ecological response units).
- Objectives for desert ecosystems are the same as alternative B, however there are fewer treatment objective acres. Due to the increase use and limited restrictions in this alternative, treatment objectives are mainly focused on highly impacted areas or high risk areas.
- Direct restoration in riparian areas focuses on stream reaches where effects of multiple uses (e.g., recreation, grazing, and mining) have impacted the ecosystem.
- Recreation management focuses on developed and dispersed recreation opportunities that are easily accessible to the public.
- Livestock numbers are similar to alternative A but incorporate adaptive management strategies to achieve desired conditions. As allotment become vacant, they are granted to new permittees.
- Mining and minerals management focuses on processing requests for personal and commercial mineral material sales.
- There is an increase in objectives for maintenance and development of roads and facilities to accommodate increasing use and need for accessibility on the forest.
- The Lakes and Rivers management area provides specific direction designed to manage the high levels of recreation along the lakes and major rivers of the Forest and natural resources.
- The Superior/Globe-Miami Mining Management Area allows for standardized expectations and processes for mining in the Superior/Globe-Miami area.
- There are no acres analyzed as recommended wilderness.

Defined management of archaeological sites to provide heritage tourism opportunities and implementation of treatment plans would minimize natural (i.e., erosion and rock fall) and human caused (i.e., vandalism and looting) processes. Under alternative D, with its emphasis on public access and multiple use opportunities, options for heritage tourism opportunities would be oriented towards those opportunities that promote place-based experiences. How would the general public access the railroad tunnel site? What level of road would be needed to accomplish this? How would members of the public with limited mobility be able to visit the railroad tunnel site? Increased visitation to archaeological sites is going to reduce vegetation, increase erosion, and limit the Forest’s ability to protect them. Additionally, it will be difficult for the Forest to preserve the scientific information still present at archaeological sites.

Does the Forest limit the number of visitors on the trail to reduce impacts, and if so, what would implementation of that program look like? Are there as yet unidentified partnership opportunities in Arizona that would allow for better monitoring of the site against vandalism and overuse? The state of the forest would move much slower towards the desired condition in this alternative than alternative B.

Effects by Management Areas

A total of 12 management areas are integrated into the forest plan: designated wilderness, designated wild and scenic rivers, inventoried roadless areas, national trails, significant caves, the Apache Leap Special Management Area, recommended wilderness, eligible wild and scenic rivers, Lakes and Rivers Management Area, designated and recommended research natural areas and botanical areas, Salt River Horse Management Area, and the Saguaro Wild Burro Management Area. All but the Lakes and Rivers Management Area are associated with all four alternatives. Of these 12 management areas, five could have effects to cultural resources depending upon the selected alternative.

Recommended Wilderness Areas

Recommended wilderness areas have not been identified for alternatives A and D. For these alternatives, management of cultural resources within recommended wilderness would continue to be treated as defined in the amended 1985 amended plan, and erosion, vandalism, and destruction would continue to be treated on a case-by-case basis. Alternative B proposes the inclusion of approximately 43,204 acres of recommended wilderness, and alternative C proposes the inclusion of approximately 399,029 acres. While this management area would not offer the same protections that designated wilderness does, it would be managed to retain the wilderness characteristics of these areas. This means that Forest activities are likely to be kept at a minimum, which would lessen effects such as erosion caused by visitation and ground disturbance caused by construction and maintenance of roads and other projects. Thus, whichever alternative is chosen will determine if the cultural resources within the recommended wilderness areas will see no change (alternative A) in disturbance or destruction, a potential reduction in disturbance or destruction (alternative B or C), or a potential increase in disturbance or destruction (alternative D).

Eligible Wild and Scenic Rivers

The proximity of water means an increased likelihood for all cultural site types, especially early habitation sites. Cultural resources is an outstandingly remarkable value for wild and scenic rivers in itself, thus some of those archaeological sites located along rivers and streams that have a cultural outstandingly remarkable value should theoretically see a moderate increase in overall protection. This increase is dependent upon whether a particular corridor has been identified as a wild, scenic, or recreational waterway. Sites that are along waterways that are considered wild could see more protection from developed infrastructure, as improvements that could affect its designation are managed similar to designated wilderness. Sites that are along waterways that are considered eligible for the scenic or recreational designation often see increases in erosion and ground disturbance, due to site location, increased visibility to river visitors, and direct disturbance or destruction through projects that are intended to enhance the visitor's experience along the waterway. Alternatives A, B, and C all include acreage within this management area; alternative D has none. If alternative A, B, or C is selected, then management of cultural resources would likely see an overall increase in site protection of historic properties that are located along waterways that are eligible as a wild waterway. If alternative D is selected, there would be no change from the amended 1985 plan.

Recommended Research Natural Areas and Botanical Areas

The number of recommended research natural areas and recommended botanical areas vary by alternative: none recommended under alternative D, with alternative A including two recommended research natural areas (Picketpost Mountain, Upper Forks Parker Creek), and four additional management areas (Blue Point Cottonwood, Fossil Springs Natural Area, Sycamore Creek Natural Area, and Three Bar Wildlife Area). Alternatives B and C both include four recommended botanical areas (Fossil Springs, Little Green Valley Fen, Horseshoe, Mesquite Wash) and four recommended research natural areas (Dutchwoman Butte, Picketpost Mountain, Three Bar, and Upper Forks Parker Creek). The locations identified in alternatives A, B, and C contain both prehistoric and historic site types. Because these locations are being specifically managed for research and restoration purposes, the types of activities proposed would be limited in scope. This would reduce the likelihood that archaeological sites within these locations would be disturbed or destroyed through project activities. Vegetation would be left in place, thereby reducing erosion and limiting visitation that could result in vandalism or looting. If alternative A, B, or C are selected, cultural resource management in these locations would be adaptive and account for the increase in site protection.

Lakes and Rivers Management Area

This management area is proposed in alternatives B and D, and is not included in alternatives A and C. With the purpose of focusing recreational activities into those areas around water, the Forest would see an increase in damage to archeological sites and decreased protection to those historic properties located in this management area. Conversely, areas outside of the management area may see a decrease in damage to archaeological sites and increased protection to historic properties. The inclusion of this management area in the forest plan may result in an initial increase to the Heritage program's National Historic Preservation Act Section 106 workload, given that the Forest would be attempting to balance the high levels of recreation along lakes and major rivers while mitigating impacts to natural and cultural resources. As of November 29, 2018, there are a total of 899 archeological sites within this management area, approximately 50 percent of which has archeological survey coverage that is up to current professional standards (mostly around Roosevelt Lake). If alternative B or D is selected, current management of cultural resources within this management area would change to account for increased recreation within the management area.

Other Management Areas

The effects of the remaining six management areas (designated wilderness, designated wild and scenic rivers, inventoried roadless areas, national trails, significant caves, Salt River Horse Management Area, and the Apache Leap Special Management Area) are not dependent upon the alternative selected and will have roughly the same effects. Proximity to water and other resources (e.g., food, clay, or lithic material) indicates an increased likelihood for all cultural site types. Official designation of any resource typically results in some level of increased site protection; at the same time, the accessibility issues inherent with these designations sometimes makes monitoring of historic properties at these locations difficult. Proposed increases to the use of prescribed fire and other vegetation management methods will also result in an increase in the potential to adversely affect historic properties in these management areas, especially those that are fire-sensitive (have combustible surface features). Identifying designated routes through these management areas for such activities as rock climbing can also adversely affect historic properties that are found in these locations (e.g., rock art and hilltop sites). Increased public access results in increased site visitation, which in turn can exacerbate erosion, vandalism, and disturbance or destruction of archaeological sites.

Cumulative Effects

This analysis relies on current conditions (as detailed in the description of alternative A) as a proxy for the impacts of past and present actions. This is because existing conditions reflect the aggregate impact of all prior actions and natural events on heritage resources. This analysis focuses on the cumulative impact of those reasonably foreseeable actions that are relevant in assessing the impacts of revising the forest plan.

This analysis is based on an evaluation of expected conditions for the next ten to fifteen years, or the life of the plan. Project-specific demands, activities, and common practices fluctuate yearly and there are no reliable use trends available that show otherwise. The Forest administrative boundaries have been identified as the boundary for this cumulative analysis.

Archaeological resources both inside and outside the Forest boundary have been lost in the past and would be assumed to continue into the future. This loss is due to both natural (i.e., erosion, rockfall, wind) and human caused (i.e., construction, vandalism, and looting) circumstances. There are also some ongoing and predictable effects outside Forest management decisions that would adversely impact archaeological sites (i.e., wildfire and erosion). Over time, this loss would result in fewer and fewer archaeological resources being available on the Forest for future generations to learn about past human lifeways, to study changes in human behavior through time, and to interpret the past for the public. Changing global factors such as climate change and geological processes could also lead to an increase in the number of historic properties lost.

In surveyed areas across the Forest, recording and archiving basic information about each cultural resource for future reference serves to partially mitigate adverse effects to cultural resources from both natural and human caused site disturbance. By doing these surveys on the Forest, the agency would be able to better understand the extent of cultural resources, to potentially avoid negative effects, and to mitigate and monitor measures related to cultural resources.

Developing heritage tourism on the forest, which was identified as a key ecosystem service, could help bring visitors to less visited areas on the forest. This, in turn, could positively impact neighboring communities who rely on visitors to the forest for economic gain or national recognition in their community.

In terms of reasonably foreseeable future actions, this analysis has attempted to include, specific to heritage resources, projects for which upcoming actions are known and can be meaningfully analyzed. What will not be analyzed are projects that are inevitable and known, but which have not yet developed proposed actions. Adjacent planning efforts (Bureau of Land Management, counties) do not indicate any cumulative effects to heritage resources. Bureau of Land Management projects may require heritage survey on National Forest System lands when associated with a project on Bureau of Land Management lands, but the survey itself would not have cumulative effects.

In addition, Tribal reservations make up much of the land bordering the Forest. Many of these Tribes focus on protection of, and at times continued traditional use of, heritage sites. Cumulatively, this would improve heritage resources across a greater landscape. However, when looking across this greater landscape, alternative A would decrease the overall focus on heritage resources, especially in areas that are historic Tribal lands within Federal lands, potentially decreasing Tribal needs to protect sites across historic Tribal lands, as opposed to the other alternatives.

Several large-scale cultural resource inventories are ongoing or have been recently completed. These projects include Travel Management, Resolution Copper Mining Project, Pinto Valley Mine, US Highway 60 Realignment, ADOT FLAP project for SR 88/Apache Trail, Red Bluff CERCLA project, Hicks-Pike's Peak Grazing Allotment Project, Hilltop/Highway Tanks (a Tribal Forest Protection Act project), Pine Mountain Prescribed Burn, Buckhead Mesa Mastication, Spring Prescribed Burn project, Four Forest Restoration Initiative (4FRI) and Payson Helitack Construction. All adverse effects to historic properties will be subject to mitigation prior to project implementation, as they are all under Federal jurisdiction and follow all applicable heritage resource laws.

Site condition assessments for heritage resources located on the Tonto National Forest are not available for any time prior to the archaeological investigations of Adolph Francis Alphonse Bandelier in the early 1880s. For this reason, the original condition of most of the heritage resources on the Forest is not known, although some level of effect is assumed to have contributed to the current condition of all archeological sites on the Forest. Most of the cultural resources on National Forest System lands were not even recorded to professional standards until the early 1990s. Given the nonrenewable nature of heritage resources (both prehistoric and historic), any portion of a given site that is damaged or removed diminishes the site's overall cultural and scientific value permanently. Therefore, all effects to heritage resources are considered cumulative. The alternative selected will determine if the cultural resource management on the Tonto will see no change (alternative A) in disturbance or destruction, a potential reduction in adverse effects (alternative B or C), or a potential increase in adverse effects (alternative D).

Tribal Relations and Areas of Tribal Importance

The Tonto National Forest shares boundaries with five American Indian Reservations and is the ancestral territory of at least 13 Tribes. The Tonto National Forest manages lands important for cultural continuation, freedom of religious practice, and economic development of Indian Tribes. All activities that have potential to affect Tribal traditional and special areas, species and activities are of concern. These activities include but are not limited to land exchanges and sales, mining, timber harvest, road and trail construction or reconstruction, forest restoration, and infrastructure development.

Affected Environment

The Tonto National Forest (Forest) shares boundaries with reservations for the White Mountain Apache Tribe, the San Carlos Apache Tribe, the Salt River Pima-Maricopa Indian Community, the Fort McDowell Yavapai Nation, and the Tonto Apache Tribe. These Tribes are directly impacted by forest health, forest activities, and forest permitted activities. The Forest also manages watersheds that feed into reservation lands; our management success in maintaining the health of these watersheds directly impacts Tribal community land downstream. The Forest routinely consults with thirteen Tribes regarding proposed projects and management policies (table 30 and figure 15).

Table 30. Contemporary Tribes affiliated with the Tonto National Forest

Tribes affiliated with the Tonto	Tribe
San Carlos Apache Tribe	Apache
Tonto Apache Tribe	Apache
White Mountain Apache Tribe	Apache
Yavapai-Apache Nation	Apache and Yavapai
Mescalero Apache Tribe	Apache
Salt River Pima-Maricopa Indian Community	O’odham
Gila River Indian Community	O’odham
Ak Chin Indian Community	O’odham
Tohono O’odham Nation	O’odham
Yavapai-Prescott Indian Tribe	Yavapai
Fort McDowell Yavapai Nation	Yavapai
Hopi Tribe	Hopi
Pueblo of Zuni	Zuni

The Tonto National Forest carries out its government-to-government trust responsibilities under a variety of Federal authorities. Tribal rights and interests are honored and considered in Tonto National Forest operations on the basis of trust relationships, mandates in laws, policies, and executive orders. The Tonto National Forest recognizes the 13 affiliated Tribes that have ancestral and cultural ties to, and knowledge about, lands now managed by the Forest Service.

The Tonto contains many plant and animal species, water sources, minerals, and geographic landforms and places that have significance to contemporary Indian Tribes for their use in traditional economics, religious practices, Tribal and clan histories, and general cultural continuity. The Tonto National Forest ensures affiliated Tribal members continue to have open access to all National Forest System land to practice cultural activities. Forest activities that have potential to affect Tribal traditional and special areas, species and activities reviewed. The Tonto National Forest ensures Tribal input is sought and addressed meaningfully when activities may affect their relationship with the land.

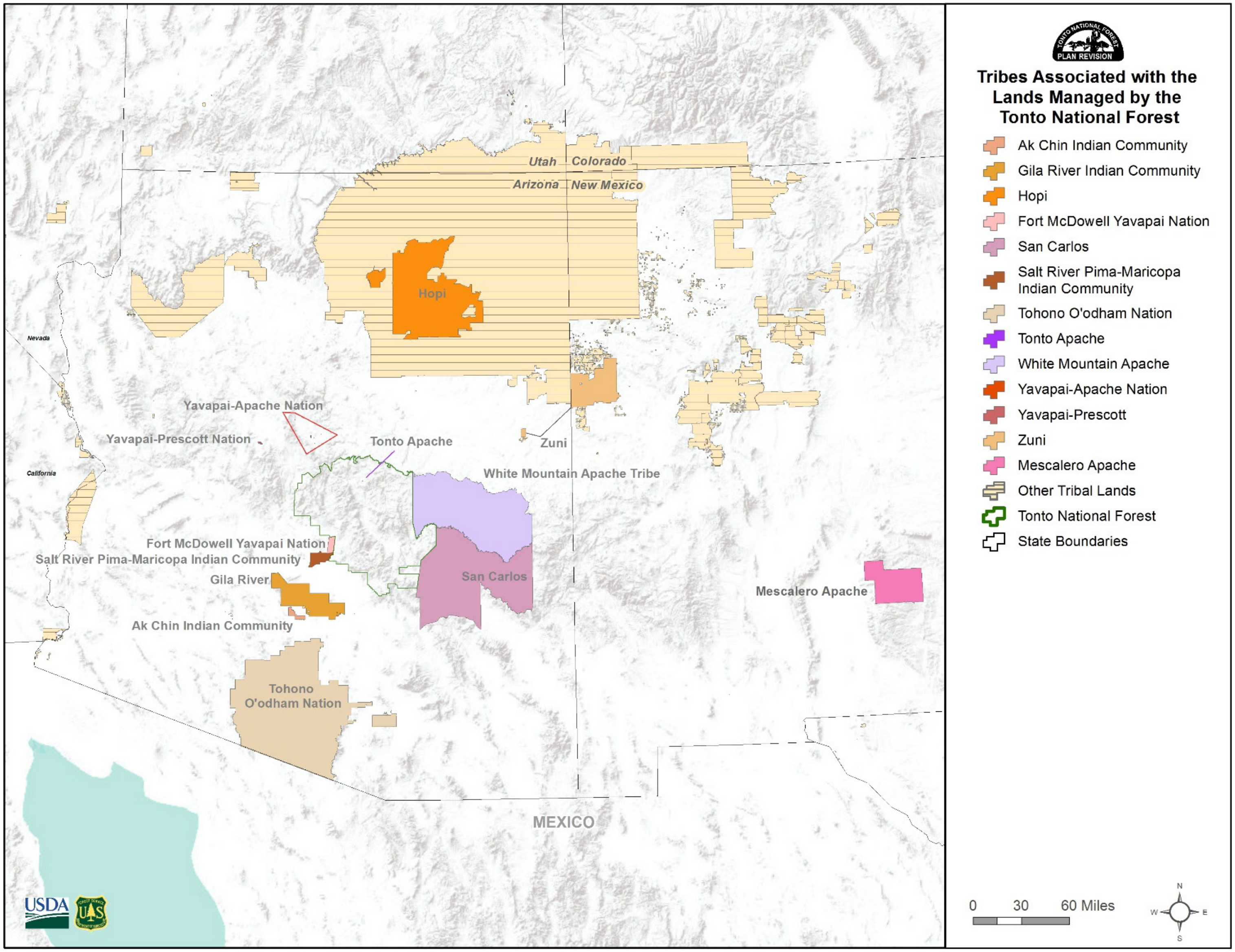

Figure 15. Location of Tribal lands associated with lands managed by the Tonto National Forest

The Tonto manages an unknown number of resources that could be eligible to the National Register of Historic Places as traditional cultural properties (TCPs). Tribes have deemed it appropriate to specifically identify the following as eligible or potentially eligible traditional cultural properties; Oakflat and Apache Leap, Fossil Creek, Haigler Creek, Butterfly Springs, Verde River, Four Peaks, Mazatzal Peak and North Peak, Sierra Anchas Mountain Range, Sierra Ancha Cliff Dwellings, Sleeping Beauty Mountain, Pinal Mountain, Mescal Mountain (El Capitan), Superstition Mountain, and Diamond Point, although most have not been formally evaluated for eligibility to the National Register of Historic Places. The Forest acknowledges these places are of importance to Tribes and will seek Tribal input when activities that may impact these areas are proposed.

Managing for multiple uses may cause degradation and/or loss of places of traditional cultural importance. Actions and activities such as land exchanges, mineral extractions, and road expansions may put areas of historical and cultural significance at risk. Every management decision that impacts these places may contribute to the cumulative loss of traditional cultural properties, sacred sites, and traditional use areas across the region.

Traditional and Cultural Use Areas

Due to the sensitive nature of information pertaining to cultural places it is not always appropriate to document specific areas of importance to Indian Tribes. However, all of the lands administered by the Forest are Tribal ancestral lands. Years of government-to-government consultation with federally recognized Tribes has identified numerous traditional use areas on the Forest. A few places identified during formal consultation are Oak Flat (Chi'Chil'Bidagoteel), Apache Leap, Fossil Creek, Haigler Creek Butterfly Springs (near Payson), Verde River, Four Peaks, Mazatzal Peak and North Peak, Sierra Anchas Mountain Range (including Picture Mountain), Sierra Ancha Mountains and Cliff Dwellings, Sleeping Beauty Mountain, Picket Post Mountain, Pinal Mountain, Superstition Mountains, and Diamond Point Mountain. This is not an exhaustive list, but are examples of culturally sensitive areas that should be managed with Tribal concerns accounted for. While some traditional uses consistently occur in one location, others may occur in a variety of locations based on the availability of resources. Tribal consultation can help inform specific planned activities and operations which might affect Tribal use areas.

Confidentiality of Sensitive Tribal Information

The Tonto National Forest uses and safeguards confidential records, maps, photographs, or other Tribal information about properties and places on the Forest significant to the affiliated Tribes. Information about sacred sites and traditional use areas is held in confidence by the forest archaeologist and Tribal liaison and is not made available to the general public. The locations of such properties and places are available on a strictly need to know basis only to Forest officers charged with the protection of these properties and places and to permitted researchers whose work has been approved by the forest archaeologist and the Tribes in furtherance of the protection of these properties and places. Data is protected by confidentiality requirements in the Archaeological Resources Protection Act (codified at 16 USC 470hh), the National Historic Preservation Act (codified at 16 USC 470w-3), Executive Order 13007- Sacred Sites, the Food, Conservation, and Energy Act of 2008 (codified at 25 USC 3056), and USDA Forest Service Regulations at 36 CFR 296.18. Data is exempt from disclosure under the Freedom of Information Act (FOIA) and shall not be made available to the public.

Environmental Effects

Indian Tribes, to the greatest extent practicable and permitted by law, should be provided the opportunity to comment before decisions are made, allowed to share in the benefits of, not be excluded from, and not be affected in a disproportionately high and adverse manner by, actions permitted by or taken by the Forest. In determining environmental effects, this analysis will consider the following;

- Access to and availability of forest products including fuel wood, plants, and minerals.
- Access to the forest for solitude and traditional activities.
- Access to and protection of sacred sites and traditional cultural properties.
- Any activities that have the potential to adversely impact archeological sites, sacred sites, and traditional landscapes.
- Protection and restoration of springs, seeps, riparian areas and other waters.

Effects of All Alternatives

Nothing in the current plan (alternative A), or being proposed under any of the action alternatives would limit or prohibit collection of personal fuelwood or participation in legal hunting for someone with a state-issued hunting license. These activities are important for the Tribes in order to sustain the continued cultural and traditional uses of these products.

All alternatives provide direction for mining on the Tonto National Forest. Tribes are adamantly opposed mining because it has the potential to adversely impact archeological sites and change traditional landscapes. Known sacred sites and traditional cultural properties should be managed to avoid adverse effects whenever possible. Adverse effects include ground disturbance, noise disturbance, and viewshed disturbance. Mining requires a substantial amount of ground water. Tribes oppose the removal and transport of ground water because it can adversely impact local aquifers and springs that are significant to Tribes.

Effects of Alternative A

In alternative A, the 1985 forest plan lacks specific guidance on Tribal consultation, sacred sites, and traditional cultural properties. The lack of protections surrounding traditional and cultural sites and practices, could degrade these experiences for some groups or may expose these sites and practices to unwarranted users of the Forest. When policies for the protection and possible preservation for places of traditional community practices are not in place, connections between the people and the land may be disrupted leading to social and cultural dislocation.

Effects of all Action Alternatives

Tribes share boundaries with the Forest and are directly impacted by forest health, forest activities, and forest permitted activities. The Forest manages watersheds that feed into reservation lands. Tribes would like to see the Forest performing active restoration work to return the forest to “pre-reservation conditions” and reduce the risk of catastrophic wildfire which could spread onto Tribal land and devastate traditional cultural properties. If areas are returned to pre-reservation conditions then there is a potential for increased accessibility of forest products such as fuelwood, pinon nuts, mushrooms, wildlings, greenery, and medicinal plants that sustain the cultural and traditional uses of these products. Tribes would like to partner in designing restoration activities to benefit culturally important natural resources and landscapes. Restoring range and other lands would improve grass and forb abundance providing for sustainable grazing practices tied to traditional ways of life and to the sustainable presence of important species necessary for the practice of traditional activities within Tribal communities.

Desired conditions for select vegetation types and wildlife species account for Tribal values, and emphasize restoring traditional resources. Restoring a sustainable ecosystem on the Forest would also create an environment more conducive to the preservation and protection of traditional resources by stabilizing soils, improving vegetative cover and watershed health. By providing sustainable forest resources, the Forest helps to support traditional and cultural uses and contribute to local economies and livelihoods. By working with the Tribes to achieve these desired conditions, and by maintaining lines of communication among the Forest Service, Tribes, communities, partners, and the public, the Forest can direct management practices on public lands that provide the greatest good.

In all action alternatives, there is a potential for increasing recreation opportunities on the Forest, driven by population growth in the surrounding communities. An increase in all recreation types on the Forest would decrease privacy and solitude for Tribal members practicing traditional activities. Increasing visitation by people from outside Tribal communities has the potential to negatively affect traditional practices through unexpected breaches in privacy or confidentiality. Recreation such as hiking, rock climbing and camping often result in the degradation of archaeological sites, traditional cultural properties, and natural water sources.

Tribal communities have stated that motorized access is essential for Tribal members to access to non-economic plants and non-construction mineral resources found within the plan area. Access is also important to perform traditional activities and visit sacred sites and traditional cultural properties. Tribes have stated that maintaining existing roads provides adequate access to the Forest to practice traditional activities.

In all action alternatives, forest plan components provide for conditions under which communication with federally recognized Tribes is enhanced. Increased communication would lead to stronger relationships between the Forest Service and nearby Tribes, improving collaboration and protection of shared interests. However, the plan components do not necessarily recognize the capacity of those communities to address requests, potentially resulting in communication barriers among these groups.

Effects of Alternative B and Alternative D

In alternatives B and D, the Lakes and Rivers Management Area provides specific direction designed to accommodate high levels of recreation along the lakes and major rivers of the forest. These alternatives would have the most negative impact to Tribal communities. Increased recreation would decrease solitude, adversely impact plants and animals and the general integrity of these places which are considered traditionally significant areas.

Tribes are concerned about the management of springs, seeps, riparian areas, and other waters. Areas where natural water occurs on the Forest are of particular importance to Tribes as they are considered traditionally significant areas. Many water sources on the Forest have been damaged by grazing, recreation, mining, and other activities. Tribes advocate for active restoration, minimal recreation use, and protection of these places.

Tribes consider water sacred and holy. Natural water landscapes are vital to Tribal ceremonies. Many traditionally important plants and animals are found near water. Tribal members access sacred sites, traditional cultural properties, and Forest lands for individual and group prayer and traditional ceremonies and rituals. Many of these sites have naturally available water. There is a need for privacy during ceremonial and traditional activities on the forest. Activities and uses that reduce visitor solitude may cause conflicts with traditional practices. Interruption degrades a traditional ceremony. Interruptions can be caused by many things, but most often vehicular noise and other activities that cause noise are common intrusions. Furthermore, Tribes are concerned with any activity that has the potential to change traditional landscapes. Lakes and rivers should be managed to avoid adverse effects whenever possible.

Effects of Alternative C

Alternative C would limit building additional infrastructure. Tribes support this alternative because development causes additional landscape disturbance and development, further damaging the land and adversely impacting Tribal cultural resources. Decreasing access by restoring or closing temporary roads, would reduce visitation by people from outside Tribal communities, helping to protect the privacy and confidentiality of many traditional or cultural practices on the Forest. Tribes support identification of recommended wilderness areas on the Tonto National Forest. Recommended wilderness areas provide greater protections for natural resources important to the Tribes for traditional cultural uses. This impacts the availability of these resources and allows the Tribes greater opportunity to use these products. In alternative C, recreation is managed to promote more primitive recreation opportunities, with no objectives for increasing accessibility and infrastructure. Tribes have stated that additional destruction and development should not be considered. That said, reduced access may negatively affect the lifeways of nearby Tribes by increasing the difficulty of accessing the Forest, especially for the elderly or those not able to walk long distances.

In alternative C allotments would be closed if they are currently vacant. Alternative C is supported by Tribes, but it is not a broad enough goal to adequately manage cattle on the entire forest. Tribes prefer to see cattle minimized and more actively managed to prevent adverse effects to Tribal resources. Grazing can adversely impact archeological sites or change traditional landscapes. Range activities that alter springs, riparian areas, and other waters are of concern to Tribal communities. Springs are sacred and should not be altered to prioritize use for cattle. These alterations are considered adverse effects. Grazing adversely impacts access to, and the availability, abundance, and sustainability of, non-economic plants, including plants used for subsistence, religious, medicinal, and other cultural purposes.

Tribes support alternative C because of the decrease in activities that are potentially harmful to resources important to Tribes on the forest and the deliberate protection of sacred sites, but more active forest restoration and restoration of riparian areas to serve Tribal concerns.

Effects of Alternative D

Under alternative D, increased use would most negatively impact Tribal resources, traditional cultural properties, and sacred sites due to the increased access on the Forest and emphasis on motorized recreation. Increased traffic on the Forest decreases the opportunities for Tribal members to have privacy and solitude when practicing ceremonies and traditional activities. Additionally, a rise in mechanized activities has the potential to adversely affect confidentiality and privacy, as additional temporary roads may open areas previously closed to Forest visitors. In order to accommodate this increasing use, there is a potential increase in maintaining and developing roads and facilities to accommodate a rise in use and increase accessibility on the Forest. Tribes oppose building new roads and highways because it can negatively impact traditional cultural properties, archaeological sites, and sacred sites.

Increased extraction of resources would inevitably adversely impact Tribal sacred sites by taking away forest products important to the Tribe for traditional cultural uses. Tribes prefer recreation that “leaves no trace,” and does not irreparably alter the natural landscape. Additionally, if recreation fees increase due to expanded existing or new recreation (or increases the number of areas requiring fees), this would have the greatest negative impact on those at lower income levels.

Tribal members need access to sacred sites, traditional cultural properties, and Forest lands for individual and group prayer and traditional ceremonies and rituals. There is a need for privacy during ceremonial and traditional activities on the Forest. An increase in motorized recreation types on the Forest would increase the likelihood that Tribal members would be disturbed during ceremonies and other practices.

Increased recreation could also result in the degradation of archaeological sites, traditional cultural properties, and natural water landscapes.

Alternative D focuses on restoring conditions primarily through mechanical treatments and to increase the supply of forest products. Fire is still managed to meet resource objectives; however, prescribed burning is mainly focused on previously thinned areas. This is the least desired alternative because of the minimal use of fire as a tool to manage vegetation and the emphasis on mechanical treatment which can cause ground disturbance. Fire is part of the natural ecosystem, prehistorically used by Tribes for natural restoration. Any activities that have the potential to adversely impact archeological sites or change traditional landscapes are of concern.

In alternative D there is an increase in use levels for grazing, and vacant allotments are granted to new permittees. This alternative would negatively impact archaeological sites, springs, plants, forest products, and traditional cultural properties.

Alternative D would have the most negative impacts on Tribes because it includes the highest level of activities that are potentially destructive to resources important to Tribes' resources and does not prioritize restoring riparian areas.

Effects by Resource

Forest Products

Where reservations abut the Tonto National Forest, some individuals and families depend on gathering fuelwood and hunting game as a means of subsistence. Often, gathering fuelwood and retrieving game requires using a motorized vehicle. Currently, Forest users are able to get a permit to collect fuelwood in designated areas within the Globe, Payson, Pleasant Valley, and Tonto Basin Ranger Districts. In addition, the Arizona Game and Fish Department issues hunting permits; and on the Payson and Pleasant Valley Ranger Districts cross-country travel is permitted, including for retrieving game. For the purposes of the Tribal effects analysis, anything being proposed in the alternatives that limits these Federal land uses would impact those who currently rely on them.

Vegetation Management in Fire-Frequent Ecosystems

Tribes would like to see the Tonto National Forest performing active restoration work. Tribes wish to see the forest restored to historic conditions. Because the Forest shares borders with five American Indian reservations, Forest Service restoration activities directly benefit Tribal lands. Restoration activities can be performed in partnership with Tribes to account for culturally significant resources and provide economic benefits to neighboring communities. This includes access to and the availability of non-economic plants used for subsistence, religious, medicinal, and other cultural purposes. Important traditional use resources should be monitored to ensure healthy sustainable plant populations are available for future users. Sustainability of these resources is facilitated through active restoration treatments including mechanical treatment, prescribed burning, and wildfire.

In alternative B, restoration activities can be performed in partnership with Tribes providing economic benefits to disadvantaged communities. Restoration activities can be designed in partnership with Tribes to include culturally used resources. Desired conditions for select vegetation types and wildlife species, account for Tribal values, and emphasize restoring traditional resources.

Alternatives B, C, and D each focus on active restoration work which is desired by the Tribes. These alternatives would not create access barriers to the Tribes.

In alternative C, desired conditions for select vegetation types and wildlife species account for Tribal values and emphasize restoring traditional resources. The historical and natural condition of landscapes is the desired condition Tribes prefer. Traditional and cultural use areas would be identified and managed.

Alternatives B and D include an emphasis on wildland fire management. Tribes wish to see the forest restored to historic conditions including returns to natural fire regimes.

Alternative D focuses on restoring conditions primarily through mechanical treatments and focuses on increasing the supply of forest products. Fire is still managed to meet resource objectives; however prescribed burning is mainly focused on previously thinned areas. This is the least desired alternative because of the minimal use of fire as a tool to manage vegetation and the emphasis on mechanical treatment which can cause ground disturbance. Fire is part of the natural ecosystem, prehistorically used by Tribes for natural restoration. Any activities that have the potential to adversely impact archeological sites or change traditional landscapes are of concern.

Riparian Areas – Availability and Abundance of Sacred Water from Natural Sources

Tribes would like to see the Forest performing active restoration work to restore the forest to prehistoric conditions. Tribes would like to partner with the Forest Service in designing restoration activities. Areas where natural water occurs on the Forest are of particular importance and Tribes are particularly concerned for management of springs, seeps, riparian areas, and other waters. Tribes consider water sacred and holy and many locations of surface water have Tribal place names and are related to Tribal histories. Tribal members conduct ceremonies at many of these locations and often traditionally important plants and animals are found near them. Because many water sources on the Forest have been damaged by past grazing, recreation, mining, and other activities, the Tribes emphasize active restoration and protection of these places.

Because water is sacred, alternative B is the Tribe's preferred alternative. The health and function of riparian areas are prioritized, often over other uses including recreation, grazing, and mining. Alternative B would actively restore watersheds and other natural water on the landscape.

Alternative C is less preferable because it would not actively restore and protect riparian areas. Restoring riparian areas would happen indirectly through additional plan components limiting or restricting uses that impact these ecosystems, such as grazing, mining, and recreation.

Alternative D includes active restoration, but only in areas damaged by recreation. Tribes prefer broader restoration goals for riparian areas.

Grazing

Cattle negatively impact Tribal resources such as medicinal plants, Emory oak groves, archaeological sites, springs, riparian areas, and other areas Tribes consider important to maintaining their traditional cultural practices.

Tribes prefer to see cattle numbers minimized and managed to prevent adverse effects to Tribal resources. Grazing can adversely impact archeological sites or change traditional landscapes. Range activities that alter springs, riparian areas, and other waters are of concern to Tribal communities. Springs are sacred and should not be altered to prioritize use for cattle. These alterations are considered adverse effects. Grazing adversely impacts access to; and the availability, abundance, and sustainability of; non-economic plants, including plants used for subsistence, religious, medicinal, and other cultural purposes.

Alternative B would have the most positive impact for Tribal communities. Grazing allotments would be evaluated as they become vacant to ensure healthy and productive rangelands. Alternative B would actively manage grazing for better forest health and would have a positive impact for Tribal resources.

In alternative C, allotments would be closed if they are currently vacant. Alternative C is supported, but would not actively manage cattle on the entire forest. More active management such as outlined in alternative B would better address Tribal concerns.

In alternative D, there would be an increase in use of forest land for grazing and vacant allotments would be granted to new permittees. This alternative would negatively impact archaeological sites, springs, plants, forest products, and areas of traditional cultural concern.

Recreation

Tribal members access sacred sites, traditional cultural properties, and Forest lands for individual and group prayer and traditional ceremonies and rituals. There is a need for privacy during ceremonial and traditional activities on the Forest. An increase in recreation on the Forest would increase the likelihood that Tribal members will be disturbed by other parties while such ceremonies and other practices are underway. Increased recreation could also result in the degradation of archaeological sites, traditional cultural properties, and natural water landscapes. Tribes have concerns for management of springs, seeps, riparian areas, and other waters. Tribal members conduct ceremonies at places where natural water occurs. Many traditionally important plants and animals are found at these waters.

In alternative C, recreation is managed to promote more primitive recreation opportunities, with no objectives for increasing accessibility and infrastructure. Tribes have stated that additional land disturbance and development should not be considered. Processes that cause further damage to the land are not desired. Alternative C “leaves the land alone,” and therefore would have the most positive impact to Tribal resources.

Alternative C has approximately 399,029 acres of recommended wilderness areas where developed recreation sites would be prohibited or seriously restricted. This alternative also focuses on increasing primitive recreation opportunities across the Forest; most of these activities do not require recreational fees. This would positively impact Tribes and those at lower income levels.

The opposite would be the case for alternative D, which has no recommended wilderness and focuses on developed recreation opportunities across the Forest, especially in the Lakes and Rivers Management Area. Alternative D would increase recreation, which can adversely affect Tribal resources. Increased recreation decreases privacy and solitude for Tribal members practicing traditional activities, adversely impacts archaeological sites, and adversely impacts natural water. Overall, alternative D would have the greatest negative impact on Indian Tribes. The development and construction of new recreation sites and trails and roads for motorized traffic creates ground disturbing activity which could potentially damage archaeological sites and traditional cultural properties. Tribes prefer recreation that “leaves no trace,” and does not irreparably alter the natural landscape. If new sites or expansion of existing sites increases recreation fees (or increases the number of areas requiring fees), this would have the greatest negative impact on those at lower income levels.

Roads and Facilities

Tribal communities have stated that motorized access is essential to be able to access non-economic plants and non-construction mineral resources found within the plan area. Access is also important to perform traditional activities and visit sacred sites and traditional cultural properties. Tribes have stated that maintenance of existing roads provides access to the Forest to practice traditional activities. Building new roads, however, can destroy traditional cultural properties and archaeological sites.

Tribal members with disabilities can be directly impacted by Federal land management decisions that affect barrier-free facilities for recreation visitors as part of facility and service planning and development (USDA Forest Service 2016). For this analysis, any limitations on access to the Forest itself and to recreation sites using a motor vehicle (e.g., passenger car, 4x4 vehicle, all-terrain vehicle, and utility vehicle), such as closing routes or decreasing maintenance levels, would impact persons with disabilities, especially those with mobility limitations (Du Lee, Graefe, and Burns 2007; and Cordell et al. 2004).

Alternatives B and C are similar in that both represent the comments heard from Tribes; roads and facilities would be maintained based on user demand, and decommissioning prioritized where infrastructure is not sustainable.

In alternative D, there would be an increase in objectives for maintenance and development of roads and facilities to accommodate increasing use and increase accessibility on the Forest. Constructing new roads and highways is opposed by Tribes, and negatively impacts traditional cultural properties, archaeological sites, and sacred sites.

Mining

Tribes adamantly oppose mining because it has the potential to adversely impact archeological sites and change traditional landscapes. Sacred sites and traditional cultural properties should be managed to avoid adverse effects whenever possible. Adverse effects include ground disturbance, noise disturbance, and viewshed disturbance. Mining requires a substantial amount of ground water. Tribes oppose the removal and transport of ground water because it can adversely impact local aquifers and springs. Tribes, therefore, do not want ground water impacted for purposes of mining.

Alternative D is the least desired alternative for Tribes. Mining and minerals management would focus on requests for personal and commercial mineral material sales. Tribes in general are opposed to mining and any processes that would streamline mining permits.

Cumulative Effects

The cumulative effects analysis timeframe for the Tribal relations analysis is the next 15 years, which is the projected lifetime of the Forest plan. Tribal relations in this country have been shaped by the history of interactions between the Federal Government and Tribes. This cumulative effects analysis is spatially based within the boundary of the Forest, and it applies to all Tribes who visit the Forest and have ancestral ties to its landscape. The Tonto shares boundaries with reservations for the White Mountain Apache Tribe, the San Carlos Apache Tribe, the Salt River Pima-Maricopa Indian Community, the Fort McDowell Yavapai Nation, and the Tonto Apache Tribe, and Arizona State Lands, Bureau of Land Management, and National Park Service.

Today, each national forest conducts its own Tribal consultation for proposed activities, so Tribal consultation processes are somewhat insulated from actions by other jurisdictions. However, major controversies resulting from one process can affect the relationship between those Tribes and other Federal entities. Land restoration, including vegetation treatments such as burning and thinning of trees, occurs on lands owned by other Federal land management agencies, State lands, county lands, and private property. Livestock grazing and recreation also occurs in these areas.

Without knowledge of what type or how many actions other entities besides the Tonto National Forest propose that could impact Tribal relations and resources over the effective period of the revised forest plan, it is not possible to identify specific cumulative effects on them.

Tribal members are concerned about the cumulative degradation of open spaces and the modification of cultural landscapes. Places of historical, traditional, and cultural significance to the Tribes are located across these landscapes. Many of these important areas are located on nontribal lands, and in particular, on the lands managed by the Tonto National Forest. Across this landscape, there has been a trend toward the degradation of places of traditional cultural importance. As with cultural resource sites, many of which are considered ancestral homes of Tribal members, losses of traditional use areas and places of traditional importance has been high in urbanized areas and on developed private lands.

Tribal relations would be enhanced under the revised forest plan direction, which would manage traditional cultural properties, important resources, and traditional use areas on the Tonto for the benefit of Tribes.

Because of its emphasis on motorized recreation, alternative D, more than the other alternatives, has the greatest potential to adversely impact the landscape and result in negative impacts. Alternative C has the greatest potential to benefit landscapes and access to traditional places because of the proposed addition of 399,029 acres of recommended wilderness, including additional protections on resource protection and recreation use. All action alternatives would provide free access to native peoples for use of forest resources. Even though the 1985 plan is silent on native access, it is freely allowed in the same way that it is proposed by the other alternatives.

Actions by other entities that have affected the Tribal relations with the Tonto National Forest include land exchanges and mining. These activities such as multiple copper mines in the same county are viewed by Tribes to have negative effects to the landscape including water and air quality, viewshed degradation, and sacred site destruction. One project that has affected the Forest Service on the local, regional, and national level is the Southeast Arizona Land Exchange (2015) and the Resolution Copper Mine.

While plan alternatives would provide protection of sacred sites in a primarily strategic manner, they would not necessarily prohibit site-specific decisions that Tribes could object to. All alternatives, however, would continue to follow existing and ongoing guidance provided by the agency and support the cultivation of positive relationships between the Tonto National Forest and Tribes. The plan alternatives are not expected to have a cumulative adverse impact to Tribal relations.

Socioeconomics

Socioeconomics are an important consideration when looking at the revision of a forest plan of a forest that is large (nearly three million areas) that is directly adjacent to a major metropolitan area (Phoenix and other cities and towns in Central Arizona). By understanding the overall social and economic conditions, better decisions concerning social and economic well-being of those affected can be made.

The 2012 Planning Rule states that plans are to guide management so that forests and grasslands contribute to social and economic sustainability, providing people and communities with ecosystem services and multiple uses that provide a range of social, economic, and ecological benefits for the present and into the future (36 CFR 219.35(b)). Specifically, plan components must include standards or guidelines to guide the plan area's contribution to social and economic sustainability, taking into account ecosystem services as well as multiple uses that contribute to local, regional, and national economies and communities in a sustainable manner. Furthermore, reasonably foreseeable risks to social benefits shall be considered when developing the forest plan. Though not a requirement under the 2012 rule, job and income estimates—a measure of the economic contribution of forest management—by alternative is an informative indicator of the economic impacts of different management alternatives on the local economy.

Many of the challenges facing the management of National Forest System lands are rooted in the values that people hold, which influence what is desired from forest management and also help define the quality of life that is important to individuals and communities (Allen et al. 2009). People are often concerned with the potential impacts of changes in land management on their quality of life and at the same time, population demographics continue to shift, creating the necessity for changes in forest management.

In addition, forest management influences the social[73] and economic[74] sustainability of the communities that surround the forest and impacts the provision of forest contributions that affect the quality of people's lives both locally and further removed from the Tonto National Forest itself.

Uses, products, services, and visitor opportunities supported by national forests produce a steady flow of benefits, or ecosystem services, which contribute to the sustainability of forest-dependent communities. This analysis, which is necessary to comply with the 2012 Planning Rule and to understand the impacts associate with the four alternatives, is addressed elsewhere in this final environmental impact statement, in detail, in the following sections of this document:

- Partnerships and Volunteers
- Recreation;
- Lands, Special Uses, and Access;
- Cultural and Historic Resources;
- Tribal Relations and Areas of Tribal Importance; and
- Scenery

[73] Social sustainability is defined in the 2012 Planning Rule as, "the capability of society to support vibrant communities, and to support the network of relationships, traditions, culture, and activities that connect people to the land and to one another."
[74] Economic sustainability is defined in the 2012 Planning Rule as "the capability of society to produce and consume or otherwise benefit from goods and services including contributions to jobs and market and nonmarket benefits."

As such, this section will focus on social demographics at a forest level and how they relate to the four-county analysis area, values, attitudes and beliefs of forest users, and environmental justice and the potential need for a civil rights analysis as required by current law, regulation, and policy.

Affected Environment

The Tonto National Forest is adjacent to the northern edge of the Phoenix metropolitan area, which has a population of nearly four and a half million people (US Census Bureau 2016). The city of Phoenix itself has a population of approximately 1.6 million (US Census Bureau 2018), making it the sixth largest city in the United States. The Phoenix area is a popular destination for conferences, conventions, and tourism with its warm and sunny year-round climate, wide variety of business, cultural, and recreational offerings, serviced by many direct flights from most major U.S. cities. These factors combine to make the Tonto National Forest one of the most heavily-visited national forests, with approximately three million recreational visitors annually (USDA Forest Service 2016).

Values, Attitudes, and Beliefs of Forest Users

In 2006, a social analysis about values, attitudes and beliefs toward the Tonto National Forest was conducted to identify local perspectives about key issues and concerns about forest resources and management (Russell, J. C. and P. A. Adams-Russell 2006).

Identification of values, attitudes, and beliefs was conducted using discussion groups or focus groups. In addition, some individual interviews were conducted with persons who were unable to attend the discussion group sessions. Participants were selected for these groups by consultation with district rangers, forest planning staff, and other individuals within the Tonto National Forest and included topics such as the social environment, forest characteristics, use of forest resources, values and benefits associated with forest resources, desired futures, and assessments of issues for forest plan revision. Four discussion groups were conducted in Mesa, Globe, Payson, and Young to collect values, attitudes, and beliefs about the Tonto National Forest. Four discussion groups and six additional individual interviews resulted in data for analysis from about fifty stakeholders with a range of perspectives.

The following are results from this report, as it relates to multiple-use, access and restrictions, fee for use, grazing, problematic uses and enforcement, power-line and transmission tower uses, and recreation and off-highway vehicle use (Russell and Adams-Russel 2006):

- Multiple use: Participant statements expressed values and beliefs about the multiple-uses of the Tonto National Forest, including access, enforcement, fees, grazing, power line rights-of-way, problem uses, recreational uses (especially off-highway vehicle use), and restriction of uses. There is some overall support for the general notion of multiple-use, although with qualifications about what types of uses can occur in which places (p. 24).
- Access and restrictions: With a perceived increase in recreational use of Tonto National Forest lands and resources, access is among the most valued aspects of this multiple-use forest. Management closures of roads, trails, or other forest resources and restricted access associated with new development abutting Tonto National Forest lands are among the specific concerns of participants (p. 25).
- Fee for use: Participant comments about fees for use were expressed in association with dialogue about (1) access to resources and (2) solutions to perceived problems with facilities and resource conditions. Some participants believe that the increased pressure on forest resources combined with declining budget and personnel of the Forest Service imply a solution of user fees (p. 26).

- Grazing: Participant comments about grazing express a history of controversy about grazing issues on the Tonto National Forest (p. 27).
- Problematic uses and enforcement: Participants identified a range of problematic uses and problem behaviors such as vandalism and littering. Problem uses include off-highway vehicle riding off and on-trail, powerboats on lakes, shooting, and illegal activities such as drug use and production and violent crimes (p. 29).
- Power-Line and transmission tower uses: The specific benefits include building roads and creating passage across rough terrain that has value for fire crews and other forest users. The societal benefits include the services that result from the access to sites on the Tonto National Forest (p. 30).
- Recreation and Off-Highway Vehicle Use: Participants describe recreation as the most prominent use of the Tonto National Forest and perceive these recreation uses are under-managed, especially some of the enforcement issues associated with recreational activities. Most participants acknowledge that motorized use is part of the multiple-use environment, but there is also recognition there are problems and issues associated with current uses. The most prominent theme about off-highway vehicle use concerns restrictions on use (p. 30 to 31).

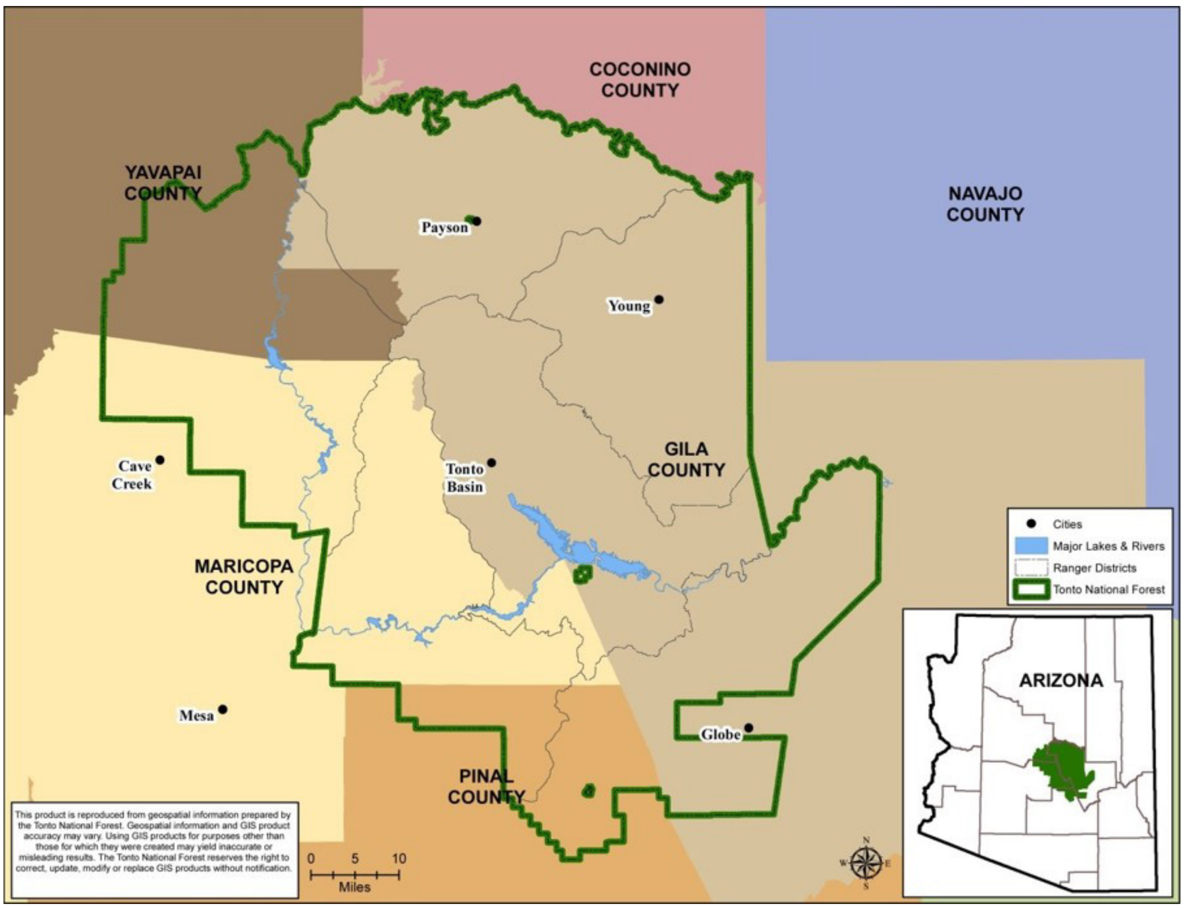

Figure 16. Map of the Tonto National Forest and the four-county area (Gila, Maricopa, Pinal, and Yavapai Counties)

Composition of Four-County Area

Figure 16 displays the four counties that overlap with the Tonto National Forest: Gila, Maricopa, Pinal, and Yavapai counties. Coconino County overlaps a few acres of the Tonto National Forest but is not considered in this analysis because the acres are too small to be meaningful.

Race

The racial distribution of the four-county area is shown in table 31 (Headwaters Economics 2018). Within this area, the greatest share of the population is in the white alone racial category at 79.3 percent. Of the four counties in this category, Yavapai County has the highest percentage at 92.0 percent. The lowest share of the population is in the Native Hawaiian and other Pacific Islander alone (0.2 percent) racial category. The four-county area white alone racial category is greater than the state average by less than 2 percent.

Table 31. Race of population for 2016 by county, including four-county area and Arizona

Population	Gila County, AZ	Maricopa County, AZ	Pinal County, AZ	Yavapai County, AZ	County Region	Arizona
Total Population, 2016[a]	53,179	4,088,549	397,604	218,586	4,757,918	6,809,946
Percent White alone	78.6	78.6	80.0	92.0	79.3	77.5
Percent Black or African American alone	0.6[b]	5.3	4.6	0.5	5.0	4.3
Percent American Indian alone	15.5	1.9	5.3	1.8	2.3	4.4
Percent Asian alone	0.8	3.8	1.8	0.9	3.5	3.1
Percent Native Hawaii and other Pacific Is. alone	0.0[c]	0.2	0.3[b]	0.0	0.2	0.2
Percent some other race alone	1.9[b]	6.9	5.1	2.6	6.5	7.0
Percent two or more races	2.6[b]	3.3	2.9	2.1	3.2	3.5
Percent Hispanic or Latino (of any race)	18.5	30.3	29.2	14.1	29.3	30.9

a - ACS 5-year estimates used. "2016" represents average characteristics from 2012 to 2016

b - Medium Reliability: Data with CVs between 12 and 40 percent are in orange to indicate that the values should be interpreted with caution.

c - Low Reliability: Data with CVs over 40 percent are displayed in red to indicate that the estimate is considered very unreliable.

Ethnicity

The ethnic distribution of the four-county area is shown in table 32 (Headwaters Economics 2018). Within this area, those that identified as Hispanic or Latino make up is 29.3 percent. It is important to note that Hispanics or Latinos can be of any race (as measured by the census, "Hispanic" is a cultural identity, and not a race). Of the four counties in this category, Maricopa County has the highest percentage at 92.0 percent, while Yavapai County has the lowest at 14.1 percent. The four-county area's Hispanic or Latino percentage is within about 1 percent of the state.

Table 32. Ethnicity of population for 2016 by county, including four-county area and Arizona

Population	Gila County, AZ	Maricopa County, AZ	Pinal County, AZ	Yavapai County, AZ	County Region	Arizona
Total Population, 2016[a]	53,179	4,088,549	397,604	218,586	4,757,918	6,809,946
Percent Hispanic or Latino (of any race)	18.5	30.3	29.2	14.1	29.3	30.9
Percent Not Hispanic or Latino	81.5	69.7	70.8	85.9	70.7	69.1

a - ACS 5-year estimates used. "2016" represents average characteristics from 2012 to 2016

Tribal

The Federal government has a unique legal and political relationship with Indian Tribal governments, established through and confirmed by the Constitution of the United States, treaties, statutes, executive orders, and judicial decisions. In recognition of that special relationship, the staff on the Tonto National Forest is charged with engaging in regular and meaningful consultation and collaboration with Tribal officials in the development of the revised forest plan[75].

The racial distribution of the four-county area is shown in table 33 and figure 17 (Headwaters Economics 2018). Within this area, those that identified as Native American make up is 2.3 percent, nearly all of this within the American Indian Tribes subgroup. The Arizona's Native American percentage is greater than the four-county area average by about 2 percent.

Table 33. Tribal Identification of population for 2016 by county, including four-county area and Arizona

Population	Gila County, AZ	Maricopa County, AZ	Pinal County, AZ	Yavapai County, AZ	County Region	Arizona
Total Population, 2016[a]	53,179	4,088,549	397,604	218,586	4,757,918	6,809,946
Percent Total Native American, 2016[a]	15.5	1.9	5.3	1.8	2.3	4.4
Percent American Indian Tribes	14.9	1.6	4.6	1.6	2.0	4.0
Percent Alaska Native Tribes	0.1[c]	0.0	0.0[c]	0.0[c]	0.0	0.0
Percent Non-Specified Tribes	0.1[c]	0.2	0.6[b]	0.1	0.2	0.3

a - ACS 5-year estimates used. "2016" represents average characteristics from 2012 to 2016

b - Medium Reliability: Data with CVs between 12 to 40 percent indicate that the values should be interpreted with caution.

c - Low Reliability: Data with CVs over 40 percent are displayed indicate that the estimate is considered very unreliable.

[75] While American Indian is one of the census categories for race, Tribal affiliation and the specific impacts of forest plan revision are detailed in the Tribal Relations and Areas of Tribal Importance section.

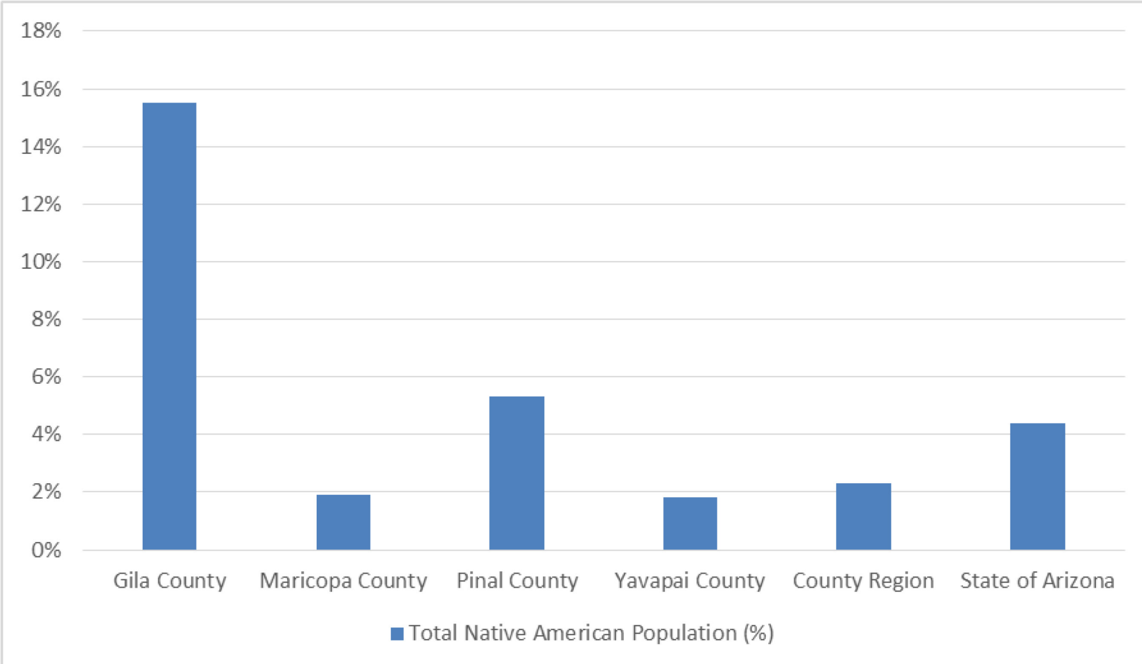

Figure 17. Percent Native American population by county, county region and statewide

Age Distribution

The age distribution of the four-county area is shown in table 34 (Headwaters Economics 2018). In the four-county area, the age distribution between the four age categories is nearly equal, with percentages similar to the state. However, in both Gila and Yavapai counties, the majority of the population is 60 years of age or older. In terms of the median age—one indicator of whether the population has gotten older or younger—all but Gila County the indicator increased. And while the age distribution for the separate counties and four-county area is similar to the state average, the median age change is not for three of the four counties.

Table 34. Age of population for 2016 by county, including four-county area and Arizona

Population	Gila County, AZ	Maricopa County, AZ	Pinal County, AZ	Yavapai County, AZ	County Region	Arizona
Total Population, 2016[a]	53,179	4,088,549	397,604	218,586	4,757,918	6,809,946
Percent 19 and under	22.34	27.67	26.55	19.58	27.15	26.58
Percent 20 to 39	18.06	27.72	25.77	17.63	26.99	26.77
Percent 40 to 59	25.38	25.46	23.49	25.06	25.28	24.59
Percent 60 and over	34.22	19.14	24.19	37.72	20.58	22.07
Percent Change in Median Age	-4.3[c]	5.0	7.3	7.9	not applicable	4.8

a - ACS 5-year estimates used. "2016" represents average characteristics from 2012 to 2016

b - From 2010 to 2016. ACS 5-year estimates used. "2016" represents average characteristics from 2012 to 2016; 2010 represents 2006 to 2010

c - Medium Reliability: Data with CVs between 12 and 40 percent are in orange to indicate that the values should be interpreted with caution.

Education

In terms of level of education achieved for the four-county area, almost a third of the population holds a bachelor’s degree or higher, as shown in table 35 (Headwaters Economics 2018). However, Gila and Pinal counties lag behind Maricopa and Yavapai counties when it comes to those with bachelor's degree or higher. Overall, the four-county area is on par with the state average for education.

Table 35. Education of population for 2016 by county, including four-county area and Arizona

Population	Gila County, AZ	Maricopa County, AZ	Pinal County, AZ	Yavapai County, AZ	County Region	Arizona
Total Population 25 years or older, 2016[a]	38,557	2,672,410	269,816	165,655	3,146,438	4,516,175
Percent No high school degree	15.7	13.1	15.1	9.8	13.1	13.5
Percent High school graduate	84.3	86.9	84.9	90.2	86.9	86.5
Percent Associates degree	9.1	8.5	9.4	9.5	8.6	8.6
Percent Bachelor's degree or higher	17.7	31.0	18.5	25.5	29.4	28.4
Percent Graduate or professional	6.9	11.2	6.6	10.0	10.7	10.7

a - ACS 5-year estimates used. "2016" represents average characteristics from 2012 to 2016

Language

For the four-county area, three-quarters of the population speak English only, as shown in table 36 (Headwaters Economics 2018). This amount is just two percent above the state average. For those speaking Spanish or Spanish Creole, the four-county area average is about one percent below the state average. Of note in this number is that both Gila and Yavapai counties are less than half of the four-county number, at 8.2 and 7.8 percent respectively. Additionally, while the four-county average for those that identified themselves as speaking English less than "very well" is similar to the national average, both Gila and Yavapai counties are less than half that number.

Table 36. Language of population for 2016 by county, including four-county area and Arizona

Population	Gila County, AZ	Maricopa County, AZ	Pinal County, AZ	Yavapai County, AZ	County Region	Arizona
Total Population 5 years or older, 2016[a]	50,143	3,812,399	372,539	209,135	4,444,216	6,375,189
Percent Speak only English	84.1	73.6	79.3	89.7	74.9	73.0
Percent Speak a language other than English	15.9	26.4	20.7	10.3	25.1	27.0
Percent Spanish or Spanish Creole	8.2	20.3	17.2	7.8	19.3	20.5
Percent Other Indo-European languages	1.1[b]	2.4	1.1	1.5	2.2	1.9
Percent Asian and Pacific Island languages	0.5[b]	2.5	1.2	0.5[b]	2.3	2.0
Percent Other languages	4.9	1.2	1.1	0.4[b]	1.2	2.2
Percent Speak English less than "very well"	4.2	9.3	6.5	3.8	8.7	8.9

a - ACS 5-year estimates used. "2016" represents average characteristics from 2012 to 2016

b - Medium Reliability: Data with CVs between 12 and 40 percent are in orange to indicate that the values should be interpreted with caution.

Income and Poverty

As shown in table 37, per capita income and median household income for three of the four counties are below the state average, with the exception of Maricopa County, which is $837 above for the median household income (Headwaters Economics 2018). In terms of poverty prevalence, only Gila County has a greater percent of people and families below the poverty level when compared to the state average (table 38 and figure 18) (Headwaters Economics 2018). When it comes to poverty as it relates to race, the majority of the population of the four-county that is in poverty is white alone, at 71.1 percent, which is almost four percent above the state average for this group (table 39) (Headwaters Economics 2018). Of note is that over a third of the American Indian population in Gila County is in poverty, over approximately 3.5 times the state average.

Table 37. Income of population for 2016 by county, including four-county area and Arizona

Income	Gila County, AZ	Maricopa County, AZ	Pinal County, AZ	Yavapai County, AZ	County Region	Arizona
Per Capita Income (2016)	$21,470	$28,791	$21,982	$26,584	N/A	$27,964
Median Household Income (2016)	$40,593	$55,676	$51,190	$46,638	N/A	$53,510

Table 38. Poverty prevalence of population for 2016 by county, including four-county area and Arizona

Population	Gila County, AZ	Maricopa County, AZ	Pinal County, AZ	Yavapai County, AZ	County Region	Arizona
People, 2016[a]	52,294	4,035,348	372,918	214,690	4,675,250	6,654,096
Families, 2016[a]	14,086	959,264	93,354	59,635	1,126,339	1,622,615
Percent People Below Poverty	21.2	16.5	16.5	14.7	16.5	17.0
Percent Families below poverty	14.3	12.1	11.8	9.7	12.0	12.3

a - ACS 5-year estimates used. "2016" represents average characteristics from 2012 to 2016

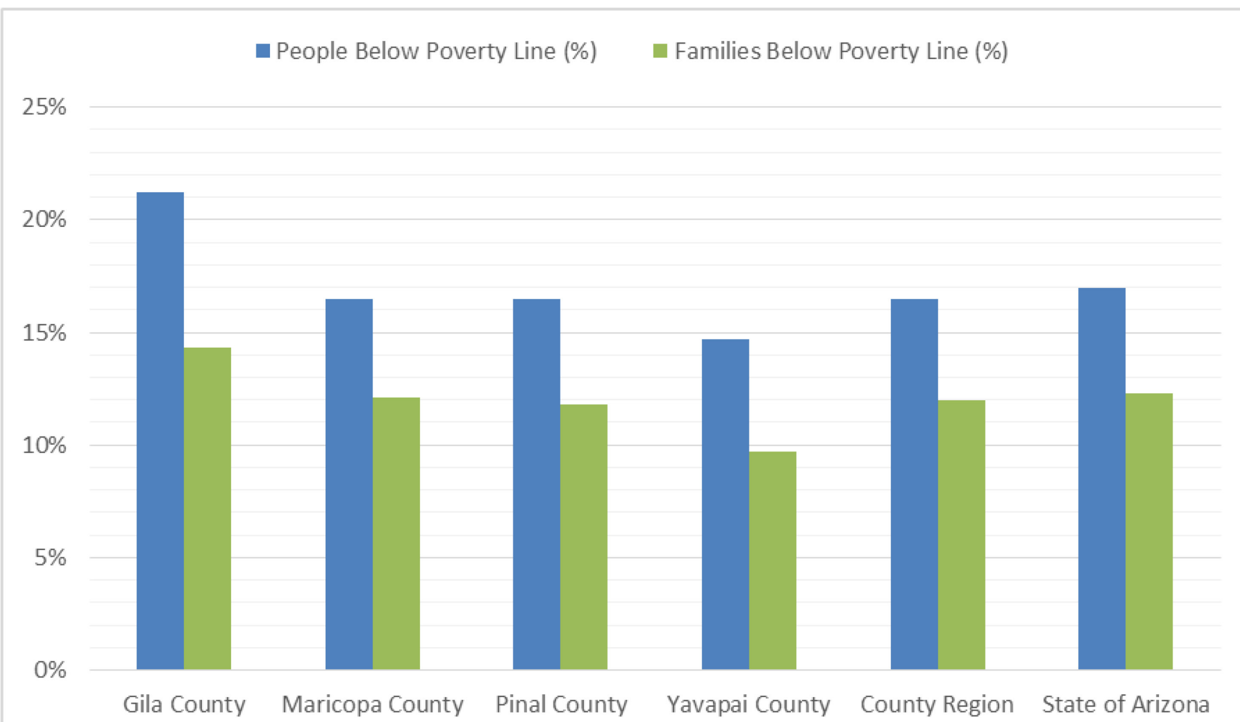

Figure 18. Percentage of people and families below the poverty line by county, county region, and statewide

Table 39. Poverty by race and ethnicity of population for 2016 by county, including four-county area and Arizona

Population	Gila County, AZ	Maricopa County, AZ	Pinal County, AZ	Yavapai County, AZ	County Region	Arizona
Total Population in Poverty, 2016 [a]	11,097	666,513	61,430	31,512	770,552	1,128,046
Percent White alone	58.2	70.5	72.5	86.6	71.1	67.7
Percent Black or African American alone	1.5 [c]	7.6	4.5 [b]	0.4 [b]	6.9	5.6
Percent American Indian alone	34.7	3.1	12.2	4.4 [b]	4.3	9.2
Percent Asian alone	0.1 [c]	3.1	1.3 [b]	0.6 [b]	2.8	2.4
Percent Native Hawaii and Other Pacific Is. alone	0.0 [c]	0.2 [b]	0.8 [b]	0.0	0.3 [a]	0.2
Percent some other race	1.8 [c]	12.2	5.8 [b]	5.9 [b]	11.3	11.0
Percent two or more races	3.8 [b]	3.4	2.9 [b]	2.1 [b]	3.3	3.8
Percent Hispanic or Latino (of any race)	21.8 [b]	51.1	37.4	25.6	48.6	45.6
Percent Not Hispanic or Latino (of any race)	41.5	33.8	43.7	67.7	36.1	36.0

a - ACS 5-year estimates used. "2016" represents average characteristics from 2012 to 2016

b - Medium Reliability: Data with CVs between 12 and 40 percent are in orange to indicate that the values should be interpreted with caution.

c - Low Reliability: Data with CVs over 40 percent are displayed in red to indicate that the estimate is considered very unreliable.

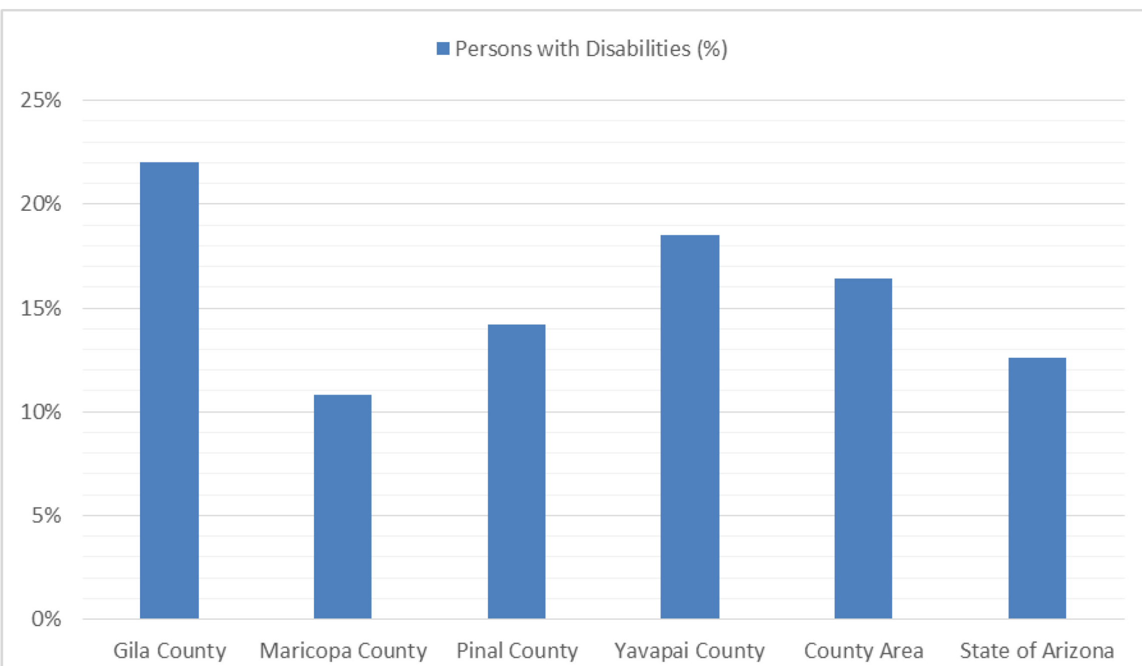

Figure 19. Percentage of persons with disabilities by county, county area, and statewide

Persons with Disabilities

In the state of Arizona for 2016, 12.6 percent of the total population identified that they had one or more disability (US Census Bureau 2018). For Gila County, the percentage of the population with disabilities is 22.0; for Maricopa County the percentage is 10.8; for Pinal the percentage is 14.2; and for Yavapai County the percentage is 18.5 (US Census Bureau 2018). The average for the four-county area based on the county percentages (US Census Bureau 2018) would be 16.4 percent (figure 19).

Composition of Forest Visitation

The National Visitor Use Monitoring program provides information about visitors to National Forest System lands at the national, regional, and forest level[76]. Once every five years, each national forest and grassland has a year of field data collection. For this survey, visitation is estimated through a combination of traffic counts and surveys of exiting visitors. Both are obtained on a random sample of locations and days distributed over an entire forest for a year. All of the surveyed recreation visitors are asked about their visit duration, activities, demographics, travel distance, and annual usage.

Race and Ethnicity

Of the 1,159 surveyed visitors to the Tonto National Forest, nearly 97 percent responded as white when asked what race[77] they were, as shown in table 40 (USDA Forest Service 2016). The other four race categories had response rates at or below 1.5 percent. In terms of ethnicity, 146 visitors indicated that they were Hispanic or Latino, 13.1 percent of national forest visits (USDA Forest Service 2016).

Table 40. Race of Tonto National Forest visitors for 2016

Race	Survey Respondents	Percent of National Forest Visits
American Indian / Alaskan Native	16	1.5
Asian	10	0.8
Black	13	1.1
Hawaiian / Pacific Islander	3	0.8
White	1,117	96.8

Based on those that surveyed visitors that indicated that wilderness was one of the “national forest site or area to participate in recreation activities”, 97.2 percent responded as white (table 41) (USDA Forest Service 2016). In terms of ethnicity, 15 wilderness visitors indicated that they were Hispanic or Latino, 5.6 percent (USDA Forest Service 2016).

[76] For more information about the National Visitor Use Monitoring program and trends associated with recreation, see the Recreation Report in the project record.
[77] Race and Ethnicity were asked as two separate questions on the survey.

Table 41. Race of Tonto National Forest wilderness visitors for 2016

Race	Survey Respondents	Percent Wilderness Site Visits
American Indian / Alaskan Native	3	1.1
Asian	2	1.6
Black	1	0.1
Hawaiian / Pacific Islander	1	0.2
White	283	97.2

Age Distribution

When looking at the age those surveyed visitors to the Tonto National Forest, nearly two-thirds of those surveyed are between 20 and 59 years old (table 42) (USDA Forest Service 2016). When looking at the age class of those 60 and over, the difference is nearly five times the percentage when compared to the same age class for national forest visits.

Table 42. Age class of Tonto National Forest visitors for 2016

Age Class	Percent National Forest Visits
19 and under	22.4
20 to 39	31.0
40 to 59	30.2
60 and over	16.4

For those surveyed visiting wilderness, the percentage for those ages 20 to 59 are similar to that of national forest visits. However, when looking at the age class for those (table 43) (USDA Forest Service 2016). When looking at the age class of those 60 and over, the difference is nearly double the percentage when compared to the same age class for national forest visits.

Table 43. Age class of Tonto National Forest wilderness visitors for 2016

Age Class	Percent Wilderness Site Visits
19 and under	11.8
20 to 39	31.1
40 to 59	28.1
60 and over	28.9

Income

Respondents to the forest visitation survey were asked to report a general category for their total annual household income, shown in table 44 (USDA Forest Service 2016). With the exception of those indicating their income was under $25,000 (8.1 percent of the total respondents) and $50,000 to $74,999 (23 percent), the percentages for all the other income categories are with three percent of each other. However, none of the difference in percentages, when taking the total number of survey respondents into consideration, between the different income brackets are substantially different from each other—the difference between the greatest percentage bracket and the least is still smaller than any of the other percentages.

Table 44. Annual house income of Tonto National Forest visitors for 2016

Annual Household Income	Percent National Forest Visits
Under $25,000	8.1

Annual Household Income	Percent National Forest Visits
$25,000 to $49,999	17.2
$50,000 to $74,999	23.0
$75,000 to $99,999	15.6
$100,000 to $149,999	17.8
$150,000 and up	18.2

Persons with Disabilities

For the Tonto National Forest, approximately seven percent of visitors identified that they had some form of disability (USDA Forest Service 2016).

Comparison of Four-County Area to Forest Visitation

Race and Ethnicity

Table 45 shows, in percentage, how racial composition of forest visitation for the Tonto National Forest (USDA Forest Service 2016) compares to that of the four-county area (Headwaters Economics 2018)[78]. While those identifying themselves as “white” for both surveys make up the majority, forest visitors in this category are nearly 20 percent great for those surveyed. In terms of those for visitors surveyed that indicated they were “white”, the percentage most closely represents Yavapai County residents. In terms of ethnicity, 29.3 of the four-county area identified as Hispanic or Latino (Headwaters Economics 2018)[79], as compared to 13.1 percent of national forest visits (USDA Forest Service 2016), over half as less as the four-county area.

Table 45. Comparison of race of four-county area to Tonto National Forest visitors for 2016

Race	Percent of Four-County Area	Percent of National Forest Visits
American Indian / Alaskan Native	2.3	1.5
Asian	3.5	0.8
Black	5.0	1.1
Hawaiian / Pacific Islander	0.2	0.8
White	79.3	96.8

Age Distribution

In terms of age comparison between the four-county area and forest visitors, the percentages represented are within plus/minus of 4 percent (table 46). When looking at the percentage of respondents 39 and under, both surveys show this group makes up the majority, with approximately 54 percent in the four-county area (Headwaters Economics 2018)[80] and 53 percent of forest visitors (USDA Forest Service 2016).

Table 46. Age class of Tonto National Forest visitors for 2016

Age Class	Percent of Four-County Area	Percent National Forest Visits
19 and under	27.2	22.4
20 to 39	27.0	31.0

[78] ACS 5-year estimates used. "2016" represents average characteristics from 2012-2016
[79] Ibid
[80] Ibid

Age Class	Percent of Four-County Area	Percent National Forest Visits
40 to 59	25.3	30.2
60 and over	20.6	16.4

Income

For income, there is no four-county area calculation. Instead, one can see where the income level indicated by forest visitor respondent is in relationship to the median household income for each county:

- For Gila County, the median falls in the $25,000 to $49,000 income category, which represents 17.2 percent of those surveyed.
- For Maricopa County, the median falls in the $50,000 to $74,999 income category, which is the slight majority income category at 23 percent.
- For Pinal County, it is in the same income category as Maricopa County.
- For Yavapai County, it is in the same income category as Gila County.

Persons with Disabilities

For the four-county area, the estimated average for the four-county area for persons with disabilities based on the county percentages (US Census Bureau 2018) would be 16.4 percent. For the Tonto National Forest, approximately seven percent of visitors identified that they had some form of disability (USDA Forest Service 2016). The forest visitor percentage of those with disabilities is less than half of those for the estimated four-county area. By county, it is less than third of the percentage for Gila County, less than half of the percentage for Pinal County, and less than 2.5 times the percent for Yavapai.

Other Demographic Indicators

Nothing in the National Visitor Use Monitoring survey provides for commiserate data that is part of the four-county area demographic composition for the following: Tribal affiliation specifics; education attainment; language and level of English-speaking proficiency; and poverty information by race and ethnicity.

Economic Contributions

Though not a requirement under the 2012 rule, job, and income estimates—a measure of the economic contribution of forest management—by alternative is an informative indicator of the economic impacts of different management alternatives on the local economy. This report provides this economic impact analysis. This analysis considers only the market transactions that result from activities on the Tonto National Forest. Numerous non-market social and economic values are associated with the Forest. The value of ecosystem services, such as, clean air and water, are not captured in the economic impact analysis. Therefore, this analysis should not be conflated with a representation of the total economic value of the Forest.

Table 47. Contribution of Tonto National Forest, by Forest Service Program Area, 2016

Program Area	Number of Jobs	Labor Income (thousands of 2016 dollars)
Recreation (non-wildlife and fish-related)	399	$14,792
Wildlife and Fish-related Recreation	106	$4,156
Grazing	530	$8,581
Timber	29	$2,004
Minerals	1,366	$96,228

Program Area	Number of Jobs	Labor Income (thousands of 2016 dollars)
Payments to States/Counties	179	$10,214
Forest Service Expenditures	626	$35,551
Total Forest Management	3,237	$171,526

Market transactions attributable to activities on the Tonto National Forest support an estimated 3,237 jobs and $172 million in labor income in the regional economy.[81] Table 47 displays the economic contribution of Tonto National Forest's activities by program area. Minerals-related program and Forest Service expenditures contribute the most to employment and labor income in the regional economy, supporting 1,366 and 626 jobs, and $96.2 and $35.5 million in labor income, respectively, on an average annual basis.

The estimation of jobs contributed by Forest Service program areas are distributed across sectors of the local economy (table 48). The two sectors with the most Tonto National Forest related employment are: mining and government; followed by accommodation and food services and retail trade. The latter two sectors are, in part, associated with the tourism economy, which is supported by the Tonto National Forest and other public and private lands in the study area. Relatively, the mining sector is the most reliant on Forest Service activities. Approximately 5.5 percent of employment and eight percent of labor income in the mining sector within the four-county analysis area is attributable to activities on the Tonto National Forest. This analysis includes the production of two copper mines, a third is scheduled to close in 2020 and not included in this analysis. Mining has an important history in the analysis area and additional copper production continues to be explored. All other sectors have minimal relative contribution from forest-related activities. This is in part due to the large metropolitan counties included in the analysis area. Forest related activities will be a smaller part of the regional economy in large metropolitan areas with the related economic activity. Less than one percent of employment and labor income in the analysis area is attributable to activities on the Tonto National Forest.

Calculating average contribution per job by dividing the total labor income by the total number of jobs suggests the average contributions of a grazing-related job is approximately $16,000 in labor income, minerals is $70,000, and a FS expenditure related jobs is $57,000. Jobs related to minerals and timber have the highest per job income and grazing-related jobs have the least, on average. Factors that may contribute to the differences in relative labor income include whether the job is seasonal or part-time or what education or skill level is required. Program areas with the greatest number of jobs, total income, or per job incomes may offer more economic contributions or more desirable employment to the local area.

Table 48. Contribution of the Tonto National Forest to number of jobs by sector and labor income in thousands of 2016 dollars

Sector	Number of Jobs Area Totals	Number of Forest Service-Related Jobs	Labor Income Area Totals	Forest Service-Related Labor Income
Agriculture (includes forestry)	16,606	415	$708,280	$4,155
Mining	10,957	604	$693,274	$56,422
Utilities	8,548	9	$1,273,369	$1,321
Construction	150,609	65	$7,086,974	$3,125
Manufacturing	135,736	23	$11,196,510	$1,370

[81] Generated using MIG, 2016.

Sector	Number of Jobs Area Totals	Number of Forest Service-Related Jobs	Labor Income Area Totals	Forest Service-Related Labor Income
Wholesale Trade	90,710	110	$7,824,337	$9,284
Transportation and Warehousing	280,051	90	$10,284,611	$4,324
Retail Trade	87,759	303	$4,581,453	$10,389
Information	46,487	25	$3,700,740	$1,925
Finance and Insurance	194,578	125	$12,394,436	$7,627
Real Estate and Rental and Leasing	164,269	107	$4,107,779	$2,861
Prof, Scientific, and Tech Services	198,083	210	$13,792,875	$10,278
Management of Companies	33,468	23	$3,009,868	$2,060
Admin, Waste Management and Removal Services	244,259	130	$10,044,592	$5,310
Educational Services	59,807	44	$2,469,145	$1,739
Health Care and Social Assistance	288,207	181	$17,279,219	$10,691
Arts, Entertainment, and Rec	57,748	63	$1,818,845	$1,625
Accommodation and Food Services	214,711	267	$5,207,295	$6,193
Other Services	158,709	114	$6,908,301	$5,024
Government	256,202	327	$18,042,184	$25,802
Total	2,697,505	3,237	142,424,088	171,526
Forest Service as Percent of Total	---	0.12 percent	---	0.12 percent

Comparison of Four-County Area Socio-economic Vulnerability to Ecological Changes

Economic sensitivity is relatively low for the economic impact area associated with the Tonto National Forest. Relative to other forests total employment and income from climate-sensitive forest resources (e.g., recreation, grazing, and timber) is high, but makes up a small share of total employment and income in the area. This is due to the presence of Maricopa County in the economic impact area. Grazing accounts for 33 percent of employment and 17 percent of labor income (see table 49). Recreation accounts for 65 percent of employment and 80 percent of labor income from climate-sensitive forest resources.

Table 49. Average annual total (direct, indirect and induced) employment and labor income contributed by National Forest and Grassland activities, by resource sector

	Climate- sensitive recreation	Grazing	Timber	Total – All activities	Percentage Total Employment
	Number / Percentage	Number / Percentage	Number / Percentage	Number	Percentage

Employment (Full- and part-time jobs)	747 / 65.1	379 / 33.0	20 / 1.7	1,147	0.05
Labor Income (thousands of 2012 dollars)	29,979 / 80.8	6,135 / 16.5	1,004 / 2.7	37,118	0.03

Climate-sensitive recreation on the Tonto National Forest is further broken down in table 50. Warm-weather activities account for the highest contributions to the forest with 415 jobs and $16,435,000 in labor income.

Table 50. Average annual total (direct, indirect and induced) employment and labor income contributed by climate-sensitive recreation on Tonto National Forest, by primary activity type

	Warm-weather activities	Wildlife activities	Gathering forest products	Water- based activities (not including fishing)
Employment (Full- and part-time jobs)	415	220	0	112
Labor Income (thousands of 2012 dollars)	16,435	9,112	-	4,432

Adaptive capacity is high for the counties that comprise the Tonto National Forest economic impact area. Green-shaded counties (higher ranks) indicates greater adaptive capacity measured by socio-economic variables. For each of the nine variables included in the index, each county's values are ranked against other counties in the region from lowest to highest. The ranked lists are then divided into quintiles; each county is assigned a quintile value (1 to 5) for each variable. The sum of these quintile values across the nine variables is the adaptive capacity index, with a minimum score of 9 indicating least adaptive capacity, and a maximum score of 45 indicating greatest adaptive capacity.

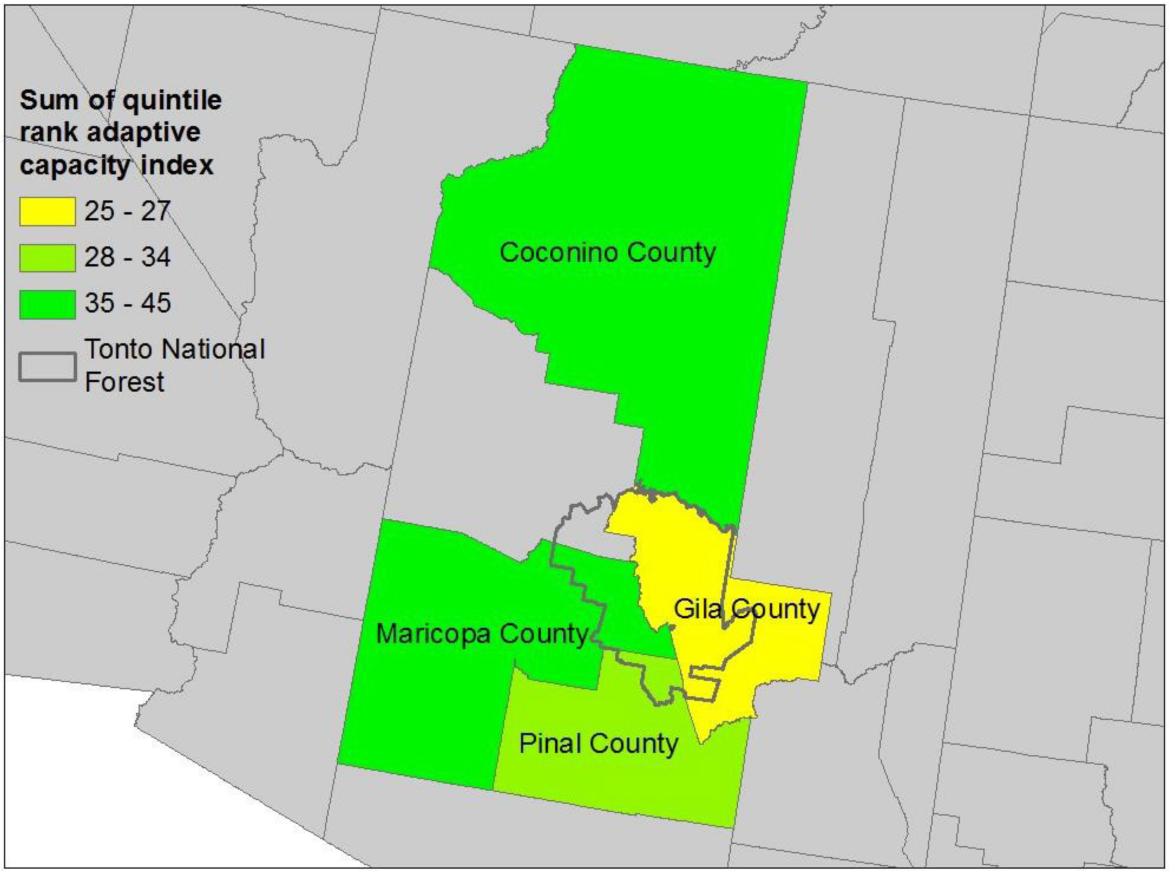

Figure 20. Adaptive capacity index for counties within the Tonto National Forest vulnerability impact area

Assumptions and Methods

Four-County Area Methodology

The Economic Profile System-Human Dimensions Toolkit (toolkit) was used to provide detailed socioeconomic reports for this project. This toolkit was designed by Headwaters Economics[82], an independent, nonprofit research group whose mission is to improve community development and land management decisions in the West. The Bureau of Land Management and Forest Service have made significant financial and intellectual contributions to the operation and content of the toolkit. The Economic Profile System-Human Dimensions Toolkit uses published statistics from Federal data sources, including Bureau of Economic Analysis and Bureau of the Census, U.S. Department of Commerce; and Bureau of Labor Statistics, U.S. Department of Labor. Data for measuring minority populations are primarily derived from the U.S. Census, American Community Survey, or other census surveys. The Forest Service uses the Economic Profile System–Human Dimension Toolkit (Headwaters Economics 2013) to collect and summarize needed demographic information. These reports compile demographic data specific to the plan project area, as identified by users from the National Visitor Use Monitoring survey (detailed later in this section), including data on minority status and ethnicity at various scales.

Using the Economic Profile System Analyst tool developed by Headwaters Economics, a socioeconomic profile was produced for the four counties that overlap with the Tonto National Forest: Gila, Maricopa, Pinal, and Yavapai counties that specifically outlined all of the demographic data—such as age, education,

[82] www.headwaterseconomics.org

and income within the four-county area—to use as a comparison to the data from the National Visitor Use Monitoring survey to determine the effects to these populations. Coconino County was initially consider for this analysis; however, based on the forest visitor survey, less than one percent of respondents indicated they were from a zip code within Coconino County.

Forest Visitation Methodology

In 1998 a team of research scientists and forest staff developed a recreation sampling (National Visitor Use Monitoring) system that provides statistical recreation use information at the forest, regional, and national level. Several Forest Service staff areas including recreation, wilderness, ecosystem management, research and strategic planning and resource assessment were involved in developing the program. From January 2000 through September 2003 every national forest implemented this methodology and collected visitor use information. This application served to test the method over the full range of forest conditions, and to provide a rough national estimate of visitation. Implementation of the improved method began in October 2004. Once every five years, each national forest and grassland has a year of field data collection.

In essence, visitation is estimated through a combination of traffic counts and surveys of exiting visitors. Both are obtained on a random sample of locations and days distributed over an entire forest for a year. All of the surveyed recreation visitors are asked about their visit duration, activities, demographics, travel distance, and annual usage. About one-third were also asked a series of questions about satisfaction. Another one-third were asked to provide information about their income, spending while on their trip, and the next best substitute for the visit.

Race and Ethnicity Data Assumptions

Overall, those Tonto National Forest visitors surveyed in the National Visitor Use Monitoring survey come from a small pool of actual visitors. In addition, there are many potential barriers to how the survey is written and administered and the locations of surveying that could result in the data being less representative of those visiting the Tonto National Forest. As a result, the most recent forest survey data are not equally representative of the four-county area statistics when it comes to determining race and ethnicity. Because of the limitations of the Forest survey and some of the date reliability issues with the US Census Bureau, one cannot determine if forest visitation is representative of the four-county area population. In absence of definitive data, it will be assumed that for these two demographic elements there is an equal representative correlation between forest visitors and the four-county population.

Age Distribution Data Assumptions

While the comparison of percentages by age between forest visitors surveyed and those in the four-county area are much more similar than they are for race and ethnicity, it will be assumed that for the age demographic element there is also an equal representative correlation between forest visitors and the four-county population.

Income Data Assumptions

Using the raw data from the forest visitation survey, a more accurate analysis could be done to determine exactly how those with Gila County zip codes identified their annual household income. However, since the differences between the difference income categories relatively small, even when taking into consideration the 8.1 percent that indicated their income was under $25,000, and the number of volume of respondents that make up the survey is overall quite small, it has been determined that no additional analysis of the visitation data will be done. In addition, it will be assumed that for the income demographic element there is also an equal representative correlation between Forest visitors and the four-county population.

Persons with Disabilities Data Assumptions

Since the forest visitor percentage of those with disabilities is less than half of those for the estimated four-county area, and with an even greater difference for three of the four counties in the four-county area, there is no equal representative correlation between Forest visitors and the four-county population. Even though there is a smaller percentage of persons with disabilities visiting the Forest, according to the visitation survey it will be assumed that visitation of this group is closer represented by the county percentages, which when averaged is nearly 20 percent of all visitors.

Socio-Economic Vulnerability to Ecological Changes Analysis

Information related to socio-economic vulnerability was derived from the Socioeconomic Vulnerability to Ecological Changes to National Forests and Grasslands in the Southwest (USDA Forest Service 2018c) and the Summary of Socioeconomic Vulnerability to Ecological Changes: Tonto National Forest (USDA Forest Service 2018d). This information included in these references is related to four counties in the area of analysis: Coconino County, Gila County, Maricopa County, and Pinal County. The rest of the environmental impact statement includes Yavapai County instead of Coconino County.

Maricopa County heavily weighs the economic impact analysis. The relatively high socio-economic ratings and high populations tend to prop up adaptive capacity, labor, and employment numbers.

Missing Information

As previously indicated, demographic composition data for the four-county area was not available for comparison to the forest visitation data in the following areas: Tribal affiliation specifics; education attainment; language and level of English-speaking proficiency; and poverty information by race and ethnicity. Because of this it will be assumed that the demographics for forest users in these categories will be identical to the data in the four-county area.

Environmental Effects

Alternatives and Plan Components

The following three revision actions and plan components have been chosen to answer the social population effects.

Recreation Site Development

As authorized by the Federal Lands Recreation Enhancement Act[83], the Forest Service may establish a fee that is "commensurate with the benefits and services provided to the visitor" (Section 6802(b)). These fees are often established for recreation sites that are developed as they offer multiple amenities for users. While nothing in this revision effort will result in changes or additions to the current recreational fees charged on the Tonto National Forest, it will be assumed that any actions that focus on more developed recreation could negatively impact those at lower income levels or in poverty.

In terms of developed recreation opportunities, research[84] has shown that Hispanics and Asians prefer larger developed recreation sites that can accommodate large family gatherings. For these populations, it

[83] Pub. L. 108–447, div. J, title VIII, §801(a), Dec. 8, 2004, 118 Stat. 3377
[84] Such as: Gramann *et al*. 1993; Carr and Williams 1993; Chavez 2001; Gobster 2002; Sasidharan 2004; and Thapa *et al.*, 2002

will be assumed that actions that allow for or encourage these types of recreation sites will have a beneficial effect, unless there is an additional income consideration with these groups, which will not be addressed in this analysis.

Motorized Access

Persons with disabilities can be directly impacted by Federal land management decisions that affect barrier-free facilities for recreation visitors as part of facility and service planning and development (USDA Forest Service 2016). For this analysis, any limitations on access to the forest itself and to recreation sites using a motor vehicle (i.e., passenger car, 4x4 vehicle, all-terrain vehicle, and utility vehicle), such as closing routes or decreasing maintenance level, will be assumed to impact persons with disabilities, especially those with mobility limitations (Burns and Graefe 2007; and Williams et al. 2004).

Forest Products

In small towns within and adjacent to the Tonto National Forest, some individuals and families depend on the ability to gather fuelwood or hunt game species as a means of subsistence. These people may also be those that are below the poverty level, although there is no current data to indicate this direct connection. Often, the gathering of fuelwood and the retrieval of game requires the use of a motorized vehicle. Currently, forest users are able to get a permit to collect fuelwood in designated areas within the Globe, Payson, Pleasant, and Tonto Basin Ranger Districts. In addition, the Arizona Game and Fish Department issues hunting permits; and on the Payson and Pleasant Valley Ranger Districts cross country travel is permitted, including for the retrieval of game.

Analysis by Plan Components

The following three revision actions and plan components are the ones that show a difference between the alternatives as they relate to the demographic populations addressed in this analysis:

Recreation Site Development

As authorized by the Federal Lands Recreation Enhancement Act[85], the Forest Service may establish a fee that is “commensurate with the benefits and services provided to the visitor” (Section 6802(b)). These fees are often established for recreation sites that are developed as they offer multiple amenities for users. While nothing in this revision effort will result in changes or additions to the current recreational fees charged on the Tonto National Forest, it will be assumed that any actions that focus on more developed recreation could negatively impact those at lower income levels or in poverty.

Furthermore, as previously indicated Hispanics and Asians who recreate on public land prefer larger developed recreation sites that can accommodate large family gatherings. For these populations, alternative D, which allows for or encourage these types of recreation sites would have a beneficial effect to these populations

Motorized Access

Persons with disabilities can be directly impacted by Federal land management decisions that affect barrier-free facilities for recreation visitors as part of facility and service planning and development (USDA Forest Service 2016). For this analysis, any limitations on access to the forest itself and to recreation sites using a motor vehicle (e.g., passenger car, 4x4 vehicle, all-terrain vehicle, and utility vehicle), such as closing routes or decreasing maintenance level, will be assumed to impact persons with disabilities, especially those with mobility limitations (Burns and Graefe 2007; and Williams et al. 2004).

[85] Pub. L. 108–447, div. J, title VIII, §801(a), Dec. 8, 2004, 118 Stat. 3377

Alternative C, which focuses on less developed recreation opportunities, including those for motorized access, could potentially negatively impact this population.

Forest Products

In small towns within and adjacent to the Tonto National Forest, some individuals and families depend on the ability to gather fuelwood or hunt game species as a means of subsistence. These people may also be those that are below the poverty level, although there is no current data to indicate this direct connection. Often, the gathering of fuelwood and the retrieval of game requires the use of a motorized vehicle. Currently, forest users are able to get a permit to collect fuelwood in designated areas within the Globe, Payson, Pleasant Valley, and Tonto Basin Ranger Districts. In addition, the Arizona Game and Fish Department issues hunting permits; and on the Payson and Pleasant Valley Ranger Districts cross country travel is permitted, including for the retrieval of game.

Effects by Alternative

Social Sustainability

This analysis attempts to provide an understanding of the effects from revising the current forest plan for the Tonto National Forest and the difference between the alternatives presented in the environmental impact statement.

Because the alternatives would not result in specific actions, they are not likely to result in any direct effects to social justice for those visiting the forest or four the four-county area adjacent to the forest.

The following effects analysis is spatially based within the four-county area as it applies to those county residents that visit the forest. While it is understood that people outside these four counties (Gila, Pinal, Maricopa, and Yavapai) visit the Tonto National Forest, the current forest visitation data does not permit a meaningful extrapolation for analysis outside this four-county area. In terms of the temporal scale of this analysis, fifteen years will be used per the National Forest Management Act directions to revise plans at least once every 15 years.

The 1985 forest plan is silent on any direction or focus for serving forest visitors that are unable to or struggle with comprehending written English. For the revised forest plan, a forestwide guideline is being proposed that will apply to all action alternatives: “In recreation areas popular with multilingual visitors, information should be provided in both English and other appropriate languages for multilingual interpretation” (REC-G-06). In addition, there is a forestwide developed recreation management approach which proposes to “Conduct and utilize accessibility assessments for compliance with Forest Service Outdoor Recreation Accessibility Guidelines and the Architectural Barriers Act on all developed recreation sites”. Based on this management direction being proposed, all the action alternatives have beneficial effects to races and ethnicities that may require non-English written communication and for person with disabilities using developed recreation sites across the forest.

Recreation Site Development

Alternative C has approximately 399,029 acres of recommended wilderness—areas where developed recreation sites would be prohibited or seriously restricted. This alternative also focuses on more primitive recreation opportunities across the forest. None of this would likely result in a great number of future recreational sites that would require a recreation fee. This would positively impact those at lower income levels or in poverty. However, from the perspective of Hispanic and Asian visitors that prefer larger developed recreation sites that can accommodate large family gatherings, this would have a potential negative impact if the current group cites can no longer meet the needs of this group. The opposite would be the case for alternative D, which has no recommended wilderness and focuses on developed recreation opportunities across the forest, especially in the Lakes and Rivers Management Area. While alternative B does have recommended wilderness, the amount is about 10 times less than in alternative C. This would likely mean that alternative B could still meet future needs of those seeking larger developed recreation sites. For alternative A, management areas that prohibit construction of large group sites would negatively impact Hispanics and Asians.

Overall, alternative D would have the greatest future potential to positively impact Hispanics and Asians. If these sites led to new or greater recreation fees, this would potentially have the greatest negative impact on those at lower income levels or in poverty. However, none of the effects related to recreation site development would result in disparate treatment, increase discrimination, have negative effects that may unfairly and inequitably impact this or other minority groups, or create disproportionate impacts specific to minority or low-income populations.

Additionally, those users that value recreation site development would find the greatest benefit from alternative D; while those that a more natural experience with less developed recreation would find the great benefit from alternative C.

Motorized Access

No alternative removes or changes current motorized access. However, in alternatives that decrease motorized access—those with recommended wilderness, proposed botanical areas, and proposed research natural areas—this could impact persons with disabilities that rely on motorized access across the forest. This is because future motorized access decisions could be limited or prohibited in a way that would negatively impact this group. In terms of the greatest impact, alternative C has the greatest acreage of recommended wilderness (399,029), which is nearly ten times greater than alternative B; alternative D has no recommended wilderness. Alternative B and C have the same proposed botanical and research natural areas. Overall, alternative C would have the greatest future potential to negatively impact persons with disabilities. However, none of the effects to persons with disabilities related to motorized access would result in disparate treatment, increase discrimination, have negative effects that may unfairly and inequitably impact this or other minority groups, or create disproportionate impacts specific to minority or low-income populations.

As with recreation site development, those users that value motorized access would find the greatest benefit from alternative D; while those that a more natural experience with less motorized access would find the great benefit from alternative C.

Forest Products

Nothing in the current plan (alternative A) or being proposed under any of the action alternatives would limit or prohibit collection of personal fuelwood or participation in legal hunting for someone with a state-issued hunting license. However, for persons with disabilities that rely on motorized access for hunting or fuelwood gathering, the effects would be the same as those in the previous section.

Economic Contributions

The 2012 Planning Rule refers to three types of Forest contributions that provide benefits to people and communities (FSH 1909.12, Chapter 10, Section 13). These include multiple uses, ecosystem services, and Forest infrastructure and operations. The Multiple Use Sustained Yield Act states specifically that “National forests…shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes” (16 USC 528). On National Forest System lands, multiple uses include recreation, range, timber, watersheds, and wildlife and fish.

This following analysis presents the likely economic consequences, in terms of jobs and income, of implementing the alternatives presented in chapter 2. This analysis considers only the market transactions that result from activities on the Tonto National Forest. Numerous non-market social and economic values are associated with the Forest. The value of ecosystem services, such as, clean air and water, are not captured in the economic impact analysis. Therefore, this analysis should not be conflated with a representation of the total economic value of the Forest.

Effects Common to All Alternatives

Under all alternatives, the population of the analysis area is expected to increase (although localized decreases may occur, particularly in more rural areas), and with it the number of Forest beneficiaries. As a result of this projected population increase, demand for Forest goods and services is expected to continue, but can also experience a localized decrease as population demographics change. For example, subsistence activities such as firewood gathering and hunting tend to decrease as income levels rise or age and physical ability changes. As newcomers to an area increase, there is the possibility that they may not share these more traditional ties to the Forest due to differing demographic characteristics or reason for residence—such could be the case for those who purchase a second 'summer' home adjacent to the Forest—it can be expected that other recreational or forest product use pressures will increase proportionately with the arrival and use of the Forest by individuals with differing demographics.

Across the nation, population growth in the wildland-urban interface is also a concern. The continues to remain true for the Tonto National Forest, as the adjacent metropolitan area continues to grow and some move closer to the forest to 'escape' suburban living. This pattern has the potential to increase fire suppression challenges in these wildland-urban areas. This could result in increased risk of adverse effects of uncharacteristic fire and strain the provision of fire management services and their associated effects.

Employment

Changes in income and jobs due to goods and services provided by the Forest can be assumed to affect economic conditions (Ng et al. 2015), resulting in changes to community or personal quality of life of Forest beneficiaries, including gain or loss of personal income, alteration in the ability of communities to continue traditional practices, changes in how well communities (especially small communities) can retain a stable population, and changes in how well community members can provide for their families and access essential products necessary for physical and psychological health.

Under all alternatives, number of jobs and labor income supported by activities on the Tonto National Forest would account for less than one percent of regional totals.

The estimated number of jobs by resource area and alternative are listed in table 51. Labor income in thousands of 2016 dollars estimated by program area, by alternative can be found in table 52.

Minerals

Copper, and related by-products, as well as gravel and sand and other materials will continue to be removed from the Tonto National Forest. While mineral production and associated revenues (and therefore actual economic impact) will fluctuate based on global market conditions and the lifecycle of the mine, this is outside the control of forest management. No quantitative variation in mineral production across alternatives is modeled.

Using 2016 revenues, mineral activities on the Tonto National Forest would support approximately 1,366 jobs (table 51) and $96 million in labor income, annually (table 52). Mineral program area provides significant economic contributions relative to other FS program areas, and on average these jobs pay relatively well. The mineral program contributes jobs, income, and raw materials to the local and national economy under all alternatives. Therefore, the mineral program contributes jobs, income, and raw materials to the local and national economy under all alternative. Qualitative discussion of recommended areas removed from mineral entry is described by alternative.

Table 51. Estimated number of jobs by program area, by alternative

Resource Area	Alternative A (current) estimated jobs	Alternative B estimated jobs	Alternative C estimated jobs	Alternative D estimated jobs
Recreation (non-wildlife and fish-related)	399	421	409	424
Wildlife and Fish-related Recreation	106	114	107	113
Grazing	530	530	530	530
Timber	29	62	50	69
Minerals	1,366	1,366	1,366	1,366
Payments to States/Counties	179	179	179	179
Forest Service Expenditures	626	626	626	626
Total Forest Management	3,237	3,298	3,267	3,309
Percent Change from Current	---	1.9	1.0	2.2

Source: Generated using Minnesota IMPLAN Group (MIG), 2016.

Table 52. Labor income in thousands of 2016 dollars estimated by program area, by alternative

Resource Area	Labor income contributed by alternative A (current)	Labor income contributed by alternative B	Labor income contributed by alternative C	Labor income contributed by alternative D
Recreation (non-wildlife and fish-related)	$14,792	$15,602	$15,151	$15,733
Wildlife and Fish-related Recreation	$4,156	$4,431	$4,157	$4,411
Grazing	$8,581	$8,581	$8,581	$8,581
Timber	$2,004	$3,487	$2,966	$3,839
Minerals	$96,228	$96,228	$96,228	$96,228
Payments to States/Counties	$10,214	$10,214	$10,214	$10,214
Forest Service Expenditures	$35,551	$35,551	$35,551	$35,551
Total Forest Management	$171,526	$174,094	$172,848	$174,556
Percent Change from Current	---	1.5	0.8	1.8

Source: Labor income contributed (in thousands of 2016 dollars); generated using Minnesota IMPLAN Group (MIG), 2016.

Payments to States/Counties

Payments to local governments are received through the Payments in Lieu of Taxes and Secure Rural Schools Act programs. Across all alternatives, these payments would support approximately 179 jobs and $10.2 million in labor income annually (table 51 and table 52). In addition to the total employment and labor income supported by these programs, they provide relatively high average labor income contribution on a per job basis—approximately $57,000. Payments in Lieu of Taxes and Secure Rural Schools Act programs offers local economic stability in the form of jobs and labor income.

Forest Expenditures

The Forest's operational expenditures contribute to economic activity in the communities that surround the Forest. Forest Service employees live in these communities and spend their income on housing, food, and a variety of other local goods and services. The Tonto National Forest's non-salary expenditures generate economic activity in businesses that supply goods and services to support Forest Service programs.

Across all alternatives, expenditures by Tonto National Forest, including salary and non-salary (e.g., field and office equipment and supplies, trail construction and range improvements) expenditures support approximately 626 jobs and $35.5 million in labor income in the local economy, annually (table 51 and table 52). This accounts for the second largest contribution to the local economy in terms of jobs and labor income relative to other program areas, and offers local economic stability both in number of jobs and total labor income.

Range

Actual use varies based on local forage and market conditions. Current authorized use averaged 191,369 animal unit months over the last four years, during which the forest experienced drought. Periods of drought are also expected to continue into the future. Current utilization supports 530 jobs and $8.5 million in labor income. Grazing related activities support jobs and labor income in the local economy, as well as supporting a way of life for analysis area residents. All the action alternatives would provide opportunities to graze livestock, benefitting area ranchers, ranching related industries, and sustaining traditional uses of the Forest.

Alternative A

Alternative A would continue Tonto National Forest management according to the 1985 plan. Management actions under alternative A are expected to support 3,237 jobs and approximately $171.5 million in labor income in the local economy (table 51 and table 52). The total contribution of jobs and labor income in alternative A is the lowest of all alternatives.

Recreation[86]

There are an estimated 2.6 million recreation visits to the Tonto National Forest annually; 17 percent of these visits originate outside of the local area. The expenditures of local and non-local visitors to the Tonto National Forest would support approximately 505 jobs and $18.9 million in labor income, annually. Alternative A provides the second lowest recreation-related contribution to the local economy in terms of jobs and labor income (table 53)[87]. However, since there is still a projected contribution, this alternative would benefit the economy of surrounding communities with jobs and income due to visitor expenditures, including lodging, meals, and other expenditures. Tonto National Forest resource specialists provided a range of estimates of changes in visitation across different activities. Table 53 reflects the average of these ranges aggregated into the categories used for the economic impact model.

[86] For a more detailed discussion regarding recreation trends, see the previous Recreation section in the environmental impact statement.

[87] Tonto National Forest resource specialists provided a range of estimates of changes in visitation across different activities. The numbers in this table reflect the average of these ranges aggregated into the categories used for the economic impact model.

Table 53. Estimated changes in recreation visitors, by alternative

Category	Alternative A	Alternative B	Alternative C	Alternative D
Recreation	No Change	5 percent	2 percent	6 percent
Wildlife-based recreation	No Change	7 percent	0 percent	6 percent

Timber

Table 54 provides the estimated annual forest product volumes available, by alternative[88]. Current annual forest product removal is 5,066 hundred cubic feet (CCF), annually (table 54)[89], the lowest removal rate of all alternatives. Forest product removal under this alternative would support 29 jobs and approximately $2 million in labor income in the local economy, annually. Alternative A provides the lowest level of timber-related jobs and total income. These estimated economic contributions, in terms of jobs and income, are fairly moderate compared with other Forest Service program areas. However, since there is still a projected contribution, this alternative would provide the potential for opportunities for the growth or development of local or regional timber and other forest products industries in the future.

Table 54. Estimated annual forest product volumes, by alternative (CCF = hundred cubic feet)

Forest Product	Alternative A (Current)	Alternative B	Alternative C	Alternative D
Harvest-Softwood Sawtimber (CCF)	600	3,100	2,200	3,700
Harvest-Softwood Pulp (CCF)	180	300	290	300
Fuelwood (CCF)	4,270	4,400	4,350	4,450
Poles (CCF)	7	12	11	12
Posts (CCF)	9	15	15	15
Total (CCF)	5,066	7,827	6,866	8,477

Alternative B

Management actions under alternative B are expected to support approximately 3,298 jobs and $174 million in labor income in the local economy (table 51; table 52). The contribution of jobs and labor income to the local economy due to Forest Service management activities in alternative B is estimated to be the second highest of all alternatives.

Recreation

Tonto National Forest visitation is estimated to increase under alternative B due to an adaptive management style to balance both motorized and nonmotorized recreation as well as improving desired conditions for each. Plan direction that increases potential visitation would benefit the economy of surrounding communities with jobs and income due to visitor expenditures, including lodging, meals and other expenditures. Plan direction in alternative B would support the second highest estimated recreation-related jobs (534 average annual) and labor income ($20 million, annually) to the local economy relative to other alternatives. However, since there is still a projected contribution, this alternative would benefit the economy of surrounding communities with jobs and income due to visitor expenditures, including lodging, meals and other expenditures. Ultimately, the differences between action alternatives are small and differences in actual visitation and expenditures could make these estimated differences negligible.

Range

While no variation in animal unit months is estimated across alternatives and therefore no changes in resulting jobs and income effects, plan components do differ across alternatives that would impact the

[88] Details of how these numbers were developed may be found in the timber suitability appendix.

[89] Tonto National Forest resource specialists provided a range of estimates of changes in visitation across different activities. The numbers in this table reflect the average of these ranges aggregated into the categories used for the economic impact model.

range program and possibly the resulting economic contribution or the well-being of the ranching community. Alternatives B and C have the potential to restrict pastures in allotments for riparian protection which could result in loss of animal unit months by allotments. Recommended research natural areas and botanical areas are not authorized for livestock grazing in alternative B and C. These changes affect the possible acres available for grazing, but not the total animal unit months. These plan components may decrease the well-being of some ranchers if areas previously grazed by their livestock are now unavailable. However, for the range program as a whole, this alternative would still provide the potential for opportunities for the growth or development of local or regional timber and other forest products industries in the future.

Timber

Objectives for mechanical vegetation treatments in alternative B increase the production of softwood sawtimber. This increased production would therefore increase local employment (50 jobs) and labor income ($2.9 million annually) and their effect related to timber activities on the Tonto National Forest relative to alternatives A and C. This increase in employment and labor income generated from timber and other forest product removal may cultivate opportunities for the growth or development of local or regional timber and other forest products industries within the plan area in the future.

Alternative C

Management actions under alternative C are expected to support approximately 1,090 jobs and $39.8 million in labor income in the local economy. This alternative supports the lowest estimated economic impact, in terms of jobs and labor income, in the local economy (table 51 and table 52).

Recreation

Tonto National Forest visitation is estimated to increase under alternative C, relative to alternative A, but is the lowest increase of action alternatives. Alternative C focuses on primitive recreation opportunities and increased protections to natural resources. This may result in a noticeable increase in nonmotorized recreation visitation levels. However, motorized recreation levels would likely decrease 10 to15 percent with additional limitations in place for motorized activities, which in turn could negatively impact local and regional businesses that depend on this recreation use.

Plan direction that increases potential visitation would benefit the economy of surrounding communities with jobs and income due to visitor expenditures, including lodging, meals, and other expenditures. Plan direction in alternative C would support the second lowest estimated recreation-related jobs (515 average annual) and labor income ($19 million, annually) to the local economy relative to other alternatives. Again, the differences between action alternatives are small and differences in actual visitation and expenditures could make these estimated differences negligible.

Range

The range consequences are the same as described for alternative B.

Timber

Because alternative C proposes increased protections to natural resources, this alternative would result in the lowest availability and removal of forest products and associated economic effects related to the timber industry of the action alternatives. Economic effects of forest product removal under alternative C would support an estimated 50 jobs and $3 million in labor income in the local economy annually. However, since there is still a projected contribution, this alternative would provide the potential for opportunities for the growth or development of local or regional timber and other forest products industries in the future, but at a slower rate than the other alternatives.

Alternative D

Management actions under alternative D are expected to support approximately 3,309 jobs and $174.5 million in labor income in the local economy. This alternative provides the largest economic contribution in terms of jobs and labor income impacts within the area of influence (table 51 and table 52). However, the estimated variation across alternatives is small and actual variation in resource use as well as changes in broad economic conditions will occur.

Recreation

Tonto National Forest visitation is estimated to have the largest increase under alternative D. Alternative D focuses on providing more accessible recreation opportunities to visitors and favors motorized recreation. Thus, it is estimated that motorized recreation would see a 10 to 15 percent increase in visitation. Overall, the estimated economic effects is highest in this alternative as it would support approximately 537 jobs and $20 million in labor income annually in the local economy.

Again, the estimated differences between action alternatives are small and differences in actual visitation and expenditures could make these estimated differences negligible.

Range

Plan components in alternative D could result in increasing the number of active allotments, increase the total animal unit months on the forest, and resulting in positive economic impacts to the local economy in terms of jobs and labor income. This increase is not estimated, but alternative D has the greatest potential economic contribution from range-related activities due to this increase in active allotments. This alternative would benefit the economy of surrounding communities with jobs and income due to visitor expenditures, including lodging, meals and other expenditures at the greatest and likely fastest rate of all the alternatives.

Timber

Alternative D has the highest overall forest product removal as a result of plan objectives. The resulting economic impact is greater than all other alternatives—supporting jobs (69, average annual) and labor income ($3.8 million annually) in the local economy. This alternative would provide the greatest potential for opportunities for the growth or development of local or regional timber and other forest products industries in the future and at the greatest rate over time.

Cumulative Effects

Social Sustainability

This cumulative effects analysis does not attempt to quantify the effects of past actions by adding up all prior actions on an action-by-action basis. In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current conditions (as detailed in the description of alternative A) as a proxy for the impacts of past and present actions. This is because existing conditions reflect the aggregate impact of all prior actions and natural events.

This analysis focuses on the cumulative impact of those reasonably foreseeable actions that are relevant in assessing the impacts of revising the forest plan. The temporal and spatial boundary for cumulative effects boundary is identical to the one for effects, because of the reliance of Census Bureau data for this analysis.

In terms of reasonably foreseeable future actions, this analysis has attempted to include projects for which upcoming actions are known and can be meaningfully analyzed. What will not be analyzed are projects that are inevitable and known, but which have not yet developed proposed actions. At this time, there are no projects in the cumulative effects temporal and spatial boundary that have impacts that have shown to result in disparate treatment, increase discrimination, have negative effects that may unfairly and inequitably impact this or other minority groups, or create disproportionate impacts specific to minority or low-income populations.

Thus, the cumulative effects of revising the Tonto National Forest's plan are the same as the effects detailed above since the four-county area reflects the similar demographic composition of those visiting the forest.

Economic Contributions

The timeframe for the economic cumulative effects analysis is the next 10 to 15 years, and the geographic scope for the economic cumulative effects analysis is the four-county region identified above. This analysis considers how past, present, and reasonably foreseeable future actions on lands throughout the region may interact with decisions made under the proposed plan to affect the economic environment. The economic analysis of the proposed plan is unique among the resources and uses in that the effects occur primarily off the forest. In this way, the indirect effects described above are cumulative in nature—they evaluate the role of Forest Service decisions under the proposed plan both on and off the Tonto National Forest. However, the indirect effects analysis does not address how actions taken on adjacent lands will affect the economic consequences of the forest plan.

The job and income estimates presented in this analysis are based on a static model of the economy. As such, it cannot accurately address natural fluctuations in adjacent employment and economic contributions of the forest. However, if additional economic opportunities, either on the forest or adjacent, the impact from these activities to occur under the proposed plan would increase. Conversely, if these opportunities leave the area, or if it becomes necessary to process greater amounts of timber, for example, outside of the analysis area the local economic impact of activities under the proposed plan would decrease.

Increased connection of lands across administrative boundaries would improve access to recreation opportunities and associated quality of life benefits. For instance, Arizona State Park's Statewide Comprehensive Outdoor Recreation Plan (2018) addresses management of land and water conservation, along with tourism and outdoor recreation, including multiple use of trails, wildlife-related, preservation of historic resources, and coordination with other agency, including Federal, State, county, and local government. Other counties and cities within the analysis area have similar goals to improve recreation and tourism that dovetail with recreation objectives proposed in this plan revision process and would support regional economic gains in recreation and tourism while also improving resident quality of life through improved access to opportunities for physical activity and the psychological benefits of experiencing nature.

In addition, forest products and other gatherable resources are available on Forest-adjacent Tribal, State, and Federal lands. These lands generate jobs and income related to timber and contribute to the overall timber economy of the analysis area and Arizona as a whole. Partnerships between adjacent Forest Service System units (such as the Four Forest Restoration Initiative) and multiple Forest stakeholder groups (such as adjacent Tribes and private landowners) have resulted in both economic benefits to the analysis area and social and ecological benefits which would contribute to moving ecosystems toward desired conditions and reducing fire hazards. Landscape-scale restoration efforts such as these would also reduce the risk of adverse impacts of fire on communities in the analysis area over the short-term through vegetation management like thinning. Over the long term, a return to natural fire regimes would reduce both fire risk and the financial and human toll of fire suppression and control on Federal, State, and Tribal governments.

Forest-adjacent communities also contribute to, support, and benefit from water resource quality and watershed maintenance performed on and around the Forest. As the Tonto National Forest was established for watershed protection purposes (see the Watershed and Water Resources in a following section of this environmental impact statement for more Information), these adjacent land's focus on water quality and the health of the watershed would increase the overall health of the greater landscape.

Landscape-scale restoration efforts like these contribute to the overall socioeconomic development of the analysis area. Economic support is provided in the form of decreased property, infrastructural, and business losses due to environmental disaster (i.e., catastrophic fires or drought) and provision of wood products, maintenance of recreational opportunities, improved forage and water resources for livestock grazing and agriculture; and social support in the form of ecosystem services that improve the quality of life of communities and individuals.

For Forest-dependent communities or those with significant cultural ties to the Forest, multi-agency and governmental efforts supporting landscape-scale restoration may improve quality of life through maintaining and restoring ecosystem services on the landscape and increasing Forest resiliency to disturbance. For instance, the Elders Council of the San Carlos developed Traditional Apache Resource Policy Statements (2006), which included the direction, for management of Tribal lands, that "All activities must ensure the long-term health of the natural world, especially emphasizing the prime importance of water." This policy statement focus on many land management desired conditions, including:

- Resilient landscape which supports healthy natural plant communities
- Plant composition returns to historic distribution and abundance
- Return to a fire return interval appropriate for the ecosystem or plant community
- Long-term health of natural water resources

In a project on both Tribal lands and the Tonto National forest—requested by the San Carlos Apache Tribe authorized under the Tribal Forest Protection Act—the Tribe stated their desired conditions for the two major watersheds that drain onto Tribal lands, indicating that:

> Both play an important role for the Tribe as both watersheds are within the Tribe's aboriginal homelands. The Tribe believes in managing our resources as close to the natural ecological process as possible. The Tribe's Integrated Resource Management Plan has a vision statement of restoring the land to Pre-Reservation conditions. Pre-reservation condition is used to describe a healthy ecosystem and used as a measuring stick for ecological health.

Projects such as this one that cumulatively impact lands across jurisdictional boundaries positively impact natural resources, which in turn increases the benefits to watersheds and water resources. Cumulatively, a sense of place and the resources needed for the continuation of cultural or spiritual traditions can be maintained into the future. Continued restoration efforts will likely improve quality of life for Forest-dependent communities over the long term, due to the support of these communities' values and traditions that can then continue to be passed down to the next generation. For communities and individuals who value these resources and whose culture is tied to the land, these cumulative policies promote broad acceptance and valuation of diverse cultural identities and preserve a sense of place important for intergenerational cultural exchange.

Environmental Justice

In 1994, President Clinton issues Executive Order 12898. This order directions Federal agencies to focus attention on the human health and environmental conditions in minority and low-income communities. The purpose of Executive Order 12898 is to identify and address, as appropriate, disproportionately high and adverse human health of environmental effects on minority and low-income populations. To capture this purpose, this report analyzes environmental justice as part of the potential social and economic impacts of the forest plan.

Environmental justice is the fair treatment and meaningful involvement of people of all races, cultures, and incomes, with respect to the development, implementation, and enforcement of laws, regulations, policies, programs, and activities. The 2012 Planning Rule requires forest plans to consider ways to reduce or eliminate adverse impacts to any environmental justice communities identified in the plan area.

An environmental justice community is a population of people or a community that meets the criterion for being considered either low-income or minority under Executive Order 12898. These populations are defined based on guidance from the Council on Environmental Quality:

- Minority population: Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater[90] than the minority population percentage in the general population or other appropriate unit of geographic analysis..."
- "Low-income population: Low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the Bureau of the Census' Current Population Reports, Series P-60 on Income and Poverty. In identifying low-income populations, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect."

In the context of forest planning, it is important to assess whether the forest plan and alternatives might affect how key social and economic benefits are currently distributed across populations. Specifically, the environmental justice mandate dictates that the Forest examine whether low-income and minority groups would be disproportionately deprived of these benefits or have more difficulty accessing these benefits compared to the populations as a whole.

Environmental Justice Communities

The demographic and poverty data presented in the Affected Environment (Race, Ethnicity, Income and Poverty, and Persons with Disabilities) describe the demographics of communities surrounding the Tonto National Forest. These data indicate that there is a concentration of minority and low-income populations within the analysis area.

The primary environmental justice communities identified are the Native American communities, persons with disabilities, and low-income communities of all races and ethnicities (table 55). These populations meet the definition of environmental justice communities outlined above as they have a meaningfully greater population in the analysis area than in the adjacent geographic areas. In this case, the analysis area and Arizona as a whole. In Gila and Pinal Counties the Native American population is between 1 and 11 percent greater than the rest of the analysis area population and between 3 and 12 percent greater than the

[90] "Identifying meaningfully greater populations means making efforts to measure the study area population in relation to the general area population. A difference of more than 5 perfect between the study area and the surrounding geographic area may indicate a minority population" (Grinspoon et al. 2014).

population of Native Americans in the whole state of Arizona (table 33 and figure 17). This makes these communities stand out in terms of having Native American populations that could be considered environmental justice communities. Communities with high populations of persons with one or more disabilities may also be considered an environmental justice population, particularly in Gila, Pinal, and Yavapai Counties (figure 19). Maricopa County, with its large population, falls well below the analysis area for persons with disabilities.

Table 55. Breakdown of potential environmental justice communities and why they might qualify as such

Community	Why they might qualify as an environmental justice community	County(ies) likely to have populations that might qualify as an environmental justice community
Native American	Minority demographic group with high populations and high instances of poverty compared to the analysis area as a whole and Arizona.	Gila and Pinal Counties
Persons with Disabilities (all races and ethnicities)	Minority population with high populations compared to Arizona as a whole.	Gila, Pinal, and Yavapai Counties
Low-income (all races and ethnicities)	Communities where the percent of individuals or families living below the poverty line is greater than that of the analysis area and Arizona as a whole.	Gila County

Communities were identified using the data in table 30, table 33 to table 35 and figure 17 to figure 19.

Although all of the counties in the analysis area had percentages of individuals and families in poverty, only Gila County had poverty levels higher than the state and stood out in the analysis area (table 38 and figure 18). All counties in the analysis area, except Maricopa County, had a median household income below the state level (table 37). All counties in the analysis area had minority populations that made up the low-income community distributions (table 39). However, 86.6 percent of the low-income communities of Yavapai County identified as white which is 19 percent higher than the state percentages.

Additionally, the Tribes with which the Tonto National Forest consults (table 30 and figure 15) are typically the majority racial group within their reservation boundaries. These minority populations meet the meaningfully greater Council on Environmental Quality guidelines for identifying a minority environmental justice population when considered in the context of the surrounding county lands (Grinspoon et al. 2014). Although not all of these Tribes reside within the analysis area, they all have historic, cultural, or spiritual ties to the forest and may experience disproportionate quality of life impacts due to management decisions and actions taken by the Tonto National Forest. Other minority ethnic or racial populations may also be affected by changes in the forest, but do not at present make up meaningful proportions of communities within the analysis area.

Methodology

Assumptions

Predicted impacts among alternatives with regard to minority or low-income environmental justice groups are not dramatically different. The bulk of these communities in the Tonto National Forest analysis area fall into the category of rural historic communities and federally recognized Tribes, impacts to whom are analyzed in the Tribal Uses and Cultural and Historic Resources sections. Other differences among alternatives concerning potential environmental justice groups are small because:

- All alternatives are expected to achieve desired conditions that contribute opportunity Native American communities in the proposed forest plan.
- When needed, projects implemented on the forest would require a site-specific analysis of their potential impacts to local low-income and Native American communities and the ability to access traditional uses important to their culture.
- None of the alternatives prohibit future site-specific project planning that contributes to the social, cultural, and economic opportunity.

Overall, the effects on environmental justice communities are not expected to be a primary driver in selecting one alternative over another.

Indicators

Disproportionately High or Adverse Impacts

The environmental justice examines disproportionately high or adverse health effects resulting from a community's environment. The Council on Environmental Quality has interpreted health effects with a broad definition: "Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian Tribes…when those impacts are interrelated to impacts on the natural or physical environment" (Council on Environmental Quality 1997).

Exposure Pathways

An exposure pathway is how an individual or community is exposed to a particular hazard. Exposures may be cumulative (e.g., low-level exposure over a long period of time leading to build up toxins in the system) or there may be multiple hazards a community is exposed to (e.g., water contamination and smoke inhalation). Identifying major exposure pathways for an environmental justice community can help understand what health effects they may be facing.

On the Tonto National Forest, the primary exposure communities may face is smoke due to wildland fire (managed and natural). Although smoke direction cannot be entirely controlled, in the event of prescribed fire treatments in the forest, Forest Service personnel can mitigate health hazards associated with smoke via communication with communities and timing of burns.

Community Ability to Participate in Plan Revision Process

Environmental justice communities may be less likely to be able to access public meetings or Forest Service materials due to factors such as lack of childcare, working multiple jobs, lack of transportation, linguistic barriers, etc. This could impede their representation in the forest plan revision process.

Environmental Consequences

Disproportionately High or Adverse Impacts

Effects Common to All Alternatives

Under all alternatives continued management of forest's ecosystems for ecological integrity; sustainable production of forest products; and health plant, fish, and wildlife populations will contribute to the resilience of Forest-dependent communities (ERU-DC-01, FP-DC-01, and WFP-DC-01). These contributions are important to some of Arizona's environmental justice communities for subsistence or cultural reasons, and will continue to help ensure these communities do not face adverse impacts due to lack of resources. Thus, the ongoing social and economic health of environmental just communities in the analysis area that rely on Forest resources is supported under all the alternatives. In addition, the Forest will continue to provide protection and access to areas of cultural and historic importance under all alternatives (TRB-DC-02), impacts to which have a disproportionate effect on minority communities.

Under all alternatives, the Forest will continue to provide opportunities for livestock grazing including transitory forage (GRZ-DC-01). The level or road and trail management activities does vary by alternative, thus the opportunity to access the forest may also vary by alternative. Proposed management areas, such as recommended wilderness, may also restrict future motorized access. However, current access is not expected to change greatly among alternatives. Furthermore, management approaches suggest communicating with Tribes and other users to maintain access to the Forest for traditional uses. These directions support continued access to the Forest for those who require motorized transport to benefit from the ecosystem services the Tonto National Forest supports.

Exposure Pathways

Effects Common to All Alternatives

Under all alternatives, the Forest Service complies with the state of Arizona and Federal ambient air quality standards (AQ-DC-01). Arizona's administrative code stipulates that all burners must comply with requirements of the Clean Air Act and Federal Regional Haze Rule, as well as all city and county ordinances relating to smoke management and vegetative burning practices.

Vegetation treatments to reduce fire risk would also occur under all alternatives, as would fire control operations by Forest Service personnel that protect quality of life for all communities. Variations in vegetation treatments may affect the magnitude of fire resilience in the Forest over the long-term, though, which may differentially impact the long-term quality of life of Forest beneficiaries.

Fire operations do not change by alternative. Under all alternatives, locations of prescribed burns are based on ecological factors (for example, does a particular area of forest need to burn in order to increase its health and return it to a natural fire regime?) and social factors (for example, is there a major risk to water supplies or lives if a wildfire were to burn in this area?).

Community Ability to Participate in Plan Revision Process

Effects Common to All Alternatives

Throughout the planning process from the development of the assessment, the recommended wilderness evaluation, the eligible wild and scenic rivers evaluation, to the forest plan and final environmental impact statement the Tonto National Forest continually provided opportunity for the general public to be involved in the process. Public meetings were throughout the process in the many small rural communities within and around the Forest, as well as in urban community centers. The forest advertised these meetings on local radio, television, and newspapers. Flyers were hung up at post officers, libraries, and other community buildings. The Forest had a Spanish translator available early in the process, and advertisements for some meetings were available in both English and Spanish. Due to lack of need, translation services were not continued at every meeting, but could be requested. During comment periods, paper comment forms were provided and maps were displayed at district offices and community buildings such as libraries to ensure those without computer or internet access could still participate in the process. Verbal comments at public meetings and mailed in comments were also considered, even outside of formal comment-request periods. This ensured that even those who could not make it to a meeting, or could not get a comment form, were still able to have their voices heard.

Throughout the planning process the Forest worked very closely with community leaders of land grants, grazing associations, Tribes, and local government officials to ensure the voices of the rural, traditional, and Tribal communities were represented in the planning process. Many of these communities have high proportions of members who identify with a minority ethnic or racial group (e.g., Hispanic or Latino, or Native American). Even members of these communities who may not identify with government categories of race or ethnicity have strong social, cultural, historical, and economic ties to the land the Tonto National Forest manages and are therefore considered particularly vulnerable to impacts due to forest planning, management, and decision-making.

Civil Rights Impact Analysis

Civil Rights Impact Analysis is an analytical process used to determine the scope, intensity, direction, duration, and significance of the effects of an agency's proposed employment and program policies, actions and decisions. It is Forest Service policy that the responsible official examines all proposed policy actions for civil rights impacts and takes one of the following actions[91]:

- Prepare a Civil Rights Impact Analysis and statement of its finding for any proposed policy, organizational action, or decisions which may have a major civil right impact or;
- Document the determination that a Civil Rights Impact Analysis and statement of findings are not needed.

This report analyzes the actions being proposed and for the revised forest plan in order to reveal any such negative effects that may unfairly and inequitably impact beneficiaries regarding program development, administration, and delivery. The objectives of this analysis are to prevent disparate treatment and minimize discrimination against minorities, women, and persons with disabilities and to ensure compliance with all civil rights statutes, Federal regulations, and USDA policies and procedures.

The analysis contained in the report has determined that, based on the guiding question—Are the distribution of potential harms and benefits related to the forest plan revision more prevalent for any identifiable subgroup than another?—the alternatives are not likely to result in civil rights impacts to Forest Service employees or customers of its programs. Also, based on the environmental justice analysis, the alternatives are not likely to result in disparate human health or environmental effects to minority, low-income, or Native American communities.

Furthermore, this analysis has demonstrated that a Civil Rights Impact Analysis is not required for the Tonto National Forest plan revision effort.

[91] Per Forest Service Manual 1730.3 Civil Rights Impacts-Policy

Forestry and Forest Products

Timber provides many ecosystem services on which humans and other life forms depend. At the most basic level, timber tree species convert sunlight and carbon dioxide into oxygen, carbohydrates and wood fiber. Timber tree species are also partially responsible for the formation of soils and soil stability, thermoregulation through shading and evaporative cooling, the cycling of nutrients and carbon, hydrologic cycling, and energy flow. Timbered areas provide habitat, food, and browse for a variety of animal species and humans, and fiber in the form of lumber, paper, fuelwood, and biomass. Especially important to humans are the social and cultural ecosystem services that timber provides to society: such as Christmas trees, botanical remedies, and aesthetics.

The ability to gather firewood for heating and cooking is important for many of the families and communities around the entire assessment area. Firewood gathering is often a family social event, but more importantly, firewood from the Tonto is how many people heat their homes at a large economic savings over propane, natural gas, and electricity. Other wood products that come off the Tonto National Forest, such as manzanita, novelty wood, and plant materials, are also important cultural and social products gathered from the forest. The Tonto has increased the number of forestry treatments it implements to improve forest health, reduce uncharacteristically severe wildfire, and make forest products more available.

Forest products include wood (timber, biomass, fuelwood) and special forest products. Special forest products include seed, Christmas trees and boughs, decorative tree or shrub limbs, manzanita, wildlings (e.g., transplanted trees, shrubs, or herbaceous plants), dry cones, mistletoe, agave and yucca stalks, post, poles, stays, novelty wood, burls and ceremonial products. National Forest System lands were reserved with the intent of providing goods, including production of a sustainable supply of forest products and services to satisfy public needs over the long term.

Affected Environment

The Tonto National Forest encompasses almost 3 million acres, predominantly comprised of dry semi-desert scrub, semi-desert grasslands, chaparral, piñon-juniper woodlands, and oak woodlands. Approximately 1.4 million acres (50 percent) are considered to be forested; the remaining 50 percent is classified as non-forest or water. Based on the tree species present, forestland can be further subdivided into two land categories: timberland and woodland. Timberland is forestland with mostly timber species typically used in the wood products industry, such as ponderosa pine and Douglas-fir. Woodland is forestland with mostly woodland species that often have a multi-stem growth form and are typically used for fuelwood and not for industrial wood products.

An annual inventory of Arizona's forests is conducted by the National Forest Inventory and Analysis program. Plot data were summarized using Forest Inventory Data Online standard reports from 2004 to 2013 inventory data (National Forest Inventory and Analysis website at http://www.fia.fs.usda.gov).

According to the analysis data, net standing tree volume on the Tonto consists of about 245 million cubic feet (MMCF) of woodland and timber species with an estimated 3.4 million cubic feet of growth from 2004 to 2013. These data also indicate average annual mortality of 6.4 MMCF of woodland and timber species on the forest. Timber species account for approximately 207 MMCF with an average mortality of 4.1 MMCF and woodland species account for approximately 38 MMCF with an average mortality of 2.3 MMCF. Mortality during this time period is greater than the growth by 3.0 MMCF. This can be attributed to overstocked stand conditions combined with drought and insect and disease outbreaks that occurred during this time.

The Tonto National Forest's 1985 forest plan (USDA Forest Service 1985a) provides timber resource direction that generally prescribes a sustained yield from scheduled harvesting, while considering other resource needs and the development and implementation of a fuelwood management program. In June 1996, the forest plan was amended to incorporate regional guidance for northern goshawk habitat and Mexican spotted owl recovery. As a result, the Tonto forestry program shifted emphasis from wood fiber production, using a scheduled harvest, to wildlife habitat management and restoration. This in combination with waning budgets and reduced forestry staffing, lead to the outputs, and accomplishments on the Tonto declining. Although projects and activities addressing hazardous fuel loading had been a part of the vegetation management approach since at least the 1980s, the 2000 National Fire Plan emphasized reducing the negative impacts of wildfires on communities and to restoring fire-adapted ecosystems to healthy conditions. The directive of the Tonto's forestry program was to further integrate with the wildlife, watershed, and fuels management programs, providing wood products as a byproduct of other management objectives rather than a primary objective.

General management objectives for the Tonto National Forest have largely focused on reducing fire hazard by reducing fuels and forest ecosystem restoration, which includes improving forest resilience, watershed condition, and wildlife habitat and providing wood products to local communities. Sale volume associated with these projects such as timber sales, commercial and personal use fuelwood sales, post and pole permits, and other convertible product sales averaged about 0.693 million cubic feet (MMCF) annually between fiscal year 2005 and fiscal year 2014. Fuelwood sales (personal and commercial) accounted for about 55 percent of the volume or an average of 0.382 MMCF annually during this 10-year period.

The Tonto National Forest also provides opportunities for the public to collect other forest products and special forest products under permit for permitted personal use. Other forest products and special forest products including seed, Christmas trees and boughs, decorative tree or shrub limbs, manzanita, wildlings (e.g., transplanted trees, shrubs, or herbaceous plants), dry cones, mistletoe, yucca stalks, post, poles, stays, novelty wood and burls will continue to be available to meet public demand in a manner that effectively contributes to watershed health and the restoration and maintenance of desired vegetation conditions.

The Four-Forest Restoration Initiative is a collaborative effort to restore forest ecosystems on portions of four national forests—Coconino, Kaibab, Apache-Sitgreaves, and Tonto—primarily along the Mogollon Rim in northern Arizona. The overall goal of the four-forest effort is to create landscape-scale restoration approaches that will provide for fuels reduction, forest health, and wildlife and plant diversity. A key objective is doing this while creating sustainable ecosystems in the long term. Business will play a key role in the effort by harvesting, processing, and selling wood products. This will reduce treatment costs and provide restoration-based work opportunities that will create good jobs. The Four-Forest Restoration Initiative will offer an opportunity for the Tonto National Forest to increase the current levels of treatment and wood products available in a sustainable fashion as it strives to achieve and maintain desired conditions.

Environmental Effects

Forest Products

All alternatives provide opportunities for the public to collect other forest products. Common forest products available to the public from the Tonto National Forest include sawlogs, fuelwood and special forest products including seed, Christmas trees and boughs, decorative tree or shrub limbs, manzanita, wildlings (e.g., transplanted trees, shrubs, or herbaceous plants), dry cones, mistletoe, agave and yucca stalks, post, poles, stays, novelty wood, burls and ceremonial products. Sawlogs and fuelwood can additionally be available as byproducts of forest restoration or forest fuels reduction projects for industrial use. Special forest products and ceremonial forest products are available to the public for personal and small business commercial use and can be collected either under the permit system or small commercial contracts.

In northern Arizona access to wood products continues to be an important component of the local social and economic fabric. Dead and down fuelwood harvest in particular is regarded as a traditional family activity and the Tonto National Forest is a major source of fuelwood for the many local residents who still rely on wood to heat their homes during the winter months. Dead and down fuelwood sales (personal and commercial) accounted for about 55 percent of the volume or an average of 0.382 million cubic feet (MMCF) between fiscal year 2005 and fiscal year 2014. Dead and down fuelwood volume in this environmental analysis is assumed constant, and is based on the above average volume removed (3.8 MMCF). This volume may vary in the future but is based on public demand.

The volume or quantity of special forest products and ceremonial forest products removed from the Tonto National Forest annually varies widely and is also based on public demand. Under all alternatives the Forest will continue to provide a sustainable supply to meet public demand in a manner that effectively contributes to watershed health and the restoration and maintenance of desired vegetation conditions. The availability of special forest products and ceremonial forest products for traditional Tribal uses does not vary among alternatives.

There would be potential negative impacts to watershed, soil, wildlife, vegetation, associated with all planned forest product removal that would be managed at the project level and in accordance with plan components for those resource areas. The majority of negative impacts from collection of dead down fuelwood, special forest products and ceremonial forest products such as soil compaction or wildlife disturbance would be short term and localized and do not differ between alternatives. Positive impacts would include moving resources toward desired conditions, maintaining forest structural stage distribution, improving forage availability for wildlife, or reducing risks from high intensity fire. Positive effects would also be highly localized and dispersed and do not differ among alternatives.

Timber Suitability

Timber production is the purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use (36 CFR 219.19). Lands determined to be suitable for timber production are areas identified as capable of producing a regular, periodic output of timber, maintained in perpetuity, without impairment of the productivity of the land or inconsistency with other land management direction. Timber production activities can contribute to social, economic, and ecological sustainability. Timber production may offset some or all of the costs of silvicultural treatments and other forest management activities that restore ecosystems to desired conditions, lower uncharacteristically severe fire and insect risk, increase understory plant diversity and abundance, and create employment opportunities.

The 1976 National Forest Management Act and subsequent 2012 Planning Rule set specific requirements regarding timber harvest. The 2012 Planning Rule requires an estimate of the sustained yield limit of timber that may be removed from the Tonto National Forest and has specific requirements for timber suitability analysis in land management plans (forest plans). It also requires that the forest plan contain direction as to the types of forest harvesting methods to be used and the size and location of timber harvests. Forest plans do not authorize any particular timber harvest, but merely identify what portions of the forest would be suitable for timber production on a regulated basis and what constraints might apply.

Note that there is a distinction between timber harvest as a resource use (that is, timber production) and timber harvest as a management tool to achieve desired conditions. Timber harvest on lands classified as not suitable for timber production may be used as a tool designed to achieve desired conditions or achieve other local management objectives. Criteria for suitability are defined in the 2012 Planning Rule procedures at 36 CFR 219.11 and Forest Service Handbook 1909.12, chapter 60. Data was developed using the latest data sources and requirements to match the criteria defined by resource specialists. A more detailed description of the timber suitability analysis can be found in Appendix B: Description of the Analysis Process, under "Timber Suitability Analysis and Planned Timber Sale Program." Table 56 and table 57 display a summary of the results for phase 1 and phase 2 of the process.

Table 56. Timber production suitability classification from phase 1

Land classification category	Acres
A. Total National Forest System lands in the plan area*	2,864,080
B. Lands not suited for timber production due to legal or technical reasons (including non-forested lands)	2,664,718
C. Lands that may be suited for timber production (A – B)	199,362

* This number reflects only National Forest System lands within the administrative boundary of the Tonto National Forest. All lands of other ownership have been removed, therefore there are fewer acres than land within the Tonto National Forest boundaries.

Table 57. Land classification summary for timber suitability from phase 2

Summary	Alternative A	Alternative B	Alternative C	Alternative D
D. Total lands suited for timber production (compatible with desired conditions and objectives)	189,295	188,851	184,224	189,517
E. Lands not suited for timber production (not compatible with desired conditions and objectives) (C – D)	10,067	10,511	15,138	9,845
F. Total Lands not suited for timber production (B+E)	2,674,785	2,675,299	2,679,856	2,674,563

Projected Timber and Wood Sale Quantity

The projected timber sale quantity is the estimated quantity of timber meeting applicable utilization standards[92] that is expected to be sold during the plan period. As a subset of the projected wood sale quantity, the projected timber sale quantity includes volume from timber harvest for any purpose from all lands in the plan area based on expected harvests that would be consistent with the plan components. The projected timber sale quantity is also based on the planning unit's fiscal capability and organizational capacity. Projected timber sale quantity is neither a target nor a limitation on harvest.

The estimated quantity of timber and all other wood products expected to be sold from the plan area for the plan period is called the projected wood sale quantity. The projected wood sale quantity consists of the projected timber sale quantity as well as other woody material such as fuelwood, firewood, or biomass also expected to be available for sale. The projected wood sale quantity includes volume from timber harvest for any purpose based on expected harvests that would be consistent with the plan components. The projected wood sale quantity is also based on the planning unit's fiscal capability and organizational capacity. The projected wood sale quantity is neither a target nor a limitation on harvest.

[92] The region 3 utilization standards were used for determining the sustained yield limit and projected timber sale quantity (PTSQ) and representing it in both cubic and board feet are: timber species 5 inches or more dbh, to a 4 inch minimum top dib for merchantable cubic feet volumes and timber species 9 inches or more dbh to a 6 inch minimum top dib for merchantable board feet volumes.

Although the National Forest Management Act provides that the plan period is at least every 15 years, it limits the sale of timber to less the sustained yield limit for each decade of the plan (16 U.S.C. 1611). Providing estimates in the plan of the annual projected wood sale quantity and the annual projected timber sale quantity for the each of first 2 decades aligns with the National Forest Management Act decadal periods limiting the sale of timber, and provides estimates to cover a second decade if revision of the plan is delayed beyond the 15-year limit. Should utilization standards change during the life of the plan, the same metrics used to calculate sustained yield limit, projected timber sale quantity and projected wood sale quantity will be used when tracking or comparing actual volumes sold to the sustained yield limit, projected timber sale quantity and projected wood sale quantity.

Planned treatment types and management levels were developed consistent with the theme and objectives for each alternative. Volumes for the projected timber sale quantity and projected wood sale quantity were calculated using a combination of outputs from the Vegetation Dynamics Development Tool and the Forest Vegetation Simulator. The Vegetation Dynamics Development Tool was used to project trends in the acres of vegetation in each state class for each ecological response unit under each alternative into the future. These were combined with regionally developed coefficients that relate acres treated to volume outputs by state class, treatment type, and vegetation community (ecological response unit) from the Forest Vegetation Simulator. Volumes were derived by multiplying the simulated harvest volumes per acre by the anticipated area treated (plan objectives for mechanical treatments). These estimates for output volumes are from the cutting of live trees only and are summarized in table 59 through table 62. A more detailed description of the projected timber sale quantity and projected wood sale quantity can be found in appendix B in the section Timber Suitability Analysis and Planned Timber Sale Program. The sustained yield limit is 37.0 million cubic feet (MMCF) per decade.

Dead and down fuelwood volumes are not included in the projected wood sale quantity. Dead and down fuelwood volume in this environmental analysis is assumed constant, and is based on the recent average volume removed (3,817,900 cubic feet per decade). That volume may vary in the future but is based on public demand. Total fuelwood volume by alternative (dead and down plus green fuelwood) is summarized in table 58 and includes a constant estimate of dead and down fuelwood (3.8 MMCF) plus projected green fuelwood which can be found in row D-Fuelwood in table 59 through table 62 which describe other non-industrial softwood fuelwood and hardwood fuelwood. Projected timber sale quantity and projected wood sale quantity expressed in millions of cubic feet (MMCF) for each alternative are summarized in table 59 through table 62.

Table 58. Total fuelwood volume per decade by alternative

Volume	Alt. A. Decade 1	Alt. A Decade 2	Alt. B Decade 1	Alt. B Decade 2	Alt. C Decade 1	Alt. C Decade 2	Alt. D Decade 1	Alt. D Decade 2
Fuelwood[1] (MMCF/decade)	4.27	4.32	4.44	4.46	4.35	4.37	4.45	4.46

1 - Includes a constant estimate of dead and down fuelwood (3.8 MMCF) plus projected green fuelwood which can be found in row D-Fuelwood in table 59 through table 62 which estimates other non-industrial softwood fuelwood and hardwood fuelwood.

Effects Common to all Alternatives

All alternatives have the potential for some level of timber harvest. All alternatives include mechanical treatment for fuels reduction, forest restoration, or both, any of which may produce commercial timber, small-diameter timber, biomass, or fuelwood as a by-product. All alternatives provide opportunities for the public to collect other forest products under permit and for permitted personal use.

Special forest products including seed, Christmas trees and boughs, decorative tree or shrub limbs, manzanita, wildlings (e.g., transplanted trees, shrubs, or herbaceous plants), dry cones, mistletoe, yucca stalks, post, poles, stays, novelty wood and burls will continue to be available under all alternatives. Treatments in piñon-juniper and juniper grass systems would create increased fuelwood availability and may ease access into these areas for the collection of special forest products like pinyon nuts. Under all alternatives the Forest will continue to provide a sustainable supply to meet public demand in a manner that effectively contributes to watershed health and the restoration and maintenance of desired vegetation conditions. Ceremonial products and other forest products will continue to be available for traditional communities and cultural activities under all alternatives. The availability of ceremonial and forest products for traditional Tribal uses does not vary among alternatives.

Timber harvest and other vegetation management activities may increase the potential availability of some special forest products. For example, group selection harvests combined with periodic selection or variable density thinning, would achieve restoration objectives, maintain habitat connectivity, and contribute a dependable flow of forest products to existing and prospective local economic infrastructure. Fuelwood may increase, either due to an increase in commercial firewood sales or as a byproduct of commercial timber sales, benefitting local citizens and recreational users at area campgrounds. Timber harvesting or non-commercial treatments would provide for an increased availability of sawtimber or other forest products that originate from small diameter stems.

The harvesting of timber or acquisition of other forest products benefits the economy and sustains important cultural and traditional uses. The removal of these products may also enhance ecological function in treated areas. Furthermore, the removal and use of some forest products would reduce competition for resources, ease drought stress, and increase the health and vigor of residual trees, leading to higher quality timber in the future. Removal of forest products used in construction can also lead to additional carbon sequestration. Commercial or noncommercial thinning can reduce existing insect or disease infestations or lessen the risk for these events in the future. Reduced overstory densities can result in better snowfall catchment and infiltration, promote grasses and forbs to protect soils from erosion and also to slow runoff and allow for more infiltration. However, the removal of forest products from the forest can also have negative implications ecologically, especially when removal involves using heavy machinery. Mechanized machinery used for commercial timber harvesting or non-commercial thinning can cause soil compaction, leading to reduced water infiltration rates, increased water runoff and soil erosion, and reduced soil productivity. Conversely, forest density reductions can result in better snowfall catchment and infiltration. Reduced density can promote grasses and forbs to protect soils from erosion and also to slow runoff to allow for more water infiltration. The use of mechanized machinery may also necessitate the reopening of or creation of new roads, leading to greater fragmentation of the landscape, which divides corridors for wildlife travel. Mechanical cutting practices may also negatively impact the aesthetic quality of an area in the short-term, yielding an un-natural appearance near areas of cuttings, however the implementation of best management practices would minimize short-term effects and result in long-term beneficial effects.

Forestwide, there is no substantial difference in the lands suitable for timber production across alternatives (all action alternatives have less than a three percent difference in suitable acres to alternative A). This is largely due to the fact that most recommended wilderness areas are located outside of timberlands. Therefore, the differences in acres of recommended wilderness areas by alternative would not have a substantial limitation on the availability of forest products or affect potential timber revenue on the Tonto National Forest, provided the suitable markets and industry are present.

All existing and recommended research natural areas, as well as designated and eligible wild and scenic rivers would have minimal effects on the availability of all forest products on the forest at large. Each of these management areas has standards and guidelines to protect or improve the resources they contain in their natural or existing states. As such, practices such as cutting trees are largely restricted unless under extreme or specific circumstances. As a result, they slightly lessen the availability of forest products evenly across all alternatives

Projected timber and wood sale quantity estimates for all alternatives for the first and second decades are well below the sustained yield limit of 37 million cubic feet (MMCF). This suggests that all alternatives are easily sustainable over the long-term, however the rate at which cutting would reduce the overstocked conditions on the forest vary by alternative and are described below.

Alternative A

Alternative A is the Tonto National Forest's current 1985 forest plan which emphasizes managing the timber resource to provide the full potential yield of quality timber on a sustained yield basis. Design of timber management activities are to integrate considerations for water quality, soils, wildlife habitat, recreation opportunities, scenery, and other values. The current plan also has direction to develop and implement a fuelwood management program for the Forest. Alternative A would continue to use an uneven-aged management approach consisting of group selection, single tree selection and thinning to complete restoration and fuels reduction treatments.

Wood products, including commercial timber, would continue to be removed from the forest at about the same rate as they have been during the last decade. The projected timber and wood sale quantity is estimated at 1.8 MMCF for the first decade and 2.6 MMCF for the second decade (table 59). The projected timber and wood sale quantity intensity of treatments under alternative A would be the least effective at reducing the overstocked conditions of the forest compared to all other alternatives. Furthermore this alternative would do little to encourage economic growth to the forest or to surrounding local communities through the sale of forest products – largely failing to provide for associated beneficial effects.

Table 59. Projected timber and wood sale quantity for alternative A

Timber Products[1] and other estimated wood products[2]	First Decade MMCF[1]	First Decade MMBF[1]	Second Decade MMCF	Second Decade MMBF
Lands suitable for timber production A1. Sawtimber	0.6	2.7	0.7	3.6
Lands suitable for timber production A2. Other products	0.08	NA	0.09	NA
Lands not suitable for timber production B1. Sawtimber	1.0	4.7	1.6	7.7
Lands not suitable for timber production B2. Other products	0.1	NA	0.1	NA
C. Projected timber sale quantity (A1+A2+B1+B2)	1.8	7.4	2.6	11.4
Other estimated wood products[2] D. Fuelwood	0.47	8,772 tons	0.52	9,689 tons
E. Projected wood sale quantity (C+D)	2.2	NA	3.1	NA

1 - Timber products include volumes other than salvage or sanitation volumes that meet timber product utilization standards, while other estimated wood products include fuelwood, biomass, and other volumes that do not meet timber product utilization standards. MMCF: Millions of cubic feet. MMBF: Millions of board feet.

2 - Fuelwood, biomass, and other volumes that do not meet timber product utilization standards.

Alternative A also includes plan components specifically for northern goshawks that direct the Forest to survey for and establish post-fledging family areas and nest areas. These areas are subject to guidelines that limit human disturbance during the breeding season (March 1 through September 30), provide for greater canopy cover and smaller opening size, and prioritize preferred treatment methods (e.g., prescribed burning). These guidelines are likely to constrain some types timber management activities in post-fledging family areas, limiting the availability of forest products. However, the need to inventory all suitable acres prior to treatment poses a large logistical challenge and may result in delays to implementing timber projects.

Alternative B

Alternative B was developed to respond to key issues identified in the assessment, needs to change, and public engagement. Alternative B includes plan direction that allows for adaptive management to address changing conditions while managing for sustainable multiple uses. Vegetation management would focus on restoring fire as a key ecosystem process in frequent-fire ecological response units, with a particular emphasis on forested frequent fire ecological response units. These forested frequent fire ecological response units make up the suitable timber base on the Tonto National Forest. This would be accomplished through a balance of mechanical treatments and wildland fire (wildfire and prescribed fire). Alternative B would use an uneven-aged management approach consisting of group selection, single tree selection and thinning to implement restoration and fuels reduction treatments.

Alternative B would result in a greater availability and production of forest products than alternative A. According to plan objectives for vegetation, alternative B's increased treatment objectives provide increased opportunities for timber production by focusing treatments in ponderosa pine forest, ponderosa pine-evergreen oak, and frequent fire-mixed conifer ecological response units. According to modeling estimates, projected timber and wood sale quantity is almost doubled in alternative B compared to alternative A (table 60). Further, in many overly stocked ponderosa pine-evergreen oak and mixed conifer forests treatments will supply numerous cords of fuelwood and bio-mass available to local industries. Alternative B also focuses treatments in woodland ecological response units such as pinyon juniper and juniper grass – increasing the availability and access to fuelwood and other important special forests products such as novelty wood and pinyon nuts.

Table 60. Projected timber and wood sale quantity for alternative B

Timber Products[1] and other estimated wood products[2]	First Decade MMCF[1]	First Decade MMBF[1]	Second Decade MMCF	Second Decade MMBF
Lands suitable for timber production A1. Sawtimber	0.9	4.8	1.0	5.3
Lands suitable for timber production A2. Other products	0.1	NA	0.1	NA
Lands not suitable for timber production B1. Sawtimber	2.2	10.6	2.9	14.2
Lands not suitable for timber production B2. Other products	0.2	NA	0.2	NA
C. Projected timber sale quantity (A1+A2+B1+B2)	3.4	15.4	4.2	19.6
Other estimated wood products[2] D. Fuelwood	0.64	11,982 tons	0.66	12,496 tons
E. Projected wood sale quantity (C+D)	4.1	NA	4.9	NA

1 - Timber products include volumes other than salvage or sanitation volumes that meet timber product utilization standards, while other estimated wood products include fuelwood, biomass, and other volumes that do not meet timber product utilization standards. MMCF: Millions of cubic feet. MMBF: Millions of board feet.

2 - Fuelwood, biomass, and other volumes that do not meet timber product utilization standards.

Alternative B does not includes plan components specifically for northern goshawks that direct the Forest to survey for and establish post-fledging family areas and nest areas. This can free up valuable resources that can be reallocated to meet the increased treatment objectives.

Based on the predicted harvesting levels, this alternative would do more to provide for a sustainable and increased product base than alternative A. Having a sustainable and increased product base may encourage more outlets for forest product utilization, increase jobs and boost the economy of nearby and regional communities.

Alternative C

Alternative C was developed in response to public comments that expressed a desire to reduce human impacts on the forest. This alternative emphasizes primitive recreation opportunities, increased protections to natural resources, use of natural processes for restoration and prioritizes natural resources over some economic development opportunities. Vegetation management in frequent-fire ecological response units relies on wildland fire as the primary restoration tool. Mechanical thinning would only be used in limited situations (e.g., wildland-urban interface areas or invasive species treatments). As a result, fewer commercial forest products would be available, and fewer suitable timber acres would be treated. While the acres suitable for timber production are not substantially different for alternative C compared to all other alternatives, the availability and quantity of forest products would be slightly greater than alternative A and much lower compared to alternatives B and D (table 61).

Table 61. Projected timber and wood sale quantity for alternative C

Timber Products[1] and other estimated wood products[2]	First Decade MMCF[1]	First Decade MMBF[1]	Second Decade MMCF	Second Decade MMBF
Lands suitable for timber production A1. Sawtimber	0.7	3.6	0.8	3.9
Lands suitable for timber production A2. Other products	0.1	NA	0.1	NA
Lands not suitable for timber production B1. Sawtimber	1.5	7.0	1.6	7.6
Lands not suitable for timber production B2. Other products	0.2	NA	0.2	NA
C. Projected timber sale quantity (A1+A2+B1+B2)	2.4	10.6	2.6	11.5
Other estimated wood products[2] D. Fuelwood	0.55	10,331 tons	0.57	10,714 tons
E. Projected wood sale quantity (C+D)	3.0	NA	3.2	NA

1 - Timber products include volumes other than salvage or sanitation volumes that meet timber product utilization standards, while other estimated wood products include fuelwood, biomass, and other volumes that do not meet timber product utilization standards. MMCF: Millions of cubic feet. MMBF: Millions of board feet.

2 - Fuelwood, biomass, and other volumes that do not meet timber product utilization standards.

Alternative C does not includes plan components specifically for northern goshawks that direct the Forest to survey for and establish post-fledging family areas and nest areas. Although this can free up valuable resources that can be reallocated to meet the increased forest objectives it would do little to increase the availability and quantity of forest products due to the focus on fire use over mechanical treatment.

Based on the predicted harvesting levels, this alternative would do little to provide for an increased product base. Additionally, some areas may require multiple entries before fire can be used as an effective management tool, thus similarly to alternative A, some areas may remain highly overstocked. The reduced harvesting levels and decreased product base would do little to encourage outlets for forest product utilization, job creation, or boost economic development of nearby and regional communities.

Alternative D

Alternative D was developed to address public comments that expressed a desire for easier access and multiple-use opportunities on the Tonto National Forest. Alternative D also emphasizes active restoration techniques to achieve desired conditions and provides for more economic opportunities on the forest including grazing and mining. Vegetation management in frequent-fire ecological response units focuses on restoring conditions primarily through mechanical treatments and focuses on increasing the supply of forest products. Prescribed burning is mainly focused in areas that have been previously thinned, and there would be fewer opportunities to use wildfires to meet resource objectives.

Alternative D maximizes the use and availability of forest products, and would be the most effective alternative to support existing forest product industries in the region, as well as have the potential to spur the creation of new business opportunities. Also, this alternative increases forest access and creates opportunities for the acquisition of forest products to a greater degree than all other alternatives. With Plan objectives for a high number of forest acres to be treated with mechanical methods, the projected availability of forest products is the highest of all alternatives. Projected timber and wood sale quantity levels are the highest in this alternative at 4.7 million cubic feet (MMCF) the first decade and 5 MMCF the second decade (table 62). However, the extensive use and frequency of mechanical treatments would likely have short-term negative impacts to the treated land and lands within close proximity including soil compaction, leading to reduced water infiltration rates, increased water runoff and soil erosion, reduced soil productivity and reduced aesthetic quality of an area.

Table 62. Projected timber and wood sale quantity for alternative D

Timber Products[1] and other estimated wood products[2]	First Decade MMCF[1]	First Decade MMBF[1]	Second Decade MMCF	Second Decade MMBF
Lands suitable for timber production A1. Sawtimber	1.0	5.2	1.0	5.2
Lands suitable for timber production A2. Other products	0.1	NA	0.1	NA
Lands not suitable for timber production B1. Sawtimber	2.7	13.4	3.0	15.0
Lands not suitable for timber production B2. Other products	0.2	NA	0.2	NA
C. Projected timber sale quantity (A1+A2+B1+B2)	4.0	18.6	4.3	20.2
Other estimated wood products[2] D. Fuelwood	0.65	12,217	0.66	12,388
E. Projected wood sale quantity (C+D)	4.7	NA	5.0	NA

1 - Timber products include volumes other than salvage or sanitation volumes that meet timber product utilization standards, while other estimated wood products include fuelwood, biomass, and other volumes that do not meet timber product utilization standards. MMCF: Millions of cubic feet. MMBF: Millions of board feet.

2 - Fuelwood, biomass, and other volumes that do not meet timber product utilization standards.

Similar to alternative A, this alternative would include guidelines that direct the Forest to identify post-fledging family areas and nest areas for northern goshawks. The alternative also includes specific desired conditions for vegetation post-fledging family areas and direction to minimize human presence in these areas during the breeding season. These constraints would likely impact the availability of forest products in post-fledging family areas during the breeding season (March 1 through September 30) by restricting timber management activities. In addition, these guidelines require inventory all suitable acres of prior to treatment; such management is likely to have a large logistical impact on vegetation management.

Cumulative Effects

The cumulative effects analysis timeframe for the forest products analysis is the next 10 to 15 years (expected lifespan of the Tonto National Forest Land Management Plan), for all lands within the forest boundary and on any adjacent lands regardless of ownership.

Forest products are available on nearby Tribal lands, state lands, government lands (for example, the USDI Bureau of Land Management) and adjacent national forests (Coconino, Apache-Sitgreaves, and Prescott National Forests) to varying extents. All neighboring forests have recently revised their forest plans and have similar desired conditions to the Tonto National Forest for forested and woodland ecological response units, and have plan objectives to incorporate uneven-aged silviculture and fire treatments to return natural conditions and function to ecosystems. Like the timberlands on the Tonto, these neighboring National Forests timberlands would also generate jobs and income associated with their projected timber and wood sale quantity outputs. Nearby Tribes also contribute to the forest product industry and help conduct fuel reduction treatments on the forest and their adjoining lands. There are a number of ongoing efforts aimed to generate forest products while maintaining or moving these ecosystems toward desired conditions that contribute to the social, economic, and ecological conditions across the cumulative effects area. The Four Forest Restoration Initiative is an ongoing collaboration with a diverse group of stakeholders to carry out landscape-scale restoration of the ponderosa pine forests in northern Arizona across the Kaibab, Coconino, Apache-Sitgreaves, and Tonto National forests. The overall goals of the Four Forest Restoration Initiative (4FRI) are to restore the structure, pattern, composition, functions, and health of fire-adapted ponderosa pine ecosystems, reduce fuels and the risk of unnaturally severe wildfires, and provide for wildlife and plant diversity. In addition to creating sustainable ecosystems, one of the key objectives is creating and developing sustainable industries. It is crucial to have appropriately-scaled businesses to harvest, process, and sell wood products. The restoration-based work opportunities are expected to create a variety of jobs across northern Arizona.

At least in the short term, the availability of forest products and opportunities for collection are likely to remain similar to current conditions or increase slightly, and cumulative effects from surrounding areas are likely to be minor. Though, as populations increase, more stress may be placed on the Tonto National Forest to meet the demands of people and industry. By having forest products available on adjacent lands, the impact and dependence on the Tonto National Forest for these products would be lessened.

The increased availability of small diameter timber and biomass combined with the potential increase associated with the revised forest plans of neighboring Forests has the potential to exceed the capacity of the current forest products industry in the future. This increased product base may encourage more outlets for forest product utilization, increase jobs and boost the economy of nearby and regional communities. If industrial capacity is increased and there are more commercial uses for forest products, then restoration activities will produce revenues. If industrial capacity remains insufficient, then these activities will remain as costs and the current over-supply of wood products will continue. This could jeopardize the Tonto National Forest’s ability to meet maximum treatment acreage objective each year. Should that happen, then return cutting cycles could be missed and uneven-aged management strategies would suffer delayed attainment of desired conditions as a negative consequence. If mechanical treatments are not viable, prescribed fire is the only other effective treatment. More use of prescribed fire than originally planned for the chosen alternative could be needed as a primary tree thinning method. That would provide its’ own consequences of increased smoke outputs, as well as less management control over tree thinning to create/maintain an even progression of age/size classes needed for sustainability.

Scenery

This section addresses the potential impacts associated with revising the 1985 Tonto National Forest Land and Resource Plan as it relates to scenery.

National Forest System lands adjacent and visible to communities provide a sense of place, contribute to the identity of communities, and provide an integral component of forest settings. It is important to manage scenic resources to ensure quality sightseeing and other recreation opportunities, as well as maintain natural landscapes for communities adjacent to the Forest. Scenic resource values are important elements of the Forest's distinctive roles and contributions. High quality scenery, especially scenery with natural-appearing landscapes, enhances people's lives and benefits society (USDA Forest Service 1995).

Scenic character is defined as the combination of physical, biological, and cultural images that gives an area its scenic identity and contributes to its sense of place. It provides a frame of reference from which to determine scenic attractiveness and to measure scenic integrity (36 CFR 219.9).

The scenery management system (SMS) was completed for the Tonto National Forest in January 2020, which was after the draft forest plan and draft environmental impact statement were released for public comment, and will replace the visual management system (VMS) in all alternatives (see volume 4 for more details). The scenery management system is used to measure the impact of human modification on the forest, as well as determine the relative value of natural and scenic areas. The scenery management system requires the identification of scenic components as they relate to people, mapping these components and assigning a value for aesthetics. The crosswalk from scenic integrity objectives and public perception of scenery are outlined in table 63 (USDA Forest Service 1995, 2 to 4).

Table 63. Scenic integrity objective and public perceptions of scenery

Scenic Integrity Objective (Alternatives B, C, and D)	Public Perceptions of Scenery
Very High	Unaltered; scenic character is intact; naturally evolving
High	Appears Unaltered; alterations to scenic character may be present but are not evident; naturally appearing
Moderate	Slightly altered; alterations are subordinate to scenic character being viewed (scenic character is dominant, not the alteration); relatively naturally appearing
Low	Moderately altered; alterations begin to dominate the valued scenic character being viewed.
Very Low	Heavily altered; alterations may strongly dominate the valued scenic character

Affected Environment

Managing for scenic quality benefits the local and regional economy of the greater area surrounding the Tonto National Forest. The Tonto is a recreation destination for Arizona residents as well as visitors from neighboring states. It is important to manage the scenic resources to ensure a quality sightseeing experience for the public. Scenery is an integral component of all national forest settings, and contributes to the quality of visitor experiences.

On the Tonto National Forest, visitors enjoy unique scenery through diverse and natural vegetation, landforms, and waterbodies (including wild and scenic rivers). Various scenic landscapes can be experienced in every way of using the forest.

The State Scenic Highways that intersect the Tonto National Forest include: Desert to Tall Pines Scenic Road (State Route 288), Apache Trail Historic Road (State Route 88), Gila - Pinal Scenic Road (U.S. 60), and the Copper Corridor Scenic Road East and West (State Route 177). These routes are managed for the scenic values for which they were designated and traverse the majority of the forest.

Nonmotorized recreationists may experience the Forest's scenery on the nearly 1,000 miles of forest service trails and on three nationally designated trails: including the Arizona National Scenic Trail, Highline National Recreation Trail, and Six Shooter Canyon National Recreation Trail. Motorized and nonmotorized recreationists may enjoy the scenery from the Great Western Millennium Trail and other opportunities throughout the forest.

Many parts of the Tonto National Forest, including most wilderness areas, are still naturally evolving landscapes with limited human intervention. Since implementation of the 1985 forest plan the existing scenic character of some areas outside wilderness has been altered by natural processes and human activities. Past natural processes that have occurred on the Tonto include wildfire, insect and disease infestation, and effects from climate change. Human activities include forest restoration projects, livestock grazing, mining, installation and maintenance of public utilities, highway expansion, expanding recreation opportunities, and illegal activities (i.e., dumping, vandalism, and cross-country travel). Both natural and human processes alter the landscape and affect scenic quality. A few of these impacts are described below.

- Past minor wildfires on the Tonto National Forest have typically been positive elements that have contributed to the Forest's natural scenic character, patterns, and diversity in the long term while uncharacteristic wildfires have dramatically altered the scenic quality for many years due to the time needed for the landscape to recover, especially in the Sonoran desert. Several large wildland fires have occurred on Payson and Pleasant Valley Ranger Districts including the Dude, Rodeo-Chediski, and Willow Fires along with the Cave Creek Complex, Bush, and Woodbury Fires on the Cave Creek, Globe, Mesa, and Tonto Basin Ranger Districts.
- All vegetation types on the Tonto have incurred extensive damage by one or more insect and disease agents. Infestations include bark beetles and dwarf mistletoe. Dwarf mistletoe has been the most prevalent disease, most commonly affecting the northern portions of the Tonto in commercial areas, although the infestation has been less severe than other national forests. The damaged vegetation or loss of vegetation has decreased the quality of scenic character.
- Higher temperatures and less moisture caused by climate change has increased the likelihood of drought, wildfire, and insect and disease infestations; the most vulnerable vegetation types are in the northern districts. The result has been damage to vegetation, vegetation loss, and damage to landforms, creating a negative impact on scenic quality.
- Grazing is yearlong on the Tonto National Forest, although cattle are rotated to different parts of the Tonto so vegetation can recover. In spite of this, the greatest negative impact on scenery has been grazing in the Sonoran desert and riparian areas due to erosion along with damage to, or removal of, vegetation and landforms. These impacts have reduced the quality of scenic character and are likely to continue.
- Scenic quality is one of the resources most negatively impacted by mineral exploration and development. There are over 20 mining districts on the Tonto National Forest with Globe-Miami District being the most active. This area, called the Copper Triangle, between Superior, Globe, and Winkleman, AZ, is one of the premier copper mining districts in America. Two currently operating large-scale open pit copper mines are Carlota (KGHM), where the open pit is complete but operations continue and Pinto Valley (Capstone). These mines have diminished the quality of scenic character on

specific areas of the Tonto, although mitigation measures required by the Forest Service have reduced their impact on scenery.

- Public utilities and communication development on the Tonto National Forest include one 60-mile designated powerline corridor, the Westside Corridor Project, 770 miles of powerlines not within designated corridors, one designated communication site, and multiple electronic sites. These structures are noticeable and detract from the form, line, color, texture, pattern, and scale of the surrounding landscape. However, mitigation measures have reduced their impact on scenic quality. Population growth and urbanization are expected to increase demand for additional energy and communication infrastructure. Future development of public utilities may include a 53.5-mile-long energy transmission corridor and renewable energy such as solar energy development. These potential infrastructure projects would reduce the overall scenic value of the Tonto, although each project would be evaluated at a project scale to mitigate and manage impacts.
- The Tonto National Forest's partnership with Arizona Department of Transportation since the mid- to late 1980s has enhanced scenic quality on highway expansion construction since mitigation measures have assured that changes to the landscape sufficiently blend with the surrounding natural landscape. Evidence of the successful partnership and benefits to the quality of scenery are the two expansion projects that have been awarded for their beauty a segment of State Route 87 on the Mesa Ranger District and a segment of U.S. 60 leading through Gonzales Pass outside of Superior on the Globe Ranger District.
- In 2005, the Chief of the Forest Service declared unmanaged recreation (and specifically unmanaged motor vehicle use) one of the four threats to the National Forest System. Managing motorized recreation is particularly challenging on the southern districts of the Tonto National Forest with their fragile desert ecosystems and high demands for motorized access. The desert ecosystem does not provide many natural barriers to prevent users from riding anywhere their vehicle will take them. Unauthorized routes often leave tracks and ruts that can remain visible for years. Many portions of the Tonto National Forest, such as near the metropolitan areas of Cave Creek and Mesa, consist of braided or crisscrossed patterns of unauthorized routes developed by motorized users[93]. In the Sonoran desert, vegetation is slow to become established or reestablished after it has been damaged. The proliferation of off-highway vehicle routes has contributed to severe degradation of the natural desert landscape through the introduction of uncharacteristic visual lines. In areas with fragile soils, the repetitive passage of vehicles has created bare areas, which lack vegetation and are quite visible to the casual observer. The existence of such tracks and bare areas visible to people traveling through the national forest tends to diminish the natural appearance of the landscape. While an occasional track or rut does not detract from scenic quality for most people, concentrations of ruts, tracks, or unauthorized routes on the landscape tend to detract from what most people expect and desire to see on the Tonto National Forest. The number of unauthorized routes continues to grow as nearby populations increase and more visitors travel off road.
- Impacts from illegal dumping and recreational target shooting are also common in areas along city boundaries (i.e., Phoenix metro and Payson). These alterations dominate the landscape in localized areas, resulting in extremely poor scenic conditions. These activities often occur in the same locations on the forest and are evident by abandoned cars and appliances with bullet holes, shotgun shells, targets, and bullet casings littering the ground. In addition, many tons of trash are being deposited on the land every year.

[93] See Final Assessment Report of Social and Economic Conditions, Trends, and Risks to Sustainability, volume 2, page 121.

- Developed recreation sites on the Tonto National Forest include facilities varying from highly developed, 300-unit campgrounds to minimally developed, 6-unit day-use sites. These facilities are beneficial to scenic quality because architectural themes and guidelines were created and followed during facility design. Separate architectural themes were created for buildings in small recreation sites appropriate for the northern or southern zone giving them their own identity appropriate for the landscape setting. Architectural guidelines were created for the design and selection of recreation buildings, landscape structures, site furnishings, wayside structures, and signs of large recreation sites or areas, such as Roosevelt Lake Recreation Area in the 1990s. These architectural themes and guidelines ensured all recreation facilities were sensitively designed to blend with the form, line, color, and texture of the surrounding natural landscape.

More detailed effects for scenery can be found in the Final Assessment Report of Social and Economic Conditions, Trends, and Risks to Sustainability (USDA Forest Service 2017a).

Environmental Effects

Each alternative provides for scenery management, and the plan components for scenery do not change by alternative. The management areas that change by alternative change the desired scenic integrity objectives that are present for each alternative. This evaluation will use the term scenic integrity objectives for all alternatives, with Alternative A representing existing scenic integrity objectives, for ease in comparing alternative consequences[94]. Scenic integrity objectives are described with classifications ranging from very high, representing the most natural-appearing landscapes, to very low, representing the most highly modified landscapes. Table 64 describes the total acres of each scenic integrity objective classification for each alternative.

Table 64. Acres of each scenic integrity objective (SIO) classification for each alternative

SIO Classification	Alternative A	Alternative B	Alternative C	Alternative D
Very high	592,905.5	593,799.7	782,785.6	592,905.5
High	1,705,977.0	1,706,521.0	1,537,285.0	1,706,007.0
Moderate	597,171.4	597,019.6	577,927.1	598,422.3
Low	12,031.6	12,014.8	10,863.5	12,015.5
Very low[1]	55,998.2	54,728.8	55,222.5	54,733.0
Total of High and Very high	2,298,882.5	2,300,320.7	2,320,070.6	2,298,912.5

1 - The Forest Service does not manage for very low scenic integrity objectives but it is included to show the areas with high departure from scenic integrity that will be difficult to change.

The desired conditions for scenery listed in the final forest plan that each alternative will analyze against are as follows:

- The Forest contains a variety of landscapes representing the desired scenic character[95] that contributes to visitors' sense of place and connection with nature.
- The Forest appears predominantly natural and includes cultural landscapes valued by forest users and local communities for their scenic and traditional values.

[94] Assumptions and methods used for this analysis can be found in volume 4 of the environmental impact statement, appendix B.
[95] Desired scenic character descriptions can be found on the Tonto National Forest website under Scenery at: https://www.fs.usda.gov/detail/tonto/landmanagement/resourcemanagement/?cid=fsbdev3_018770.

- High quality scenery dominates the landscape in areas valued by the public (e.g., state designated scenic routes, major roads, developed recreation sites, wilderness, national scenic trails, and wild and scenic rivers).
- Scenery reflects ecosystem diversity, enhances recreation settings, and contributes to the quality of life for local residents and communities, as well as forest users from outside the area.
- Scenery is managed for present and future generations, is resilient to changing conditions, and supports ecological, social, and economic sustainability on the forest and in surrounding communities.

Effects Common to All Alternatives

There is a potential for management activities to impact the existing landscape and scenic integrity under all alternatives. Management activities affect scenery by altering the appearance of the landscape and include both short-term and long-term effects. Short-term and long-term effects would be defined in the project-level analysis based on the potential effects of the activities proposed. Short-term effects for scenery are usually noticeable after project completion and are seen as contrasts to the surrounding natural landscape. Management activities, although they may have some short-term impacts on scenery, also may begin to move the landscape toward the desired scenic integrity objective. Effects that move the landscape toward the desired scenic integrity objective are often realized over a long period or cumulatively and lead to the lasting sustainability of valued scenic integrity. Project mitigation and design would consider scenic resources under any alternative to meet the scenic integrity objectives.

Management activities on the Tonto National Forest with the greatest potential to affect scenic resources are vegetation management, wildland fire, range, roads and motorized trails, recreation, mineral extraction, and natural processes. These effects are described below in more detail.

Vegetation Management

There is a potential to temporarily impact the existing landscape and scenic quality from vegetation management activities (e.g., mechanical treatments and invasive species treatments) under all alternatives. These activities have varying consequences on scenery. Mechanical treatments could change the character of the landscape where activities occur in the short-term. These effects may include ground disturbance, visible stumps, and slash while are not accounted for in the scenic integrity objective categories. In the long term, these treatments should help achieve desired conditions for the ecological response unit and make the area more resilient to uncharacteristic large-scale disturbance. Project design and mitigation would consider scenery under any alternative so vegetation management should meet scenic integrity objectives in the short term to the extent possible but particularly in the long term. These types of activities may be most evident in management areas with timber, fuelwood, or a restoration emphasis.

Wildland Fire (Wildfire and Prescribed fire)

Treatments (prescribed fire and wildfire) to restore fire-adapted ecosystems (e.g., ponderosa pine) vary by alternative and effects would be evident in the short-term with burned, blackened vegetation, and charred ground surfaces. These kinds of temporary features may cause soil erosion and sedimentation, further impacting the scenic character of the area. Recreationists may also be affected by signs of vegetation treatment and decide to recreate elsewhere[96]. Grasses and shrubs typically recover quickly, depending on when treatment occurs and moisture conditions during the growing season. In the long-term, fire management usually increases the diversity of vegetation texture, color, size classes, and distribution across the landscape in fire-adapted ecosystems which are important for scenic resources.

[96] See the Recreation section for more information.

Uncharacteristic wildfire has a greater potential to negatively impact scenic resources in the both short- and long-term by altering the vegetation and natural appearance of the landscape (especially in non-fire-adapted ecosystems) outside of the normal range of variation. Fire retardant may also be used to protect values at risk but discolors the landscape and has the potential to impact scenery in the short term.

Natural Processes

Impacts of other natural processes (e.g., insects and disease, flooding, and landslides) will be mitigated in every alternative, especially as it relates to public health and safety. These types of activities may be most evident in management areas with departed or impaired conditions where the ecosystems are less resilient and have the potential to dramatically change the scenic landscape. Therefore, the impacts from natural processes and responsive management would be similar in all four alternatives.

Range

It is anticipated that change in vegetative cover from year-round forest-wide grazing would meet desired conditions for rangelands, forage, and grazing as well as the ecological response units; therefore, also meeting desired conditions for scenery. In places with the most range activities, views may include windmills, cattle, stock tanks, fences, and other private rangeland features. These facilities are typically small and localized, and with some mitigation for scenery, would have minimal effects on or help contribute to, scenic character of the landscape. Many local residents are accustomed to viewing these structures and features and consider them a highly valued part of the traditional landscape. Visitors may also have an appreciation for the rural or pastoral character of these landscapes. For many residents and some visitors, the presence of this activity contributes to the sense of place or cultural identity of these areas. It is also anticipated that the presence of large concentrations of cows and/or cow manure in locations with heavy recreation use has the potential to degrade scenic character. Grazing, to some degree, continues under all alternatives.

Recreation, Roads, and Trails (motorized and nonmotorized)

Recreation activities, both developed and dispersed, would continue in all alternatives but to varying degrees. Developments for recreation activities (e.g., roads, trails, campgrounds, trailheads, and site facilities) are evident and they are appropriate for the landscape. New developments will comply with the scenic integrity objective they are in and will be designed to blend with the surrounding landscape (FC-DC-06), thus having minimal effects to scenery such as color differences during season changes or during development of structures. The location of recreation and infrastructure improvements needed for recreation activities (e.g., roads, trails, and viewing platforms for visitors) affects the surrounding scenic integrity by disturbing the natural patterns of forest scenery and will be considered in the design. Improvements can also have a positive effect on scenic character. An example would be directing and concentrating use at a well-designed recreation facility which could lead to less user created access points in the surrounding landscape which may impact vegetation through compaction and denuded vegetation. The Tonto National Forest is one of the most recreated Forests in the nation and these improvements help to support that program and allow for the betterment of forest visitors.

Roads and motorized trails related activities (e.g., road maintenance, decommissioning, and construction) would continue under all alternatives and have varying degrees of impacts to scenic resources. For example, dispersed motorized camping can result in sites that are easily identifiable visually due to the removal of vegetation from vehicles driving off road exposing bare ground and altering the existing scenic character. The width and color of roads and trails can impact the scenic integrity of the Forest; choosing soil and surface material close in color to surrounding landscape as well as following natural contours will limit visual impacts. Facilities may be evident and noticeable, creating a built environment in an otherwise natural environmental setting. When best environmental and sustainable design practices are used, facilities can harmonize with the surrounding landscape or enhance and complement the surrounding scenic character. Decommissioning of roads and motorized trails have the potential to create noticeable soil color contrasts in the short term but should have long-term benefits to scenery as the areas revegetate and the routes become less evident on the landscape. In the long term, road decommissioning is typically beneficial to scenery resources by recontouring slopes to mimic natural landforms and rehabilitating and revegetating exposed soils typically noticeable on cut and fill slopes created during road construction.

Development or construction of motorized trails will be done to achieve desired conditions, such as “Motorized trails and staging areas are sustainable and resource damage (e.g., soil erosion, vegetation trampling, and litter accumulation) related to these recreation areas is minimized” (REC-DIS-MO-DC-03) and will consider scenic integrity in the design. For this reason, these activities should only have short-term impacts to scenic integrity such as restricting viewing areas and disturbing vegetation, and have the potential to actually enhance scenery throughout the forest by providing public access to unique opportunities.

Public Utilities

Public utilities and communication development are noticeable and detract from the form, line, color, texture, pattern, and scale of the surrounding landscape. Mitigation measures have reduced their impact on scenic quality, and desired conditions for special uses work together to ensure utilities are planned appropriately for the landscape (SU-S-03). Population growth and urbanization are expected to increase demand for additional energy and communication infrastructure (USDA Forest Service 2017a) and will likely have negative impacts to scenery on the landscape. These potential infrastructure projects would reduce the viewshed and scenic value of the Tonto National Forest. Some examples of potential effects include clearing vegetation for utility right of ways, visible towers from mountain tops, and additional fencing to protect utilities. These future utilities will be managed and or mitigated at the project level.

Mining

Mining activities can involve major landform alteration, as well as form, line, color and texture contrasts, resulting in adverse scenic impacts. The majority of lands outside of designated wilderness have the potential for mineral extractions in all alternatives. Therefore, the impacts from minerals management would be similar in all four alternatives and have the potential to negatively impact scenic integrity. Salable mineral resources (i.e., sand, gravel, and other common variety minerals) also have the potential to negatively impact scenery by altering the form, color, and texture of the landscape. While these activities account for scenic integrity at the project level, once completed the landscape is reclaimed and not restored and has the potential to permanently alter the landscape. Some of the forest users that would normally have recreated in that area may not like the changes in the landscape from mining and may choose to visit other locations on the forest that have a less impacts to scenic integrity. These future activities will be managed and or mitigated at the project level.

Effects Common to All Alternatives from Areas

Designated Areas

Designated areas (wilderness, wild and scenic rivers, research natural areas, inventoried roadless areas, and national trails) offer additional levels of protections for the resources to which they were designated. Generally, these additional protections help maintain or enhance scenery resources throughout the designated area and the viewsheds of the surrounding landscape. Wilderness areas offer primitive, unaltered landscapes and are managed to protect wilderness characteristics for the future. Other than as a result from natural processes, wilderness areas will offer the highest quality scenery on the forest. Restricting motorized recreation and development in wilderness areas allows for vegetation regrowth and eliminates alterations to the landscape as a result of human interference. Wild and scenic rivers are managed to protect the outstandingly remarkable values for which they were designated. The Verde River and Fossil Springs Wild and Scenic Rivers offer spectacular opportunities to view unique landscape features for the southwest including waterfalls, canyons, rugged mountains, and high-water flows. These features draw visitors to recreate and enjoy public lands, helping meet recreation objectives such as "Recreation contributes to enhanced quality of life for all of our visitors and the communities we serve" (REC-DC-01). Protecting wild and scenic rivers will contribute to maintaining high scenic integrity objectives through limiting human disturbances while allowing access to beautiful views and scenery for the public to enjoy. No new nationally-designated trails are proposed in any alternative. The current nationally-designated trails would continue to be managed to protect the values for which they were designated and provide opportunities to view natural features and scenery, recreational opportunities in a variety of recreational opportunity spectrum settings, and public use and enjoyment of historic routes and associated historic remnants. No new inventoried roadless areas are proposed for any alternative. Under all alternatives, inventoried roadless areas would be managed in accordance with current regulation and policy. Inventoried roadless areas would continue to be reference areas to measure the effects of development on other parts of the landscape and a variety of ecosystem services such as undisturbed landscapes that are important to biological diversity, clean drinking water, and opportunities for dispersed outdoor recreation, reference areas for study and research, and high scenic quality. Current regulation and policy support natural growth patterns that do not disrupt the overall scenic integrity objective of the landscape.

In each alternative, all designated areas will be managed to achieve desired conditions and the effects to scenery will not change from their current conditions. More information about designated areas can be found in the Management Areas section of the final environmental impact statement.

Designated and Proposed Research Natural Areas and Proposed Botanical Areas

Although the list of areas proposed in each alternative varies, the impacts to scenery for these areas is the same across alternatives. These additional management protections have the potential to further benefit scenic integrity by conserving more of the natural landscape needed for the management of the resources outlined in the creation of each area. These areas will be discussed specifically under each alternative where applicable and additional information can be found in the Management Areas section of volume 2 and Appendix F: Evaluation of Designated and Proposed Areas in volume 4.

Eligible Wild and Scenic Rivers

Eligible wild and scenic rivers offer additional levels of protection for the outstandingly remarkable values for which makes them eligible. Each alternative includes the same set of eligible wild and scenic rivers and will be managed to achieve desired conditions. The effects to scenery will not change by alternative. More information can be found in the management areas section of volume 2 and in Appendix E: Wild and Scenic Rivers Eligibility Process in volume 4 of the final environmental impact statement.

Apache Leap Special Management Area

Apache Leap Special Management Area is common to all alternatives. The plan components for this management area support, maintain, or enhance the scenic integrity of the area. Any impacts of future management will only be short term (i.e., development of nonmotorized trails) and will not change by alternative. More information can be found in the Management Areas section of volume 2.

Effects Common to Alternative A

Direction in the current forest plan for visual resource management includes a forest visual resource inventory that assigns visual quality objectives for all management areas of the forest plan. With the completion of the scenery management systems, this alternative has been updated to assign scenic integrity objectives for the whole forest, which includes each of the management area (figure 21). This alternative also includes goals, forest wide standards and guidelines, and standards and guidelines for each management area cross walked from the visual management system to the scenery management system.

Forest-wide standards and guidelines in the 1985 forest plan include[97]:

- Manage for the scenic integrity objectives ranging from very high to very low as defined for each prescription and delineated in the Scenery Management System Inventory for the Tonto National Forest. Apply design guidelines found in the USDA handbooks, National Forest Landscape Management Series.
- Refine variety classes, sensitivity levels, and scenic integrity objectives when needed for project-level planning.

The analysis for alternative A evaluates whether or not the current direction, including standards and guidelines found in the existing forest plan, would move conditions toward the desired conditions for scenery in the forest plan.

[97] These have been updated to reflect the scenery management system.

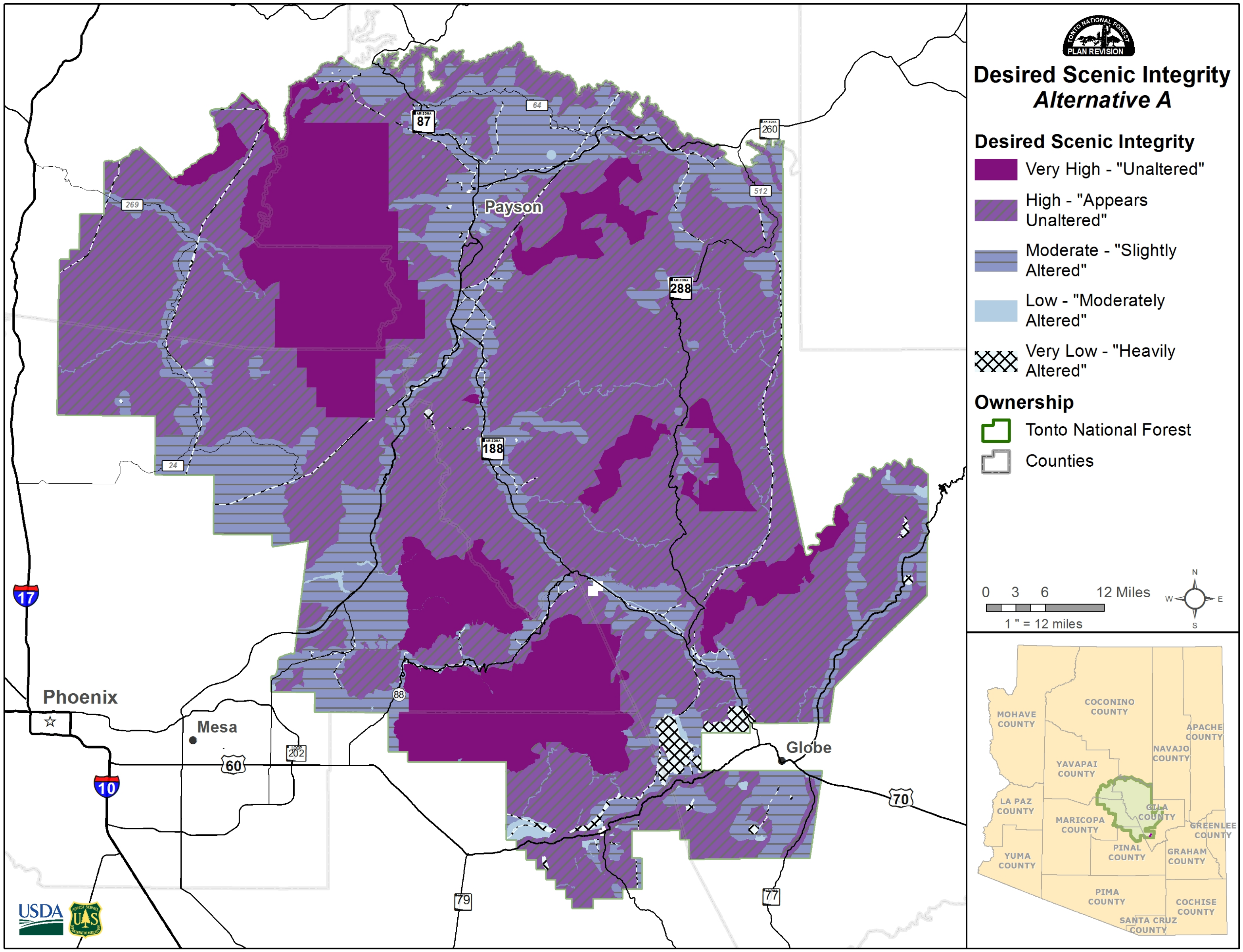

Figure 21. Scenic integrity objectives for alternative A

Vegetation Management, Wildland Fire, and Range

This alternative does not have the same emphasis on restoration and improved ecological desired conditions as the action alternatives. Improved ecological desired conditions should help to achieve the intent of the scenic integrity objectives, which focuses on naturally appearing landscapes expressed as dynamic, functioning ecosystems. Lack of management will lead to vegetation thinning and an increase in invasive species. For this reason, alternative A would achieve landscape scale desired conditions for scenery at a slower rate than the action alternatives. Alternative A does not emphasize rangeland, riparian, and watershed health as thoroughly as the action alternatives or incorporate additional protections for the scenery of these landscapes.

Recreation, Roads, and Trails (Motorized and Nonmotorized)

Alternative A does not incorporate the same emphasis on sustainable recreation other than the desired conditions for recreation. Sustainable recreation has beneficial impacts to scenery management and this alternative only offers the connections to the few additional plan components listed above.

The impacts of maintaining, increasing, or decreasing our current roads and motorized trails has the potential to impact scenic integrity objectives across the forest. Decommissioning existing routes has the potential to cause short-term impacts. This reduces accessibility and can reduce the opportunities for visitors to view the forest, resulting in less areas with higher scenic quality. The long-term benefits of decommissioning roads include vegetation regrowth and lack of visual disruption caused by color and surface differences in roads. Maintaining our current roads and motorized trail system will have no change in visuals as the assumed maintenance considers scenic integrity objectives.

Recommended Wilderness Areas

Alternative A does not include any recommended wilderness areas. Recommended wilderness areas would typically have minimal human impacts over the long term and would maintain high scenic integrity for recreational visitors. Not including recommended wilderness areas could have long term impacts to scenic quality. More development and recreational use (e.g., motorized recreation, mountain biking, non-primitive campgrounds) will impact the natural growth patterns in the forest as well as create disturbances in scenic views.

Proposed Research Natural Areas and Proposed Botanical Areas

Alternative A includes two proposed research natural areas where the emphasis is on managing for natural landscapes, rather than utilization of the resources. Although the list of areas proposed in each alternative varies, the impacts to scenery for these areas is the same across alternatives. These additional management protections have the potential to further benefit scenery.

Management Areas 1a through 6k

Each management area would be managed to achieve desired conditions which will in turn benefit scenery. Specific impacts would be related to the management area purpose.

Effects Common to Alternatives B, C, and D

The analysis for alternatives B (Proposed Action), C, and D evaluates the degree to which plan components, including standards and guidelines, move conditions toward the desired conditions for scenery. The plan components are the same for each of the action alternatives (as seen in the forest plan) and the differences of effects are related to the impacts of the alternative drivers. The analysis for alternatives B, C, and D evaluates whether or not the management direction, including standards, guidelines, and objectives would move conditions toward the desired conditions for scenery in the forest plan.

Figure 22 through figure 24 and table 64 show the scenic integrity objectives by alternatives B, C, and D. While the plan components, and therefore the analysis, for these alternatives does not change by alternative there are differences between scenic integrity objectives based on the management areas that are included in each alternative (e.g., recommended wilderness).

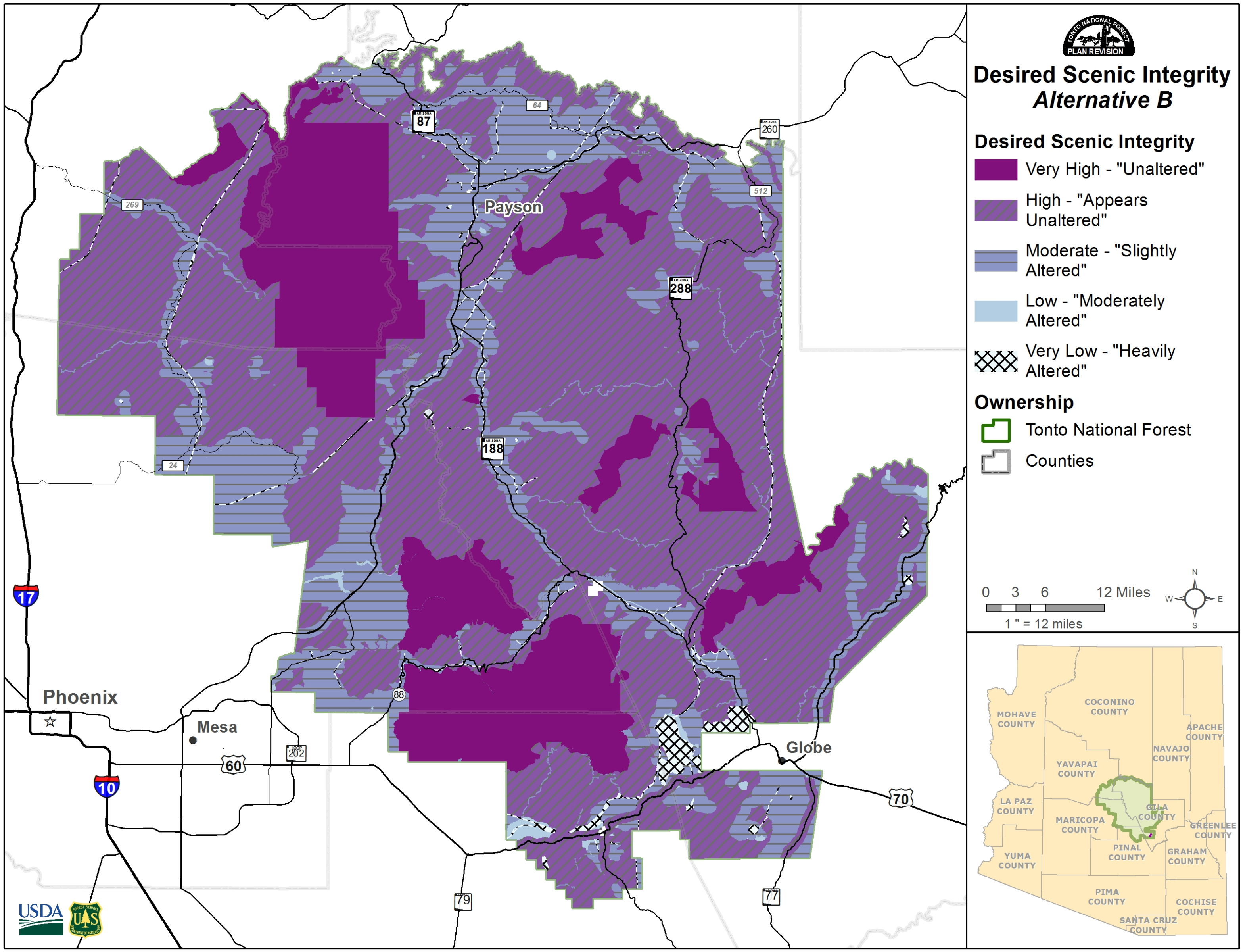

Figure 22. Scenic integrity objectives for alternative B

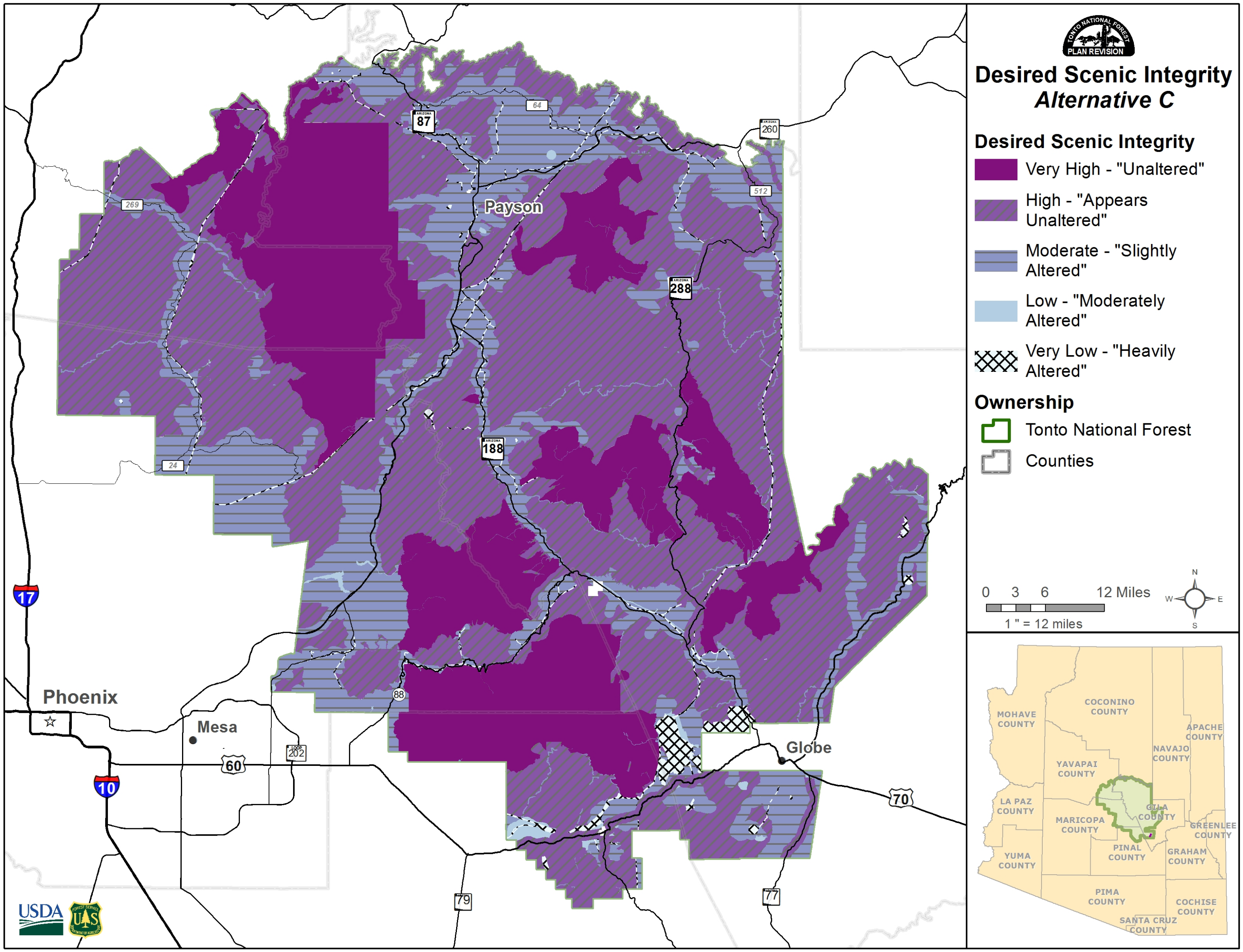

Figure 23. Scenic integrity objectives for alternative C

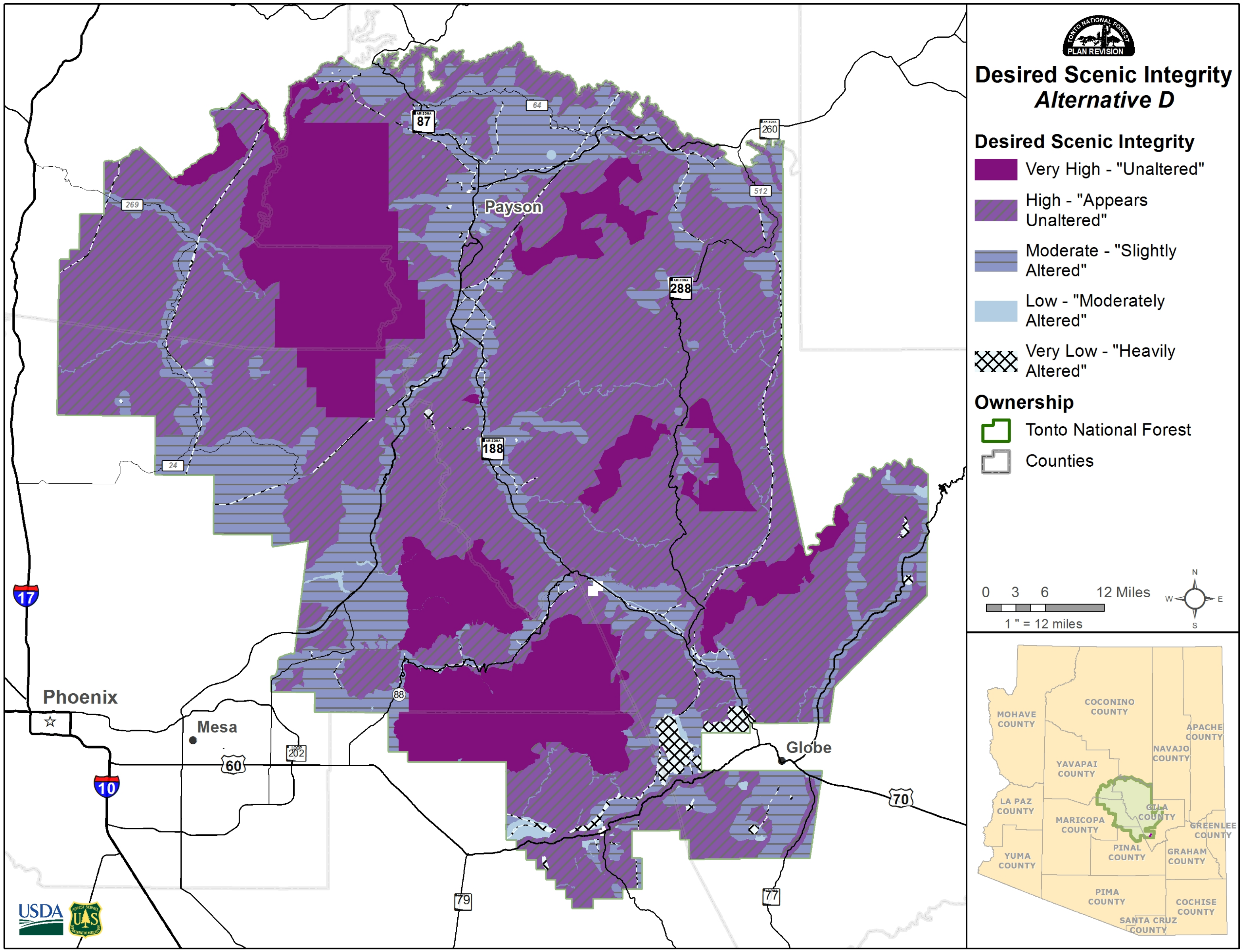

Figure 24. Scenic integrity objectives for alternative D

Vegetation Management, Wildland Fire, and Range

All the action alternatives have the same emphasis on restoration and improved ecological desired conditions. Improved ecological desired conditions (e.g., riparian condition, erosion, and water quality) should help achieve and/or maintain the mapped scenic integrity objectives, which focuses on naturally appearing landscapes expressed as dynamic, functioning ecosystems.

There is a potential to temporarily impact the existing landscape and scenic quality from vegetation management activities (e.g., mechanical treatments and invasive species treatments) and treatments to restore fire-adapted ecosystems (prescribed fire and wildfire). Alternative B has a combined focus on mechanical treatments and wildland fire for restoration, giving it the greatest potential to achieve desired conditions for scenery (SC-DC-01, SC-DC-03, SC-DC-04). Alternative C emphasizes the use of wildland fire as a restoration tool and limits the use of mechanical thinning; this may negatively affect scenic integrity long-term as wildfires can cause scarring and large-scale evidence of fire (e.g., flooding after fires, and landslides resulting in changes to the landscape). It may improve scenic integrity short-term, however, by the lack of manual treatments to the natural environment. Alternative D would primarily use mechanical treatments focused on increasing the supply of forest products; this would affect scenic integrity temporarily during treatment, but would improve conditions long-term as management activities move areas to desired scenic integrity objectives, per plan direction.

Alternative C emphasizes riparian and watershed health by closing nonfunctional riparian management zones from all uses. This would improve scenic integrity by allowing riparian zones to recover, however public motorized access would be restricted which would reduce the amount of motorized-accessible high-quality scenic resources.

Scenery plan components for areas with scenic integrity objectives of very high allow for range facilities. All alternatives allow for grazing uses, but alternative C has the greatest potential to closes grazing allotments as they become vacant. Removing this use should minimally affect scenic integrity. Removal of grazing infrastructure is the only expected effect as it may take away from the sense of place or cultural identity that can be seen by some visitors as a highly valued part of the traditional landscape.

Recreation, Roads, and Trails (motorized and nonmotorized)

All action alternatives focus on providing sustainable recreational opportunities. These alternatives differ from alternative A in that they incorporate sustainable concepts allowing for adaptability of recreation and protections for scenery.

Alternative D has a greater likelihood to have an increased human presence and would probably diminish high quality scenery at recreation sites and, occasionally, along road and trail vistas. Expansion of sites and developed areas is also more likely under alternative D. Alternative C has a greater likelihood to have a decrease in human presence and developments. With more recommended wilderness areas in alternative C, which have high and very high scenic integrity objectives identified in plan components, there would be an increase in these scenic integrity objectives from the current condition of 21,188.1 acres as compared to alternative D, which would decrease scenic integrity objectives of high and very high from the current condition by 30 acres.

Alternative C has a greater likelihood for reduction in motorized access (roads and motorized trails) and an increase in nonmotorized recreational activities. The impacts of maintaining or decreasing our current roads and motorized trails has the potential to improve scenic integrity objectives across the forest. Decommissioning existing routes can have long-term impacts by reducing the surface area of disturbed ground and color contrast and returning it back to natural conditions. Decommissioning existing routes can also cause short-term impacts by reducing the accessible opportunities for visitors who prefer motorized means to view the forest, resulting in less areas with higher scenic quality. Maintaining the current road and motorized trail system would have no change in scenic integrity as the assumed maintenance considers scenic integrity objectives.

Alternative D has a greater likelihood for an increase in motorized access (roads and motorized trails). The impacts of increased accessibility in alternative D by a combination or roads and motorized trails can be both positive and negative for scenic integrity objectives; it would potentially create more accessible opportunities for visitors to view the forest, and it can also increase the amount of surface area with disturbed soils and color contrast, decreasing scenic qualities. Maintaining our current road and motorized trail system would have no change in scenic integrity as the assumed maintenance considers scenic integrity objectives.

Recommended Wilderness

Alternative B has 43,204 acres identified as recommended wilderness and alternative C has 399,029 acres of identified recommended wilderness. The recommended wilderness would increase high and very high scenic integrity on the forest through managing for wilderness characteristics. For example, restricting construction of new roads and facilities would maintain the natural appearance and other scenic qualities of the area. In addition, lack of motorized recreation and developed recreation will protect natural vegetation and support scenic improvements. Encouraging natural regrowth moves the Forest towards the scenic integrity objective of very high. Alternative D has no recommended wilderness so would not include management for acreage of high and very high scenic integrity objectives for recommended wilderness areas which alternative C does include.

Proposed Research Natural Areas and Proposed Botanical Areas

Alternatives B and C include four proposed research natural areas and four proposed botanical areas where the emphasis is on managing for natural landscapes, rather than utilization of the resources. Research natural areas are principally for non-manipulative research, observation, and study. Any research natural areas within existing wilderness are managed in accordance with agency policy on retaining wilderness character. A botanical area is an area that contains plant specimens, plant groups, or plant communities that are significant because of their form, color, occurrence, habitat, location, life history, arrangement, ecology, rarity, or other features.

Less resource use would decrease or limit impacts to scenic integrity in these areas by allowing only natural processes to occur or research specific management. This has the potential to reduce the appearance of thinning and mechanical alterations to the landscape. Allowing native plants and unique species to thrive in these areas will create new viewing areas that are special and unique to the Tonto National Forest, therefore contributing to the scenic integrity of the area and increasing the public's ability to observe native plants. Alternative D does not include these areas. Not including research natural areas and botanical areas increases the risk of damage to native plants and will have a long-term impact on the Forest's scenery

Lakes and Rivers Management Area

Alternative B and D include the Lakes and Rivers Management Area which incorporates adaptive management strategies to manage for the impacts of increased recreation in these areas. The Lakes and Rivers Management Area is likely to have more low and very low scenic integrity objectives to account for high levels of recreation and visitation. Facilities and other infrastructure are used to contain and prevent further resource damages such as soil erosion, water quality issues, and wildlife hazards including litter. Managing these resource impacts directly affects scenery qualities; when the environment appears clean (minimal litter) and functioning (for example good water qualities), the public enjoys their National Forest. However, there is a potential for negative impacts to scenic integrity as more facilities and infrastructure are installed. This management area will likely not appear predominantly natural and to minimize impacts to scenery plan components were included so they “are developed and maintained with scenery desired conditions in mind (FC-DC-06) including using appropriate colors, shapes, and signs to compliment the natural area.”

Alternatives A and C do not include this management area. Not including the Lake and River Management Areas will likely result in soil erosion and compaction, vegetation trampling, increased spread of invasive species, degraded watershed conditions, and low user satisfaction rates. This would impact the scenic character of area.

Salt River Horse Management Area

The Salt River Horse Management Area is common to all action alternatives. The plan components for this management area allow a deviation in the management of ecological response units from forestwide management. This deviation has the potential to impact the scenic integrity objectives of the area as the disturbance from horses could damage the landscape and therefore the scenic values. However, the Salt River Horses draw wildlife-watching opportunities on the Forest and many forest visitors would consider them to add scenic values to the area they reside. More information can be found in the Management Areas section of volume 2.

Cumulative Effects

This cumulative effects analysis does not attempt to quantify the effects of past actions by adding up all prior actions on an action-by-action basis. In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current conditions (as detailed in the description of alternative A) as a proxy for the impacts of past and present actions. This is because existing conditions reflect the aggregate impact of all prior actions and natural events.

This analysis focuses on the cumulative impact of those reasonably foreseeable actions that are relevant in assessing the impacts of revising the forest plan. The temporal boundary chosen for this analysis is the life of the forest plan, likely ten to fifteen years. The spatial boundary chosen for this analysis is the full extent of the Tonto National Forest and neighboring lands such as the Bureau of Land Management, state lands, private lands, municipalities, counties, and other National Forests.

Ongoing and Reasonably Foreseeable Actions

In terms of reasonably foreseeable future actions, this analysis has attempted to include, specific to scenery resources, projects for which upcoming actions are known and can be meaningfully analyzed. What will not be analyzed are projects that are inevitable and known, but which have not yet developed proposed actions.

Areas modified by timber harvest would continue to appear highly managed over the next 10 to 15 years, and impacts to scenery may occur in the short term, but all activities will need to meet scenic integrity objectives per the forest plan in the long term. Timber harvest on adjacent private, State, and Federal lands might influence overall scenic integrity around the forest (i.e., forest thinning, temporary roads, vegetation openings) with changes in management creating a different foreground and middleground appearance than would occur on the Forest. Fuel reduction treatments in the wildland-urban interface might also add to these effects resulting in forest canopy reduction. However, the scenic backdrop above the valleys would remain generally unchanged regardless of alternative. Driving for pleasure and other scenery dependent activities on the Forest could be affected slightly by human disturbance to areas under other administrations including clearings and structures for developed recreation, color differences in trails and landscape fragmentation. Wildland fire and other disturbance processes, if large in scale and severity, might result in lowered scenic attractiveness for a few years in those areas affected by the disturbance (i.e., scorched soil, damage to vegetation, and interruption of natural scenery). These effects cannot be predicted or analyzed, but the area would naturally recover over time.

Some management on adjacent lands complements the scenery management of the Tonto National Forest including open lands managed by Phoenix, Scottsdale, Mesa, and other cities along the boundary and lands managed by Bureau of Land Management, which uses a visual resource management system. Counties with open space or scenery related language in guiding documents or plans also compliments scenery across ownership boundaries throughout the greater landscape. The Prescott National Forest, Coconino National Forest, and Apache-Sitgreaves National Forests all border the Tonto National Forest and incorporate the same scenery management systems (or visual management system) which creates visual connectivity through the landscape. Between all these public lands surrounding the forest, visual qualities have protections in place which should help to protect them for the future. Agencies which do not manage for scenery, such as the Department of Defense, may have noticeable differences in levels of development across boundaries that could impact the scenic quality in areas such as scenic byways and nationally designated trails.

The state of Arizona manages State Trust Lands to optimize economic benefit for the trust beneficiaries (e.g., schools, universities, hospitals, and public institutions). While these lands permit public access, they are not managed like other public lands (e.g., national forest, national parks, or state parks). As these lands are managed, leased, or auctioned, scenic resources may or may not be considered in that action and natural landscapes have the potential to be lost to development.

Since most private lands and other ownerships do not have regulations for scenic resource management, the effects of ongoing developments next to National Forest System lands can sometimes have negative effects on scenic resources when viewing the continuous landscape. Forest visitors often view scenery as a continuous landscape with little discernment regarding the land ownership being viewed. Sometimes management activities occurring on ownership boundaries can be quite noticeable if the change in form, line, color, or texture of the activity follows ownership boundaries rather than a natural landscape feature. If activities on private lands are designed to lessen impacts to scenic resources, the difference between private lands and National Forest System lands are less apparent. The regional, county, and community plans inclusion of scenic or aesthetic resources or open space character helps promote the management and value of scenic resources across ownership boundaries in the cumulative effects analysis area.

Natural resources and settings would be vulnerable to adverse effects of atypical temperatures and rainfall patterns from climate change. Some associated effects include drought, increased number and severity of wildfires, increased insect and disease outbreaks affecting vegetation, and decreased water yield and availability. Severe wildfires would remove forest vegetation and diminish the scenic quality of the landscape, especially when a wildfire burns at an uncharacteristic scale or severity. When fires burn with high severity over large areas, as is more likely during severe drought and increased temperatures, heavy runoff from extreme storms may remove understory vegetation, which would reduce the quality of scenic vistas. When insect and disease outbreaks occur at epidemic levels, tree mortality with standing and fallen dead trees would reduce scenic quality especially when the mortality dominates scenic vistas. Defoliation of trees from insects and disease would also affect the scenic quality changing the scenic views while trees are defoliated.

Current projects occurring on the Tonto National Forest can also have impacts to scenery on the forest. While these projects are analyzed for scenery at the project level and implement mitigation where possible, it does have effects in both short- and long-term. The Four Forest Restoration Initiative will accomplish landscape scale restoration of the ponderosa pine and adjacent ecological response units through vegetation management and prescribed fire. As mentioned above, in effects common to all, short term effects to these types of management activities can include visible landing sites, stumps, slash, scorched vegetation, and evidence of ground disturbance which all have a negative impact to scenic integrity. However, long-term effects for these management activities are the development of healthy vegetation communities which will meet the scenic integrity in those areas.

Mining, Minerals, and Abandoned Mines

Public domain lands on the Tonto National Forest are available for exploration, development, and extraction of mineral resources except where lands have been withdrawn from mineral entry and discovery of a valuable mineral was not made prior to the withdrawal. Mineral exploration, mining activity, and other mineral activity on the Tonto National Forest is separated into two federally recognized legal and regulatory mineral categories, locatable and salable minerals.

1. **Locatable**: Locatable minerals are those that may be located with a mining claim under the General Mining Law of 1872, as amended (30 U.S.C. 22, et seq). Locatable mineral deposits include, but are not limited to, most metallic mineral deposits and certain nonmetallic and industrial minerals such as gold, silver, copper, lead, zinc, platinum, precious gems, uranium, bentonite, and chemical grade limestone.
2. **Salable**: Also known as mineral materials, salable minerals include common varieties of mineral materials such as petrified wood, common varieties of sand, rock, stone, cinders, gravel, pumice, clay, most building stone, and other similar materials.

The Forest Service recognizes minerals are fundamental to the Nation's well-being and, as policy, encourages exploration and development of mineral resources on National Forest System lands. The Agency's role in managing mineral resources is to provide reasonable protection of surface resources while allowing use of the land for operations authorized by U.S. mining laws. To this end, the Secretary of Agriculture has authorized regulations (36 CFR 228) that ensure surface resource protection, while encouraging the orderly development of mineral resources on National Forest System lands.

Management of the Tonto National Forest's minerals program supports the goal of environmentally sound energy and minerals development and reclamation. Therefore, operations on the forest are required to be conducted to minimize adverse environmental impacts to National Forest System surface resources. Minerals-related proposals require site-specific analysis to evaluate compliance with applicable laws, regulations, and with the forest plan.

This environmental impact statement neither evaluates nor provides information in support of a decision to approve any mining-related activity on the Tonto National Forest. The Forest Service, itself, generally does not initiate exploration or development of mineral resources. Rather, proposals for access to, exploration for, and development of mineral resources are driven by external parties and market forces. As they are received and determined to be ready for consideration, individual proposals are evaluated on a site-specific basis and mitigated individually under a separate environmental analysis that follows Forest Service policy regarding the approval of mineral plans of operation.

Affected Environment

The Tonto National Forest has abundant locatable mineral resources, some salable mineral materials, and no recent interest in leasable resources. Following is a summary of current minerals activity on the forest.

Locatable Minerals

Past and current locatable minerals activity on the Tonto National Forest is associated with base metal and precious metal deposits of the Globe-Miami and Superior mining districts, mostly from large copper porphyry-type deposits and many small deposits of base and precious metals scattered around the Forest. Mineral interests and potentials are copper, gold, silver, molybdenum, mercury, iron, uranium, asbestos, perlite, limestone and marble, and potential exists for future production.

Past activities have included exploration for locatable minerals, including drilling and underground or surface mining, including open pit mining. Mining and exploration interests are currently strongest for copper, silver, gold, and molybdenum, but interest in these commodities is highly influenced by market conditions. Copper and other locatable deposits potentially exist in different locations on the forest, with much of the potential and interest in the Globe-Miami and Superior mining districts. Future development proposals are probable if the demand for these commodities continues to increase.

The Forest has several approved plans of operations, and several proposed operations are in review. Plans of operation under review include proposals for locatable minerals activities, involving trenching and exploratory drilling, as well as two large-scale plans of operation for construction and operation of an underground copper mine and processing facilities (Resolution Copper Project) and expansion of an existing open-pit copper mine (Pinto Valley Mine Project). Several localized or district level proposed exploration drilling operations have been proposed and are also under review. There is currently one commercial limestone quarry in temporary shut-down status on the Globe Ranger District.

In addition to plans of operations, the Forest receives notices of intent for activities such as small-scale placer mining, panning, and exploration with hand tools or geophysical investigations that do not involve digging. As market commodity prices increase, private industry would likely invest more in exploration and development, making additional areas desirable for potential mineral exploration and extraction projects.

Salable Minerals

Common variety mineral materials production on the Tonto National Forest includes crushed and pit run aggregate, fill material, landscape rock, and decorative and building stone. Some of these are used administratively by the Forest Service in constructing or maintaining roads, while other salable resources are managed for sale to the public.

Extraction of salable resources on the Forest has been variable in recent years. Demand for common variety mineral materials is influenced by industrial and commercial activities and economic conditions. Current salable mining activity is low due to lack of permitted extraction locations and is expected to remain the same or slightly increase with the local increase in demand.

Leasable Minerals

In general, interest in leasable resources on the Tonto National Forest is low because of past unsuccessful attempts to locate and develop these resources. Any approved plans for exploration or development of this resource would be done in coordination with the Bureau of Land Management, who has permitting authority.

Abandoned Mines

A complete inventory of the abandoned mines lands on the Tonto National Forest has not been compiled; however, there are multiple sites in many different areas across the forest. Some abandoned mine sites have significant safety hazards, health hazards, or both (i.e., there are open shafts, emissions of toxic gases, falling debris). To date, over 110 sites have been safely remediated under the Region 3 Abandoned Mines Lands Remediation Program by installing fencing, bat-friendly gates, foam plugs, or back filling. Smaller, district level abandoned mines lands sites are remediated on a case-by-case basis. In addition to the safety hazards, many of the sites have environmental contamination.

To date, under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, commonly known as Superfund, the Tonto National Forest has remediated over 35 past mining sites of environmental hazards. Forest staff are continually inventorying and identifying abandoned mine lands sites.

Environmental Effects[98]

Effects Common to all Alternatives

Most of the direction that affects locatable mineral activities comes from Code of Federal Regulations under Title 36 CFR 228, subpart A, Forest Service Manual and Handbook. These laws, regulations, and policies governing locatable minerals can be found in the Forest Service Manual, FSM 2800 (Mining Claims FSM 2810) and Forest Service Handbook, FSH 2809.15. This guidance is independent from forest plan direction and does not change across alternatives.

Mining interests and exploration for locatable minerals is influenced by market conditions and likely that demand could increase over time. Effects of new and ongoing mining operations can have the potential to adversely impact other resources such as the potential for reduced water quality and quantity, as well as potential for increased surface disturbance for access and infrastructure, which potentially increases surface disturbance for access and infrastructure, which potentially contributes to loss of vegetation, and increased soil compaction and erosion. There are also potentially positive effects from new and ongoing mining, which could include contributions to the increase in jobs, income and raw materials to the local and national economy under all alternatives. The effects of new locatable mineral operations would be addressed on a site-specific basis and mitigated individually following the Forest Service policy regarding the approval of plans of operation for mineral activities.

In all alternatives, salable mineral extraction would be prohibited in areas designated for national trails and eligible and designated wild and scenic rivers. Salable mineral extraction is eliminated in these areas, thereby liming availability of these materials for use in the Tonto National Forest, but would result in preserving characteristics of the national trails and eligible and designated wild and scenic rivers, relative to salable mineral extraction. The effect on salable minerals resource is that there would be less personal or commercial use of mineral materials available. Because commercial and personal use areas are localized, this effect is limited in the scope of effects, overall. It would have short- and long-term beneficial effects of maintaining or supporting improvement to other resources affected by extraction of salable minerals, such as less soil erosion and compaction and less disruption to species sensitive to disturbances.

In the minerals section of all alternatives, there is a standard that ensures reclamation of mineral areas to restore resource impacts (MM-S-01). Throughout the plan, standards and guidelines in resource sections for scenery, watershed, soils, cultural resources, vegetation, and wildlife resources require that these resources are protected or effects are mitigated during projects, which would include salable mineral projects.

Short-term environmental consequences from mineral activities could include increased human activity, such as motorized traffic, noise from drilling and mining equipment, temporary roads, ground disturbance during exploration activities, and construction of the authorized well pads, pipelines, or mines. Long-term environmental consequences could include operation and maintenance of the authorized facilities over the life of the facility. Operation and maintenance activities may include increased human activity and noise, motorized vehicle traffic, or additional ground disturbance. The effects of these short- and long-term consequences could include increased traffic conflicts with other users on Forest roads, changes to surface

[98] All assumptions and methods used for this analysis can be found in Volume 4 of the environmental impact statement, appendix B.

water flow paths and quantities, the loss of vegetation, soil disturbance and compaction, wildlife displacement and habitat fragmentation, decreased air quality due to dust and vehicle emissions, increased noise, increased risk of human-caused fires, and decrease in recreational opportunities.

The potential benefits of mineral activities include having sources of minerals such as gravel and landscaping rock to meet the requests of the public, domestic sources (e.g., not foreign) of oil and natural gas to increase national energy security, local employment, royalties paid on the minerals support Federal and State programs, and State and county taxes are paid by operators.

Alternative A Effects

Direction for minerals resource management in the 1985 forest plan was based on Forest Service policy and Federal law and regulations applicable to locatable, salable, and leasable mineral resources. Together, the laws, regulations, and policy minimize the adverse effects of minerals projects on the Tonto National Forest while concurrently supporting mineral exploration and development. The 1985 forest plan emphasizes management of minerals operations through the use of operating plans, bonds, and reclamation and also provides for the timely analysis and processing of mineral prospecting, exploration, leasing, and development proposals. Future protection of resources under alternative A would be the same as current protection under the 1985 forest plan.

Management of locatable mineral resources would not change if the 1985 forest plan continues to be in effect. Mineral proposals would continue to follow the direction of laws, regulations, and policies, and operations would be conducted to minimize adverse environmental impacts to National Forest System surface resources.

There would be less available sources for saleable minerals imposed by the need to protect other resources, such as recreational areas or wilderness character in this alternative. This alternative makes common variety minerals less available but is the least restrictive. It is the same result as in alternative D. This alternative is the most supportive of the desired condition to make mineral materials available on National Forest System lands because it is the least restrictive. For these reasons there would be lower adverse impacts that come with salable minerals such as increased human activity, ground disturbance, and negative impacts to species.

Alternative B Effects

Alternative B includes plan direction that allows for adaptive management to address changing conditions while managing for sustainable multiple uses**.**

The recommended wilderness areas in alternative B have no effect on the establishment of new or existing mining projects for locatable minerals such as copper and gold within the area. Claims for locatable minerals are processed through the Bureau of Land Management, and until recommended wilderness areas are designated and the lands are withdrawn, they are still open to mineral entry. If the areas are withdrawn as wilderness, they would be closed to new claims, but any valid existing claims would not be affected.

Alternative B contains no restrictions to locatable minerals and therefore, effects are the same for all alternatives.

In addition to the effects listed as common to all alternatives, this alternative would include guidelines directing removal of salable minerals in riparian areas (MM-G-01). Under alternative B, there would be 43,204 acres of recommended wilderness, as well as multiple other management areas, which reduces the number of acres available for salable minerals development. This could potentially improve soils by reducing erosion and sedimentation related to salable mineral extraction in riparian areas. However, because commercial and personal use areas of salable minerals are localized, this effect is limited in scope of effects overall. This results in less available sources for saleable minerals imposed by the need to protect other resources, such as recreational areas or wilderness character in this alternative. This protects the wilderness characteristics of the area from disturbances related to salable mineral extraction, so that the recommended wilderness areas remain eligible for potential designation as wilderness by Congress.

This alternative makes common variety minerals less available but has more sources available than alternative C. The result would be that alternative B has less potential for negative impacts to other resources but has less potential to develop or expand mineral material sources and is therefore, less supportive of the desired condition to make mineral materials available on National Forest System lands (MM-DC-03).

Alternative C Effects

Alternative C emphasizes primitive recreation opportunities, increased protections to natural resources, use of natural processes for restoration, limiting some aspects of grazing, and prioritizing natural resources over some economic development opportunities. The recommended wilderness areas in alternative C have no effect on the establishment of new or existing mining projects for locatable minerals such as copper and gold, the areas are withdrawn from mineral entry if they are established as designated wilderness by Congress. Claims for locatable minerals are processed through the Bureau of Land Management, and they are still open to mineral entry. If the areas are withdrawn as wilderness, they would be closed to new claims, but any valid existing claims would not be affected. Alternative C contains no recommendations for restrictions to locatable minerals and therefore, effects are the same for all alternatives.

This alternative would effectively reduce the number of acres available for salable minerals development, by about 399,029 acres of recommended wilderness, as well as multiple other management areas. This results in less available sources for saleable minerals imposed by the need to protect other resources, such as maintaining wilderness characteristics of the area from disturbances related to salable mineral extraction, so that the recommended wilderness areas remain eligible for potential designation as wilderness by Congress. This could potentially improve soils by reducing erosion and sedimentation related to salable mineral extraction in riparian areas, however because commercial and personal use areas of salable minerals are localized, this effect is limited in scope of effects overall. In addition, any riparian areas identified as nonfunctional in alternative C would be restricted from all uses, regardless of cause, until recovery is achieved.

This alternative makes sources for common variety minerals the least available. The result would be that alternative C has less potential for negative impacts to other resources from mineral material sources but has the least potential for development or expansion of mineral material sources and is therefore, least supportive of the desired condition to make salable minerals available on National Forest System lands (MM-DC-03).

Alternative D Effects

Potential impacts to locatable and salable minerals would be as described in the effects common to all alternatives section. This alternative makes common variety minerals less available but is the least restrictive. The result would be that alternative D has more potential for negative impacts to other resources from potential salable mineral sources, such as the potential for increased soil erosion or compaction and should benefit watershed conditions. However, it is least restrictive for common variety and helps meet the desired condition to make mineral materials available on National Forest System lands.

Cumulative Effects

This cumulative effects analysis does not attempt to quantify the effects of past actions by adding up all prior actions on an action-by-action basis. In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current conditions (as detailed in the description of alternative A) as a proxy for the impacts of past and present actions. This is because existing conditions reflect the aggregate impact of all prior actions and natural events.

This analysis focuses on the cumulative impact of those reasonably foreseeable actions that are relevant in assessing the impacts of revising the forest plan.

The temporal bound for the same is the life of the forest plan, which is estimated to be 10 to 15 years.

The geographic boundary for actions that may result in cumulative effects on the Tonto National Forest is in the central portion of Arizona, including Gila, Maricopa, Pinal, and Yavapai counties.

Ongoing and Reasonably Foreseeable Actions

In terms of reasonably foreseeable actions, this analysis has attempted to include, specific to mineral resources, projects for which upcoming actions are known and can be meaningfully analyzed. What will not be analyzed are projects that are inevitable and known, but which have not yet been developed or proposed.

Ongoing and reasonably foreseeable actions, with emphasis on mining activities on and off-forest, are potential sources of effects that may additively affect mineral resource production and disturbances on the Tonto National Forest, by increasing demand for locatable or mineral materials. Several large mines exist within and near boundaries of the Tonto National Forest, including Carlota, Pinto Valley, and Miami Copper Mines in the Globe-Miami area. Active mineral exploration areas often coincide with those where there has been past historic mining, mineral districts, and similar favorable geologic conditions. The natural progression for minerals resources projects is from exploration to a mining plan of operation. Therefore, it is foreseeable that some, but not all, of the current mineral exploration prospects could develop into actual mining operations and contribute a positive cumulative effect by increasing minerals production and economic contributions related to the increase in production.

The demand for locatable and salable mineral resources on the Forest is influenced by external factors such as the economy and public demand for these resources, which could in turn, increase pressure to develop these resources in the future. As the communities in and around the forest continue to expand, more emphasis could be placed on clean air and water, which would increase the pressure on mining industries to use production methods that produce fewer environmental impacts. If the price of locatable minerals, such as copper and gold, increases over time, it could be expected that more new projects could be proposed on the Tonto National Forest and adjacent lands that contain suitable ore-bearing deposits. It could also be expected that the demand for locatable and salable minerals would continue or increase. If locatable and salable minerals are not available on forest, sources off-forest would continue to be used and depleted.

Several large mining proposals are currently undergoing environmental review on the Tonto National Forest. Environmental consequences of the Resolution Copper Project and Land Exchange, and expansion of the Pinto Valley Mine onto National Forest System lands are currently being analyzed at the project level. These projects have potential to have adverse and beneficial effects on other resources, such as major landform alteration, resulting in adverse scenic impacts and contribute beneficial effects to employment and labor income in the regional economy. Mitigation would be identified in each project to help minimize adverse effects.

The Tonto National Forest is adjacent to both the Coconino and Apache Sitgreaves National Forests, and other federally managed lands. These national forests and Federal lands are guided by the same or similar laws, regulations, and policies as the Tonto National Forest to development locatable minerals; effects would be similar across all Federal lands. Cumulative effects can range from positive contributions to regional economy to negative impacts, for example, to water quantity, depending on how the management of locatable and salable mineral resources on neighboring lands relates to the management of other resources on the forest, such as recreation, riparian areas, soils, etc.

Roads

The Tonto National Forest expects to maintain an appropriately sized and environmentally sustainable road system, including airfields that are responsive to ecological, economic, and social concerns. The National Forest System road system would continue to provide access for recreation and resource management as well as to support watershed restoration and resource protection in order to sustain healthy ecosystems.

Affected Environment

The transportation system for the Tonto National Forest is defined as the "The system of National Forest roads, National Forest System trails, and airfields on National Forest System lands (36 CFR 212.1)". National Forest System trails are included in the "Recreation" section.

A National Forest System road is defined as "a forest road other than a road that been authorized by a legally documented right-of-way held by a state, county, or local public road authority" (USDA Forest Service 2005). National Forest System roads are under the jurisdiction of the Forest Service, wholly or partly within or adjacent to and serving the National Forest System, that the Forest Service determines are necessary for the protection, administration, and utilization of the National Forest System and for the use and development of its resources.

Forest-wide, there are roughly 4,295 miles of National Forest System roads. 14 percent (595 miles) of these roads are in custodial care (closed to all motorized use), and 88 percent (3,726 miles) are open to public motorized use (either annually or seasonally). Of the 88 percent of roads open to public motorized use, 76 percent are maintained for high-clearance vehicles; leaving 10 percent maintained for passenger cars. Road systems provide access to public lands and private in-holdings. The Tonto road system provides access to the following resource areas; administration, recreation, vegetative management, wildland fire management, livestock grazing, habitat restoration, natural resource development, electronic utility corridor development and maintenance, minerals, as well has monitoring activities. The roads system also includes related features such as culverts, grade dips, cattle guards, and signage. Roadway bridges are included in the Facilities section.

National Forest System roads are categorized by the vehicle classifications and maintenance standards for each road. Single lane roads are generally considered wide enough for typical cars and trucks. Since many of the roads were initially constructed for vegetation management objectives, the design vehicles were lowboys or logging trucks. The Forest Service uses five maintenance levels to define the general design standards, uses, and associated type of maintenance required. These five maintenance levels are as follows:

- **Maintenance level 1.** Assigned to roads that have been placed in storage between intermittent uses. The period of storage must exceed one year. Basic custodial maintenance is performed to prevent damage to adjacent resources and to perpetuate the road for future resource management needs. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Roads managed at this maintenance level are described as being in basic custodial care.
- **Maintenance level 2.** Assigned to roads open for use by high-clearance vehicles. Passenger car traffic, user comfort, and user convenience are not considerations. Warning signs and traffic control devices are generally not provided. Motorists should have no expectations of being alerted to potential hazards while driving these roads. Traffic is normally minor, usually consisting of one or

more of a combination of administrative, permitted, dispersed recreation, or other specialized uses. Roads managed at this maintenance level are described as high-clearance vehicle roads.

- **Maintenance level 3.** Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. Roads in this maintenance level are typically low speed with single lanes and turnouts and are included in the term “passenger car” roads.
- **Maintenance level 4.** Assigned to roads that provide a moderate degree of user comfort and convenience at slow to moderate travel speeds. Most roads are double lane and aggregate surfaced. However, some roads may be single lane. Some roads may be paved and/or dust abated.
- **Maintenance level 5.** Assigned to roads that provide a high level of user comfort and convenience at slow to moderate travel speeds. The roads are normally double-lane, paved facilities. Some may be aggregate surfaced and dust abated.

Roads managed by public road agencies such as states, counties, and municipalities that help provide access to National Forest System lands are also considered part of the overall regional transportation system but do not fall under the jurisdiction of the National Forest. There are approximately 476 miles of roads falling under the jurisdiction of other road management agencies such as interstate highways, state highways, and county roads. These roads serve as arterials providing primary access to the Tonto National Forest destinations via connecting the National Roads System. Management and maintenance of roads not under Forest Service jurisdiction are the responsibility of the respective road management agency. Although they are not under the jurisdiction of the Forest Service, use on these roads, road conditions, and maintenance activities on the roads have the potential to impact the land and other resource areas ecologically, economically, and socially.

Aviation facilities for the Tonto National Forest include airstrips and helipads. Airstrips are popular destinations for back-country pilots. There are 3 historic inventoried airstrips located within the Tonto National Forest. The Pleasant Valley Airstrip located in Young, AZ is the only one that is officially part of the Tonto National Forest transportation infrastructure but is currently not maintained by Forest Service personnel. It is likely that interest in airstrip use will remain strong and will increase with growing populations and desires for access to recreation opportunities. Helipads are essential infrastructure for firefighting and fire prevention. There are six active helipads throughout the Tonto National Forest. The helipads are paved surfaces built and marked for helicopter landings. More information on other forest facilities including roadway bridges, dams, administrative and fire facilities, and administrative and drinking water and wastewater treatment systems can be found in the Facilities section.

All aspects of road maintenance are based on health and safety, general use by the public, and local access needs for access and administration. Work priorities are through historical maintenance data, field condition surveys, and input from resource planning. Specific work tasks are prioritized according to health and safety, and local program needs. Variations in all aspects of road maintenance management can occur throughout the year due to equipment breakdown, budget constraints, personnel fluctuations, and weather events.

A temporary road or trail is defined as a road or trail necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road or trail and that is not included in a forest transportation atlas (36 CFR 212.1). More information about temporary roads and trails can be found in the Vegetation, Ecological Response Units, Fire, and Fuels section.

Environmental Effects[99]

Effects Common to all Alternatives

Current direction from the 1985 Tonto Land Management Plan instruct providing a serviceable road and trail transportation system to meet public access, land management, and resource protection needs. All alternatives, including alternative A, may decrease the need for road maintenance by closing or decommissioning roads National Forest System roads. In all alternatives, major roads necessary for through traffic would remain open.

In general, the presence of roads increases access for users and supports multiple uses like recreation, hunting, fishing, wildlife viewing, and sightseeing. Forest system roads make participating in multiple use activities easier, increasing user satisfaction and bringing economic revenue to surrounding communities from increased visitation. Forest roads also increase access for ranchers to care for and manage their livestock, facilitating grazing operations that contribute to the local economy and sustain traditional uses on the Forest. Forest roads also provide the necessary access to complete vegetative management treatments to increase ecosystem diversity and resiliency. Roads provide ease of access for firefighters, increasing their safety and ability to successfully fight fires and mitigate fire risks. The acquisition of forest products such as fuelwood, Christmas trees, mushrooms, medicinal plants, is eased by roads sustaining the continued cultural and traditional uses of these products.

In all alternatives, roads continue to receive annual maintenance according to existing Forest budget and schedule. Existing management objectives and travel management decisions regarding access would not be modified unless separate analysis occurred. Road decommissioning or re-location would require separate analysis.

Roads can also have detrimental effects to the environment in which they occur. Ecological impacts may include habitat fragmentation, avenues for undesired species dispersal, and altered water runoff and drainage patterns. Roads also restrict travel and dispersal for small animals, particularly for aquatic and riparian species.

In all alternatives, climate change and drought would likely reduce access and require additional maintenance because of the increased likelihood of catastrophic wildfire, flood events, and uncharacteristic natural disasters, which can lead to erosion, fallen trees, damaged culverts, and road failures. This would result in less opportunities for the public to access the forest and for land management and resource protection activities.

Designated areas offer additional levels of protections for the resources to which they were designated. Generally, these additional protections limit motorized public access, the amount of roads within each area, and in some cases restricts adding any additional roads to the Forest System.

- Wilderness areas offer primitive, unaltered landscapes and are managed to protect wilderness characteristics for the future. Modern, human-made developments are rare, substantially unnoticeable, and use natural or complementary materials (DWMA-DC-05). New roads are not authorized in wilderness areas. More information can be found in the “Management Areas” section below.
- Wild and scenic rivers are managed to protect the outstandingly remarkable values for which they were designated. The Verde River and Fossil Springs Wild and Scenic Rivers offer spectacular

[99] All assumptions and methods used for this analysis can be found in volume 4 of the environmental impact statement, appendix B.

opportunities to view unique landscape features for the southwest including waterfalls, canyons, rugged mountains, and high-water flows. These features draw visitors to recreate and enjoy public lands, helping meet recreation objectives such as “The Recreation Program contributes to enhanced quality of life for all of our visitors and the communities we serve” (REC-DC-01). Wild and scenic rivers have the potential to impact the addition of any new roads or improvements. The user experience, including the level of development and improvements along the river corridor, is consistent with the river’s classification (DWSRMA-DC-2). Only in segments classified as recreational can there be evidence of public access and the potential for future improvements or roads. The outstandingly remarkable values for these segments is the management emphasis over public access and might make it more difficult for forest users needed motorized access. More information can be found in the “Management Areas” section below.

- No new nationally-designated trails are proposed in any alternative. The current nationally-designated trails would continue to be managed to protect the values for which they were designated and provide opportunities to view natural features and scenery, recreational opportunities in a variety of recreational opportunity spectrum settings, and public use and enjoyment of historic routes and associated historic remnants. The nationally designated trail are nonmotorized opportunities on the forest. They have no effects on roads or future road improvements.
- No new inventoried roadless areas are proposed for any alternative. Under all alternatives, inventoried roadless areas would be managed in accordance with current regulation and policy. A road shall not be constructed or reconstructed in inventoried roadless area, unless the responsible official determines that a road is needed according to the circumstances allowed in the 2001 Roadless Rule (36 CFR 294.12) and the road construction has been approved by the appropriate review (IRAMA-S-2). Inventoried roadless areas would continue to be reference areas to measure the effects of development on other parts of the landscape and a variety of ecosystem services such as undisturbed landscapes that are important to biological diversity, clean drinking water, and opportunities for dispersed outdoor recreation, reference areas for study and research, and high scenic quality.

Although the list of proposed research natural areas and proposed botanical areas in each alternative varies, the impacts to roads for these areas is the same across alternatives they are present. These areas provide additional management protections and have the potential to further restrict roads by conserving more of the natural landscape needed for the management of the resources outlined for each area. These areas will be discussed specifically under each alternative where applicable and additional information can be found in the “Management Areas” section below.

Eligible wild and scenic rivers offer additional levels of protection for the outstandingly remarkable values for which makes them eligible. Each alternative includes the same set of eligible wild and scenic rivers and will be managed to achieve desired conditions. To be considered eligible, the outstandingly remarkable values must be currently present on the landscape, including around our existing road system. Eligible wild and scenic rivers have the potential to impact the addition of any new roads or improvements. New roads or motorized trails should not be constructed within 0.25 miles of a wild river segment (EWSRMA-G-2). Only in segments classified as recreational can there be evidence of public access and the potential for future improvements or roads. The outstandingly remarkable values for these segments is the management emphasis over public access and might make it more difficult for forest users needed motorized access. More information can be found in the “Management Areas” section below.

Apache Leap Special Management Area is the only management area common to all alternatives. The plan components for this management area emphasize preserving the area’s natural character. Traditional public access to parts of the Apache Leap will be restricted and will limit motorized use of the area. This has the potential to impact the road system around the Apache Leap and could cause congested areas along the western boarder for parking and staging before entering the leap. More information can be found in the “Management Areas” section below.

Alternative A Effects

The no-action alternative, alternative A, would continue direction of the previous 1985 Tonto Land Management Plan to “provide a serviceable road and trail transportation system to meet public access, land management, and resource protection needs.”

Alternative A would allow the potential for the second greatest number of miles of National Forest System roads open to motorized travel, due to no additions for recommended wilderness and no travel-restricted management areas (excluding restrictions within designated wilderness). This would have the potential effect of continued and ongoing unmanaged impacts to environmental resources, and allow for unbalanced public access through allowing unauthorized routes; which would remain as impacts on the landscape.

Alternative A would differ from all other alternatives in allowing for continued road system management without addressing needs for change and subsequent ecological issues. It continues to accommodate needs for public access, land management, resource protection, user safety, contributing to social and economic sustainability, however it places no emphasis key issues or sustainability common to alternatives B and C.

Alternative A would continue to allow for interconnectivity with other transportation and road networks such as other Federal, State, county and local government agencies, as well as associations, non-government organizations, outfitters and guides, local businesses, and other community groups, to leverage resources for mutual benefit to enhance and maintain forest roads.

Alternative A continues existing direction for decommissioning and does not increase road systems common to alternative D. Under this alternative unnecessary roads would continue to be identified for decommissioning and would not be considered for additional access.

Alternative B Effects

Alternative B is the forest plan and was developed to respond to key issues identified in the assessment, needs to change, and public engagement.

Alternative B includes plan direction that allows for adaptive management to address ecological changes along with other changing conditions while managing for sustainable multiple uses. It would emphasize that recreation opportunities are relevant and address changing user demands while remaining sustainable.

Roads would be maintained based on concerns for safety, resource protection, user demand and decommissioning would be prioritized where infrastructure is not sustainable or needed (RD-DC-01, RD-G-03).

Alternative B would allow for less additional motorized Forest access than alternative A and alternative D, but more than alternative C. The change in Forest access is predominantly due to motorized travel restrictions in the following proposed management areas: recommended wilderness, proposed botanical areas, and proposed research natural areas.

Alternative B may increase a need for specific actions such as improving road surfaces for public access and safety, or constructing new roads for additional facilities. These variations by alternative would require road management activities to be adjusted further to meet planning goals and objectives.

Alternative B would increase opportunities to develop and expand partnerships with various interest and user groups in addition to expand existing partnerships with other Federal, State, county and local governments, to leverage resources for mutual benefit to enhance and maintain forest roads.

In effect this alternative would balance the Forest and public needs for transportation systems and infrastructure while maintaining key connectivity with other road systems. Furthermore, it may target unauthorized routes for removal from the landscape; while maintaining recreational access and opportunities.

Alternative C Effects

Alternative C was developed in response to public comments that expressed a desire to reduce human impacts on the Tonto National Forest. Management of roads would focus on maintaining current systems or decommissioning unused infrastructure.

Alternative C would allow for the least additional motorized access to the Forest because it focuses more on decommissioning roads than the other alternatives. This alternative also has motorized travel restrictions in the following proposed management areas: recommended wilderness, proposed botanical areas, and proposed research natural areas.

Alternative C would provide for reduced human presence in areas within the Tonto National Forest. Roads would be decommissioned and the surrounding landscape would be restored to its natural condition. Reduced motorized access would increase values related to natural landscapes such as solitude, absence of noise pollution, and presence of wildlife species. Soil conditions such as compaction may also be reduced as road are decommissioned. Additional decommissioning of roads may occur in areas where facilities are identified as underused.

In addition, if a riparian area is nonfunctional, as identified in the Proper Functioning Condition Assessment Framework, or similar protocol, all permitted and allowed uses would be removed until riparian recovery is achieved. This has the potential to temporarily close or decommission roads popular for public access, potentially reroute roads traveling through the riparian management zone including the addition of bridges and culverts, and limit restrict land management in those areas. While this is likely to benefit the riparian condition, it restricts all public access and creates difficulties in administrative access to the riparian areas for resource management.

Alternative D Effects

Alternative D was developed to address public comments that expressed a desire for easier access and multiple-use opportunities. There is an increase for maintenance and development of roads and facilities to accommodate increasing use and need for accessibility on the Tonto National Forest.

Alternative D would allow for the greatest motorized access because it places greater emphasis on road maintenance and less on road decommissioning, while also recommending no additional areas for wilderness designation, and no proposed botanical or research natural areas. Plan components would emphasize road maintenance to increase access for traditional and cultural uses, for removal of forest products including fuelwood, administrative access, and for recreation activities.

Under alternative D, the management of roads and recreational access would continue to receive annual maintenance according to existing Forest budget and schedule. Existing management objectives and travel management decisions regarding access would not be modified unless separate analysis occurred. Additional opportunities for road construction and improvement to existing roads would occur where needs for additional accessibility and increased use occur. Road decommissioning or relocation would require separate analysis.

Alternative D may increase a need for specific actions such as improving road surfaces for public access, or constructing new roads for additional facilities. These variations by alternative would require road management activities to be adjusted further to meet planning goals and objectives.

In addition, alternative D would provide easier access to the Forest and increase multiple-use opportunities which would then reduce ecological function. The ecological consequences of increasing access and multiple uses generally could result in decreased wildlife habitat connectivity, increased dumping and sedimentation, greater impacts to plants and archeological sites, increased vandalism and theft of archeological sites, and more noise disturbance for wildlife. Additional roads would require more mitigation at the project level to achieve the desired condition “roads have minimal adverse environmental impacts to soil, riparian areas, watercourses, native vegetation, and at-risk species” (RD-DC-04).

Cumulative Effects

This cumulative effects analysis does not attempt to quantify the effects of past actions by adding up all prior actions on an action-by-action basis. In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current conditions (as detailed in the description of alternative A) as a proxy for the impacts of past and present actions. This is because existing conditions reflect the aggregate impact of all prior actions and natural events.

This analysis focuses on the cumulative impact of those reasonably foreseeable actions that are relevant in assessing the impacts of revising the forest plan. The cumulative effects timeframe for roads and related infrastructure is 10 to 15 years and the spatial boundary includes the national forest adjacent to the Tonto National Forest, state and county highways that access and traverse the Forest, cities encompassed by the Forest, and easements to access inholdings.

State and local government agencies with road management authority can be expected to continue to maintain their existing road network across the Forest. Some changes such as road widening and resurfacing are probable but are dependent on budgets and funding allocations. The likelihood of the jurisdiction of National Forest System roads being passed to other public agencies is low.

Ongoing and Reasonably Foreseeable Actions

In terms of reasonably foreseeable future actions, this analysis has attempted to include, specific to road resources, projects for which upcoming actions are known and can be meaningfully analyzed. What will not be analyzed are projects that are inevitable and known, but which have not yet developed proposed actions. Specific ongoing and foreseeable actions include:

- **Travel Management Rule Implementation.** Final decisions and implementations of the Travel Management Rule will significantly impact all aspects of Road mileage; maintenance activities are assumed to continue while varying in scope based on new objectives.
- **Forest Service budget** is expected to remain at the same level or lower than current levels.
- **Economic Conditions.** The economy will continue its steady growth and populations engaging in use of the transportation systems of the Forest will rise. Increasing populations and the influx of regular recreation and off-highway vehicle traffic will have additional impact to roads.

- **Climate Change.** The need for resource protection may increase with climate change. Roads may experience increased runoff and degradation from changes in climate. Additional surfacing, drainage features and additional maintenance may be required to maintain existing roads.

Change in ownership of private lands will result in continued requests for road access across National Forest System lands. Depending on the circumstances, these may be requests for easements or private road special use authorization. Depending on the terms and conditions written into any new authorizations, opportunities for access to National Forest System lands may be created.

Continued population growth in surrounding communities are expected (see Socioeconomic section for more information) and would add to the demand for additional lands for development purposes, especially roads. Communities that have not planned for additional needs would likely request acquisition of National Forest System lands for roads. As private properties, especially inholdings change from rural or undeveloped land to subdivisions or higher density uses, encroachment into National Forest System land becomes more frequent, resulting in resource impacts and land survey needs; these impacts may be new access routes onto the Forest, encroachment of private structures and increased disturbance to soils, wildlife, and plants. As communities grow and infill occurs, undeveloped lands and their open space values are converted to residential or commercial uses. This growth would likely result in continued pressures to maintain National Forest System lands for their open space values. This may also trigger the need to acquire right-of-way in places where informal public access is lost to development. Cumulatively, continued growth in communities as shown in the census numbers, and the resulting demands for acquisition of National Forest System land, tend to move the forest away from desired conditions of natural open space adjacent to communities.

Facilities

The Tonto National Forest expects to manage and maintain the appropriately-sized and environmentally sustainable portfolio of facilities that are responsive to ecological, economic, and social concerns. Current management direction is to ensure effective management of facilities for occupancy; to provide the most cost-effective, safe, and functionally efficient use of space within available resources; and to ensure the buildings, related facilities, equipment, and subsystems function as originally designed.

Affected Environment

The Tonto National Forest's facilities within the plan area include roadway bridges, dams, administrative facilities (district offices, warehouses, storage, employee housing and crew quarters, fire facilities, fire lookout and communication towers), and drinking water and wastewater treatment systems. Administrative facilities are necessary to support the employees, equipment, and activities required for the management of the Tonto National Forest. Over the past several years management emphasis has been to reduce the square footage and deferred maintenance costs of administrative facilities and still meet the needs of the Forest. Pedestrian bridges and developed recreation site buildings are included in the Recreation section.

In addition to roads, the Forest has 25 roadway bridges and culverts reported as bridges located around the Forest. The bridges are required to be inspected and rated according to the Federal Highway Administration's National Bridge Inspection Standards and Forest Service directives. The inspections also identify deferred maintenance needs for the bridge and surrounding stream channel. It is unlikely that the number of bridges will increase or decrease. Bridges on the forest will continued to be maintained when the funding becomes available. If the bridge is deteriorated to the point of jeopardizing the safety of the user, it may be required to rehabilitate, replace, or close the bridge to traffic. Roads and related infrastructure, culverts, grade dips, cattle guards, and signage, etc. are covered in the Roads section.

The Forest also manages 13 dams located around the Forest. These are dams that meet the classification of "jurisdictional" per USDA FSM 7500. Dams are given a "hazard rating" of high, medium, or low risk based on the design and location factors. This rating is an indication of the amount of damage and risk of loss of life that could happen if the dam failed. The ranking contributes to the frequency of inspection cycle. All of the Tonto-owned dams have "low" hazard ratings with regard to damage and risk of loss of life. It is unlikely that the number of dams will either increase of decrease. Dams on the Forest will continue to operate and be maintained when funding becomes available. The Tonto also has 7 special use "high hazard" dams owned and managed by Salt River Project that are essential for power generation and water distribution control for the Phoenix metropolitan area. The special use permitted dams are covered in the Lands, Special Use, and Access section.

On the Tonto, there are 23 administrative sites. Administrative sites include various types of buildings, fire lookouts and communication towers. Forest facility master plans are planning documents that are designed to guide the acquisition, continued use, maintenance, improvements, and disposal of Forest Service administrative facilities on the Tonto National Forest. They also identify facility needs and guide decisions regarding proposed and existing facilities. The plans are required to be updated every 10 years or as necessary depending on management objectives and they include administrative sites and associated buildings only. The current Tonto National Forest Facility Master Plan was completed in 2016. The plan proposes an overall reduction in the number and square footage of administrative facilities through consolidation and decommissioning. Condition assessments are required to be conducted on all administrative site facilities every 5 years. Condition assessments identify deferred maintenance items that are then used to determine the facility condition rating, which is a quantitative value applied to a facility index percentage. The facility condition index is the ratio of the deferred maintenance of a building to its current replacement value. The facility condition rating is used as the indicator of the facility condition and could be either good (over 95 percent), fair (90 to 94 percent), or poor (less than 89 percent). Approximately 30 percent of these facilities are more than 50 years old and are rated as in “poor” condition. These facilities are in various states of repair and some are in need of repair. The majority of the remaining systems are rated as “good” and the remaining as “fair”. The INFRA database shows the deferred maintenance backlog of administrative buildings on the Tonto National Forest at approximately $2 million. Because of the declining budgets it is impossible to maintain the facilities to the highest standard. As a result, we have to prioritize the work based on health, safety, and accessibility to the employees, and do the more critical maintenance first. In the desert areas, an example of critical deferred maintenance would be replacing failing air conditioning units or replacing leaking roofs which can in turn create building mold and air quality situations.

The Tonto also manages numerous drinking water and wastewater systems, most are associated with campgrounds, picnic areas, and administrative sites. Approximately 27 sites are service by Forest Service-managed water systems and approximately 16 sites are served by Forest Service-managed wastewater systems. The source of the water systems are groundwater wells, some form of treatment, storage, and distribution systems. The drinking water systems operation and maintenance must meet Federal and State drinking water standards. Similarly, wastewater must be treated to meet Federal and State standards. In order to meet these standards, the systems must be routinely tested and sanitary surveys conducted to insure safe drinking water for the users and adequate groundwater protection from the wastewater treatment. In order to keep these systems operational, they will need to be maintained and upgraded when necessary. As a result of declining budgets, it is unlikely that any new systems will be added. Since the operation and maintenance cost and environmental risks are high with these systems, the trend has been to decommission those systems, mostly at recreation sites, that are underused or have high operation and maintenance costs.

Environmental Effects[100]

Effects Common to all Alternatives

The majority of the management direction affecting bridges, dams, administrative site buildings, drinking water and wastewater systems, fire lookout and communication towers on the Tonto National Forest would not change under any alternative. The administrative Facility Master Plan would be reviewed and updated annually as necessary to reflect current management needs. Required inspections would be completed. Funding would be prioritized to accomplish critical health and safety maintenance and deferred maintenance items identified in the inspections. For all alternatives, management direction to propose overall reductions in the number and square footage of facilities would continue through consolidation and decommissioning of those unused or underused facilities. Decisions made in other resource areas effecting facilities shall be properly analyzed before implementation.

Designated management areas offer additional levels of protections for the resources to which they were designated. Generally, these additional protections limit public access to, the amount of, and ultimately the need for facilities within each area.

- Wilderness areas offer primitive, unaltered landscapes and are managed to protect wilderness characteristics for the future. Modern, human-made developments are rare, substantially unnoticeable,

[100] All assumptions and methods used for this analysis can be found in volume 4 of the environmental impact statement, appendix B.

and use natural or complementary materials (DWMA-DC-06). Nonconforming structures or facilities that are no longer in use and do not meet the desired conditions will be removed from wilderness (DWMA-S-04). More information can be found in the Management Areas section.

- Wild and scenic rivers are managed to protect the outstandingly remarkable values for which they were designated. The Verde River and Fossil Springs Wild and Scenic Rivers offer spectacular opportunities to view unique landscape features for the southwest including waterfalls, canyons, rugged mountains, and high-water flows. These features draw visitors to recreate and enjoy public lands, helping meet recreation objectives such as "The Recreation Program contributes to enhanced quality of life for all of our visitors and the communities we serve" (REC-DC-01). Wild and scenic rivers have the potential to impact the addition of any new facilities or improvements. The user experience, including the level of development and improvements along the river corridor, is consistent with the river's classification (DWSRMA-DC-02). Only in segments classified as recreational can there be evidence of public access and the potential for future improvements or facilities. More information can be found in the Management Areas section. No new nationally-designated trails are proposed in any alternative. The current nationally-designated trails would continue to be managed to protect the values for which they were designated and provide opportunities to view natural features and scenery, recreational opportunities in a variety of recreation opportunity spectrum settings, and public use and enjoyment of historic routes and associated historic remnants. The nationally designated trail are nonmotorized opportunities on the forest. This land management area has no effects on facilities or future facility improvements.
- No new inventoried roadless areas are proposed for any alternative. Under all alternatives, inventoried roadless areas would be managed in accordance with current regulation and policy. Inventoried roadless areas appear natural, have high scenic quality, and provide opportunities for dispersed recreation (IRAMA-DC-04). Inventoried roadless areas would continue to be reference areas to measure the effects of development on other parts of the landscape and a variety of ecosystem services such as undisturbed landscapes that are important to biological diversity, clean drinking water, and opportunities for dispersed outdoor recreation, reference areas for study and research, and high scenic quality (IRAMA-DC-03). The potential for new facilities or future facility improvements is less in inventoried roadless areas than other parts of the forest under all alternatives.
- Although the list of proposed research natural areas and proposed botanical areas in each alternative varies, the impacts to facilities for these areas is the same across alternatives they are present, reduction of facility maintenance base on area management protections. These areas provide additional management protections and have the potential to further restrict facilities management by conserving more of the natural landscape needed for the management of the resources outlined for each area. These areas will be discussed specifically under each alternative where applicable and additional information can be found in the Management Areas section.
- Eligible wild and scenic rivers offer additional levels of protection for the outstandingly remarkable values for which makes them eligible. Each alternative includes the same set of eligible wild and scenic rivers and will be managed to achieve desired conditions. To be considered eligible, the outstandingly remarkable values must be currently present on the landscape, including around our existing facilities. Eligible wild and scenic rivers have the potential to impact the addition of any new facilities or improvements. The user experience, including the level of development and improvements along the river corridor, is consistent with the river's classification (EWSRMA-DC-02). Only in segments classified as recreational can there be evidence of public access and the potential for future improvements or facilities. The outstandingly remarkable values for these segments is the management emphasis over public access. More information can be found in the Management Areas section.

- Apache Leap Special Management Area is the only management area common to all alternatives. The plan components for this management area emphasize preserving the area's natural character. There are no effects to facilities from Apache Leap Management Area. More information can be found in the Management Areas section.

Effects Common to All Action Alternatives

Under the action alternatives B, C, and D, the management of the facilities on the Tonto National Forest would not change. The administrative Facility Master Plan would be reviewed and updated annually as necessary to reflect management needs. Required inspections would be completed. Funding would be prioritized to accomplish critical health and safety maintenance and deferred maintenance items identified in the inspections. Construction and operation of new or existing facilities or decommissioning of unused or underused facilities would have minimal long-term impacts to surrounding soil, water and vegetation, such as soil erosion and compaction or the removal of vegetation from decommissioning efforts. Facilities would complement the forest's scenery and not cause damage to ecologically sensitive areas, as well as be energy-efficient, durable, well-maintained, and serve their intended purpose. These measures would improve the aesthetics of the landscape surrounding the facilities and contribute small areas of refugia for species within these areas. Decisions made in other resource areas effecting facilities shall be properly analyzed before implementation.

Effects of Alternative A

Alternative A (no-action) is the Tonto National Forest's current 1985 forest plan. The current plan statements include the following:

- Construct or reconstruct capital improvements to support fire, administrative, and other multifunctional activities in compliance with FSM 7310 and energy conservation requirements.
- Maintain or upgrade (minor betterment) capital improvements to support fire, administrative, and other multifunctional activities to abate serious safety hazards. Additional funding is needed to allow for maintenance or to prevent further degradation and for the abatement of health hazards.
- Remove unneeded, non-conforming facilities on a preplanned schedule.

Under alternative A, management direction of facilities would continue to receive annual maintenance according to existing Forest budget and schedule and continue to provide safe access for public and administrative use, support local communities and their economies by contracting out deferred maintenance work, however, the plan doesn't reflect the changes in the current economic, social, and ecological conditions or new policies and priorities. Reduction in funding for deferred maintenance of facilities could result in the deterioration of the facilities and their components. Resource damage such as soil erosion from deteriorating concrete sidewalks or building foundations or the risk of fire from lack of vegetation management surrounding the facilities. Existing management objectives and travel management decisions regarding access would not be modified unless separate analysis occurred.

Effects of Alternative B

Alternative B is the forest plan and was developed to respond to key issues identified in the assessment, needs to change, and public engagement. Alternative B includes plan direction that allows for adaptive management to address ecological changes along with other changing conditions while managing for sustainable multiple uses. Alternative B would address the changing ecological, social, and economic conditions while managing sustainable multiple uses. It would emphasize that recreation opportunities are relevant and to changing user demands while remaining sustainable. Facilities would be maintained based on user demand and decommissioning would be prioritized where infrastructure is not sustainable. A positive impact would be to continue supporting the economy of the local communities with regard to popular multiple uses as well as to decrease the number of those facilities which are too expensive to sustainably maintain.

Effects of Alternative C

Alternative C was developed in response to public comments that expressed a desire to reduce human impacts on the Tonto National Forest. Management direction of facilities would focus on maintaining current or decommissioning unused or underused facilities. Positive impacts would be the reduction of resource damage as a result of reducing the number of facilities. For example, reducing the number of drinking water and wastewater systems would add more protection to the associated resource areas of water quality and watershed health; or decommissioning a building would reduce the environmental footprint of the area, decreasing impacts with regards to the watershed, soil, and other ecological areas. Negative impacts would be a decrease in any social or economic development because of reducing the human use to the areas.

In addition, if a riparian area is nonfunctional, as identified in the Proper Functioning Condition Assessment Framework, or similar protocol, all permitted and allowed uses would be removed until riparian recovery is achieved. This has the potential to temporarily close or decommission facilities popular for public use in the riparian management zones and limit and/or restrict land management in those areas. While this is likely to benefit the riparian condition, it restricts all public use and creates difficulties in administrative uses to the riparian areas for resource management. Impacts would be limited use and maintenance of the facility due to rehabilitation of the riparian area.

Effects of Alternative D

Alternative D was developed to address public comments that expressed a desire for easier public access and increased multiple-use opportunities with fewer restrictions on the Tonto National Forest. There would be an increase of maintenance and development of roads and facilities to accommodate the increasing use and need for accessibility on the Tonto National Forest. Negative impacts would be when a new building or water system is constructed the environmental footprint would be increased therefore increasing the risk of damage to resource areas such as water quality and watershed area, the increase of the presence of invasive species, and soil erosion from construction. Positive impacts could be an increase in the social and economic values of local communities due to more multiple uses.

Cumulative Effects

This cumulative effects analysis does not attempt to quantify the effects of past actions by adding up all prior actions on an action-by-action basis. In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current conditions (as detailed in the description of alternative A) as a proxy for the impacts of past and present actions. This is because existing conditions reflect the aggregate impact of all prior actions and natural events.

This analysis focuses on the cumulative impact of those reasonably foreseeable actions that are relevant in assessing the impacts of revising the forest plan. The cumulative effects timeframe for roads and related infrastructure is 10 to 15 years.

There are no expected cumulative effects of Forest facilities however those facilities adjacent to the forest, such as other public land agencies, may put pressure on the Forest if the current forest needs are not met as a result of the directives given in the forest plan. However, infrastructure within the management area may be impacted if wildfire burns across the Forest with high severity, consuming vegetative cover which would result in unstable soils which erode in rains following fires. The increased run-off from these burned areas would also result in plugged culverts and road and bridge damage. This would then also cause extensive damage to buildings or other infrastructure through flooding.

Despite the challenges faced in terms of budget limitations and resource protection concerns, the Tonto National Forest has generally been able to meet current plan objectives in the management of bridges, dams, administrative site facilities, and drinking water and wastewater systems. Facilities provided for employees are safe and functional. Water and wastewater provided are meeting all operational safety requirements. Although the trend for funding is declining, there is no known resource damage as a result of the continued management of bridges, dams, administrative site facilities, and water and wastewater systems.

In terms of reasonably foreseeable future actions, this analysis has attempted to include, specific to facilities resources, projects for which upcoming actions are known and can be meaningfully analyzed. What will not be analyzed are projects that are inevitable and known, but which have not yet developed proposed actions. For all alternatives, any decisions made in other resource areas effecting facilities shall be properly analyzed before implementation.

Ecological Response Units

In order to do a meaningful analysis, it is necessary to classify and characterize the ecosystems and vegetation on the Tonto National Forest. This analysis uses ecological response units, which characterize vegetative attributes, disturbance ecology, and associated ecosystem services at the landscape and strategic planning scales. Some ecological response units are relatively simple, and determining what is needed to restore or maintain a healthy condition is relatively straightforward when they're only moderately departed. Such ecological response units include ponderosa pine forest, and semi-desert grasslands. Other ecological response units are more complex, and can be difficult to identify on the ground because they are highly departed, because there are subclasses that can differ quite a bit from the primary ecological response unit, and/or because the variability inherent to the ecological response unit includes multiple fire regimes.

Table 65. Ecological response unit (ERU) distribution on the Tonto National Forest

ERU Code	Ecological Response Unit Name	Acres	Percentage	Elevational Range (feet)
SDS	Sonora-Mojave Mixed Salt Desert Scrub	22,067	1	1,900 to 3,200
MSDS	Mojave Sonoran Desert Scrub	808,297	28	1,300 to 5,800
IC	Interior Chaparral	290,771	11	2,300 to 7,800
SDG*	Semi-Desert Grassland	346,739	12	1,800 to 6,800
PJO	Pinyon-Juniper Woodland	55,970	2	2,300 to 7,300
JUG*	Juniper Grass	416,471	15	2,200 to 7,600
MEW*	Madrean Encinal Woodland	94,785	3	3,400 to 6,700
MPO*	Madrean Pinyon-Oak	5,277	less than 1	4,000 to 7,000
PJC	Pinyon-Juniper Evergreen Shrub	401,990	14	2,400 to 7,800
PJG*	Pinyon-Juniper Grass	80,694	3	3,400 to 7,000
PPE*	Ponderosa Pine-Evergreen Oak	516,709	7	5,500 to 7,200
PPF*	Ponderosa Pine Forest	37,472	1	5,500 to 7,600
MCD*	Mixed Conifer-Frequent Fire	51,990	2	6,100 to 7,900
MCW	Wet Mixed Conifer/Mixed Conifer with Aspen	6,807	less than 1	7,000 to 7,900

*ERUs with frequent fire regimes.

Affected Environment

The importance of disturbances (mostly the frequency and severity) in maintaining a sustainable pattern, structure, composition, and ecological function of these systems prompted the following organization of this analysis:

1. **Ecological response units with frequent fire/disturbance regimes:** About 42 percent of the Tonto National Forest is comprised of frequent fire regimes. These areas evolved with, and are adapted to or dependent on frequent fire to maintain a sustainable pattern, structure, composition, and ecological function. Fire is a keystone process affecting the ecological functions of large areas, including adjacent cover types that are not adapted to frequent fire. The interruption of natural fire regimes has changed species composition and fuel structure of many southwestern ecosystems (Swetnam 1990; Huffman et al. 2018). This change is the result of the overgrazing of livestock, selective timber harvesting, and fire suppression (Covington and Moore 1994). Fire, in particular, is a critical component of these systems, and its effects cannot be replicated by other means, it is an ecological imperative in these ecological response units.

2. **Desert ecological response units:** The lowest elevations of the Tonto National Forest are dominated by Sonora-Mohave desert communities, which occupy about 30 percent of the Tonto National Forest. Fire was rare enough in these areas that it didn't contribute to individual species, or plant community evolution, so most species in the Sonoran-Mohave desert are not fire adapted. Prior to Euro-American settlement fires did sometimes occur, largely from lightning and Native Americans, however most deserts did not burn except during unusual circumstances (Paysen et al. 2000). Exotic grasses that burn easily are increasingly a concern in the Sonoran Desert. These grasses provide highly receptive and contiguous fuel beds, resulting in more frequent and larger fires than these desert plant communities are adapted to (Abella 2010).
3. **Other ecological response units:** The remaining vegetative communities on the Tonto National Forest evolved with less frequent fire that produced mixed and high severity. These communities vary widely, and range from dry, hot areas dominated by shrubs to cool, dense forested areas at higher elevations.

Ecological Response Units with Frequent Fire

About 42 percent of the Tonto National Forest is composed of ecological response units with frequent fire regimes. Typically, fire regimes I and II are considered 'frequent' fire regimes, with average fire return intervals less than 35 years. On the Tonto National Forest, the fire frequencies of these ecological response units are sometimes longer than 35 years, or can be as frequent as 1 year. Most frequent fire ecological response units on the Tonto National Forest need to burn much more often than every 35 years to maintain structure, composition, pattern, and ecological function. The typical fire return interval for the frequent fire ecological response units on the Tonto National Forest was often less than 10 years (Huffman 2018). Note, the ***range*** of a fire return interval refers to the extremes; the shortest period between fires and the longest period between fires. The ***average*** fire return interval is an average based on what the available science indicates was typical for a specific ecological response unit.

Characteristics Common to All Frequent Fire Ecological Response Units

Frequent fire ecological response units are the most highly departed ecological response units because they evolved with fires that burned every few years (table 66). Missing just 2 or 3 fire cycles can result in ecosystems that are sufficiently departed from their natural state that it can result in large areas, including adjacent and nearby ecological response units, being at risk of uncharacteristically large areas of uncharacteristically severe fire effects.

Table 66. Summary of ecological response unit departure, fire return intervals, and threats for frequent fire ecological response units

Ecological Response Unit[1]	Acres (percent) of Forest	Current Departure (percent) / future trend	Historic Fire Return Intervals in years (min / max / typical) and severity	Current fire return interval (years)	Threats	Primary Departure Characteristics
Semi-Desert Grasslands	346,739 (12 percent)	94 percent (high); away	2 / 30 / 10; high severity	210	Invasive species; uncharacteristic grazing; uncharacteristic fire; increased woody cover (late seral, trees and shrubs)	Patch size much smaller than reference conditions; herbaceous layer dominated by exotics; overabundance of ruderal species; decreased biodiversity; increased fire intensity; insufficient ground cover to carry surface fire
Juniper Grass	416,471 (14 percent)	65 percent (moderate); away	1 / 30 / 15; low severity	96	Invasive species; uncharacteristic grazing; uncharacteristic fire; increased woody cover (late seral, trees and shrubs)	Patch size much larger than reference conditions; increased coarse woody debris; decreased ground cover; reduced diversity; surface vegetation (fuel) continuity
Pinyon–Juniper Grass	80,695; (3 percent)	35 percent (moderate); away	1 / 35 / 20; low severity	215	Invasive species; uncharacteristic grazing; uncharacteristic fire; increased woody cover (late seral, trees /shrubs); insects/pathogens when stressed (e.g., pinyon bark beetles)	Patch size much larger than reference conditions; increased coarse woody debris; decreased ground cover; reduced diversity, particularly forbs; surface vegetation (fuel) continuity
Madrean Encinal Woodland	93,785; (3 percent)	43 percent (moderate); away	10 / 100 / 20; low to mixed severity	170	Invasive species; uncharacteristic fire; uncharacteristic grazing	Areas of medium/large closed state (G); excessive coarse woody debris; decreased species diversity; species composition highly departed from reference conditions, particularly forbs
Ponderosa Pine–Evergreen Oak	216,709; (7 percent)	73 percent (high); towards	21 / 60 / 5; low to mixed severity	115	Invasive species; uncharacteristic fire; uncharacteristic grazing; insects and pathogens when stressed (including bark beetles)	Patch size larger than reference conditions; excessive coarse woody debris; decreased species diversity; surface vegetation/ ground cover dominated by invasive/exotic species, particularly weeping lovegrass; high potential for uncharacteristically large and severe fire; dense shrub understory and/or overly dense sapling and pole sized ponderosa pine; vertical and horizontal tree canopies often contiguous

Ecological Response Unit[1]	Acres (percent) of Forest	Current Departure (percent) / future trend	Historic Fire Return Intervals in years (min / max / typical) and severity	Current fire return interval (years)	Threats	Primary Departure Characteristics
Ponderosa Pine Forest	37,472; (1 percent)	95 percent (high); no change	2 / 22 / 12; low severity	84	Invasive species; uncharacteristic fire; uncharacteristic grazing; insects and pathogens when stressed (including bark beetles)	Patch size larger than reference conditions; excessive coarse woody debris; decreased species diversity; surface vegetation/ ground cover dominated by invasive/exotic species, particularly weeping lovegrass; high potential for uncharacteristically large and severe fire; ladder fuels over-represented and/or overly dense sapling and pole sized ponderosa pine; vertical and horizontal tree canopies often contiguous
Mixed Conifer–Frequent Fire (Dry Mixed Conifer)	51,990; (2 percent)	62 percent (moderate); away	2 / 60 / 15; low to mixed severity	115	Invasive species; uncharacteristic fire; uncharacteristic grazing; insects and pathogens when stressed (including bark beetles); climate change	Patch larger than reference conditions; excessive coarse woody debris; decreased species diversity; surface vegetation/ ground cover dominated by invasive/exotic species, particularly weeping lovegrass; high potential for uncharacteristically large and severe fire; ladder fuels over-represented and/or overly dense sapling and pole sized ponderosa pine; vertical and horizontal tree canopies often contiguous
Total	1,250,199 (42 percent)					

1. Madrean Pinyon-Oak (MPO) is not included in this table. It occupies less than 1 percent (~6,300 acres) of the Tonto National Forest, and was not modeled.

In the semi-desert grasslands, uncharacteristically high severity can result from the burning of significant amounts of woody encroachment that produce more heat than grass fuels could, depending on the conditions of the burn. Often, in grasslands, a result of multiple missed fire cycles is insufficient surface fuel to produce characteristics fire behavior or effects, particularly when they are grazed.

The role of fire in a frequent fire regime cannot be effectively evaluated by considering the effects of just one or two fires, it is the cumulative effects of frequent fires that define the regime, and those fire effects that are most influential (Pellegrini et al. 2017). Frequent fires regulate nutrient cycling, fuel and vegetation structure, species composition, surface cover, and multiple other ecological functions and characteristics. The effects of frequent fires on adjacent ecological response units are also important, and include effects from smoke, ash, and nutrients and other chemicals in overland flow after a fire. Some of the effects to adjacent systems are more frequent than the fire return interval is at a specific location, because they can be produced by fires from many adjacent areas, while a fire cannot burn more than once a year on a given spot.

Frequent fire regimes are found where there are combinations of species that can produce sufficient fuel to burn every few years, primarily perennial grasses and forbs that thrive in open conditions; such as grasslands, savannas, or open forests. When fires are frequent, the fuels that are burning are mostly light and flashy, and support fires with short residence times, so little heat is transmitted into the soil or tree boles. Flame lengths on any one spot can vary widely, depending on surface fuels structure and composition, and the conditions under which they burn. In most cases, herbaceous species comprise the majority of the light surface fuels, though litter from overstory species, such as ponderosa pine, can be a critical component. In some frequent fire ecological response units, there are specific conditions where litter from trees and/or shrubs comprises the majority of the surface fuels. In these cases, typical fires would be of slightly lower intensity with a slightly longer residence time.

Fire and other disturbances maintain a mosaic of seral stages, which shift both temporally and spatially, depending on the ecological response unit and environmental conditions affecting the disturbance. The patch size is also limited by environmental conditions at the time of the disturbance, such as species, fuel structure, current and recent weather, but is also dependent on site-specific variables, such as soil, slope, and aspect. In most places, in most frequent fire ecological response units, woody species are likely to increase when the fire frequency increases. The increased shade decreases the herbaceous component that comprises the light flashy surface fuels. As canopies become more closed in later seral stages, the nature of the fire behavior and effects that are possibly changed, as fuel loads eventually increase to a point that fires that do burn may damage soil, kill overstory trees, and decimate the seed bank. The absence of fire allows the establishment of species that are not fire adapted, prevents species that are fire dependent from thriving, and allows shade tolerant species to establish, and/or species that are present to become overly dense or overrepresented.

Historically, grazing management has had significant impacts on many ecological response units on the Tonto National Forest. Grazing impacts herbaceous surface vegetation, which was the primary light, flashy fuel that carried fire in all of the frequent fire ecological response units on the Tonto National Forest. Grazing too heavily, at the wrong time, too often, or in the wrong locations impacts the characteristics of the fires that could burn. When surface fuels (primarily grasses) are sparser, shorter, or not as dense as they would have been historically, and/or the litter layer that would normally be present is sparse or absent, fire cannot produce the intensity (flame lengths) or heat to kill or top-kill encroaching woody species. When herbaceous surface fuels are no longer contiguous, fires are patchier, and more likely to burn around encroaching woody species or seedlings with little, if any, effect. Historically, northern Arizona did not support large herds of grazing animals (Milchunas 2006). Domestic livestock are not subject to the same types of controls as native ungulates were, and are not currently regulated by season, only minimally by location and, for the most part, are not managed in a manner that will allow pastures to be rested for 2 to 3 years prior to a fire and/or 1 to 3 years post-fire.

Because grasses are a fundamental component of frequent fire systems, they have some adaptations that can withstand some levels of grazing, since both fire and grazing tend to remove the above-ground portions of plants. Grazing, like fire or mechanical treatments, can be a useful tool for managing vegetation. Some components of grazing management have become wildlife habitat (tanks), water source/s for veg and fire management, or infrastructure used by recreational visitors (such as corrals). Historic grazing management practices had significant adverse effect on herbaceous surface vegetation cover, composition, and diversity on the Tonto National Forest (Croxen 1926). Fire regimes were altered as well, as grazed herbaceous fuels were inadequate to carry fire, or to carry the type/s of fire that ecosystems were adapted to, and tended to facilitate the growth and encroachment of many woody species (Huffman et al. 2018; Milchunas 2006). Current grazing practices are much improved, but still include grazing in ecological response units with few adaptations for it, such as in desert areas (Hall et al. 2005).

There is a moderate likelihood of vegetative change due to climate change for the Tonto National Forest. Mesa ranger district (mostly Maricopa County) indicate a higher proportion of area where vegetative change is more likely to occur. This is where majority of the desert ecological response units are located on the Forest. Globe and Payson ranger districts have the highest probability that a randomly selected acre are at high or very high risk for stressors on the landscape (e.g., vegetative change, wildfire hazard potential, and insect and disease mortality risk) (USDA Forest Service 2018e).

Semi-Desert Grassland

In the semi-desert grassland (SDG) under reference conditions based primarily on woody species cover, a majority of acres (70 percent) would be in the high seral state (B) where a majority of the vegetation is composed of perennial grasses and late successional herbaceous plants with shrub and tree cover collectively less than 10 percent (table 67). Twenty-five percent of the vegetation would have been grasses with shrub and tree cover collectively less than 10 percent (A). Less common, representing 5 percent of vegetation, low-mid seral states consisted of perennial-mixed grasses and forbs with various shrub and tree cover (C and D). Contemporary states (E and F) are novel-low seral states with exotic grasses and various shrub and tree cover.

Table 67. Semi-desert grassland seral state descriptions, reference conditions, and current conditions

Seral State	Description	Reference Condition (percent)	Current condition (percent)
A	Mid seral: Perennial-mixed grasses, shrub/tree cover less than 10 percent, grass cover more than 10 percent. Includes post-fire plant communities previously high seral	25 percent	0.8 percent
B	High seral: Perennial grasses, shrub/tree cover less than 10 percent; grass cover more than 30 percent	70 percent	0.2 percent
C, D	Low-mid seral: perennial-mixed grasses, shrub/tree cover, Ruderal Grass, Shrub (open and closed) more than 10 percent, grass cover more than 10 percent	5 percent	9.1 percent
E	Low Seral, Ruderal Grass, Shrub (closed)	0	43.5 percent
F	Low Seral Exotics	0	0.4 percent

Current conditions show very high departure across the forest. On the Tonto National Forest, a majority of the acres are nearly split between mid-seral, ruderal grass, shrub open and closed (C, D) and low seral, ruderal grass, shrub closed states (E). Less than 1 percent is in the high seral state (B). The exotic low seral state (F) is also less than 1 percent and found mostly in small pockets and along roadways. The Agua Fria zone does have the highest proportion of state F at 1.3 percent.

The most pronounced change to semi-desert grasslands has been an overall shift from predominately open perennial grasslands to more savanna-like conditions, or even shrublands. The higher proportion of closed states on the national forest is where shrub/tree encroachment has occurred. Many shrubs and subshrubs are overrepresented, such as broom snakeweed, and buckwheat. These shrubs commonly invade grasslands and can reach dominance at sites with a history of heavy grazing (Brown and Makings 2014). Velvet mesquite and catclaw acacia are also well above the similarity to site potential. Shrub and tree encroachment is also evident by the much smaller average patch size of 47 acres from reference conditions (1,015 to 1,343 acres). Many native bunch grasses are also poorly represented while sod-forming grasses have increased in abundance in areas. The shift from bunch forming grasses to sod-forming grasses is an indication of altered site conditions from a changed disturbance regime: less fire and more grazing than semi-desert grassland evolved with.

The loss of frequent high severity fires has strongly influenced grassland conversion to shrubland. Fire return intervals in semi-desert grasslands on the Tonto National Forest currently average about 210 years, roughly 6 to 30 or more times the historic fire return intervals. Most fires have been low to mixed-severity, while only 6 percent have been stand-replacing. These changes in the fire regime have favored the continued establishment of woody species and, in many places, the elimination of grasses and forbs.

When the disturbance regime is interrupted, woody shrubs and other desert plants establish. Without frequent fires, changes in the surface soils over time will increasingly favor deep-rooted shrubs and trees over shallow-rooted grasses resulting in an almost irreversible cycle (McAuliffe 1995). Many sites today are in a disclimax state where soil-binding perennial grasses have been replaced by native and nonnative shallow rooted shrubs and annuals that compete with grasses (USDA Forest Service 2017a).

Juniper Grass

Under reference conditions juniper grass (JUG) is generally uneven-aged and very open in appearance. Trees occur as individuals or in smaller groups with the majority (60 percent) medium to large in size. Like many of the other woodland types, a fair proportion of small trees is also represented on Juniper

Grass landscapes with 25 percent of the small trees in an open condition and 10 percent in a closed canopy condition. This ecological response unit supports a dense herbaceous matrix of native grasses (mostly perennials) and forbs. Typically, native understory grasses are perennial species, while forbs consist of both annuals and perennials. Shrubs are characteristically absent or scattered. Typical disturbances (fire, insects, and disease) are of low severity and high frequency with a historic average fire return interval that was probably less than 10 years with low to moderate severity effects. These disturbance patterns create and maintain the uneven-aged, open-canopy nature of this ecological response unit. The dense herbaceous matrix of native grasses and forbs along with the frequent disturbance limit the average patch size of less than 0.5 acres.

The current condition of the juniper grass ecological response unit is moderately departed from reference conditions for seral state distribution. The forest shows a significant shift toward the early states with 67 percent of this ecological response unit in the grass and forb state, and just under 20 percent in the late development, medium to large tree states. The medium/large tree state on the plan scale is in a closed canopy condition (13 percent) with only 6 percent in the open canopy condition. A great deal of this shift to the grass/forb/shrub state can be attributed to six wildfires that burned through this ecological response unit within the last twelve years. Repeated wildfires, range management activities and grazing have all contributed to larger patch size. Patches now average 30 acres at the plan scale, 60 times larger than the reference patch size of less than 0.5 acres. There has been a decrease in ground cover, and a reduction in species diversity that is also likely result of uncharacteristic fires and grazing. Almost all forbs, have increased in abundance, while the abundance of various grasses and forbs have shifted, with some increasing and some decreasing.

Historically, these systems burned with frequent, low to moderate severity fires about every 15 years. Now they are experiencing fire return intervals of up to 96 years with 21 percent of these fires burning with mixed-severity and 5 percent burning with stand-replacing intensity. Many of these sites now have insufficient surface vegetation to carry surface fire.

Pinyon–Juniper Grass

The pinyon-juniper grass (PJG) ecological response unit historically occurred with trees as individuals or in smaller clumps that ranged from young to old (uneven-aged) open woodlands with grassy understories (Ffolliott and Gottfried 2005). Trees occur as individuals or in smaller groups with about 60 percent medium to large trees. Like many of the other woodland types, a fair proportion of small trees is also represented on pinyon-juniper grass landscapes with 25 percent of the small trees in an open condition and 10 percent in a closed canopy condition. Scattered shrubs and a dense herbaceous understory of native perennial grasses and annual and perennial forbs characterize this type. Site productivity suggests that the development of a grass and fine fuels layer (22 percent groundcover) would have supported a mosaic of frequent-fire, open-forest dynamics (Gottfried, Neary and Bemis 2003). Typical disturbances (fire, insects, and disease) were of low severity and high frequency, creating and maintaining an uneven-aged open canopy. The historic fire return interval was about 8 to 36 years with low to moderate severity fire (Margolis 2014; Baison and Swetnam 1995; Grissino-Mayer et al. 1995; Allen 1989). Reference patch sizes in this system ranged from 0.7 to 1 acre.

Seral state distribution for pinyon-juniper grass on the Tonto National Forest is moderately departed, with a shift in canopy cover toward the more closed canopy states with the medium/large closed state increasing from the 10 percent found in reference conditions to 23 percent. The grass/forb/shrub state on the Tonto is now at 24 percent and the seedling/sapling small tree state is at 19 percent. The small closed state is near reference conditions within the national forest, currently at 13 percent. Patch size has increased, averaging nearly 19 acres on the forest, which is highly departed from the small patch sizes of

1 acre or less found in the reference condition. There has been a decrease in ground cover, and a reduction in the diversity of grass, forbs, and shrubs as a result of the in-filling of the canopy gaps and increased density.

The pinyon-juniper grass currently has fire return interval of around 215 years, with 29 percent mixed severity and 29 percent high severity. Many of these sites have uncharacteristically high shrub cover and insufficient surface vegetation to carry the mostly low severity surface fire that these systems are adapted to. All these changes combined have stressed this system, increasing the potential for bark beetle activity above what would have been expected in pre-settlement conditions. That would produce significant mortality, such as the pinyon bark beetle outbreak of 2003.

Madrean Encinal Woodland

Madrean encinal woodland (MEW) was historically dominated by open stands of Madrean evergreen oaks such as Arizona white oak and Emory oak, with denser stands on north facing slopes and in drainages. Open states accounted for 40 percent of the ecological response unit with 25 percent in the seedling/saplings and 15 percent in medium/large states. The small closed state account for 40 percent of the area while 20 percent was in the grass/forb state. The medium/large closed state was not historically found in this ecological response unit. The understory in this ecological response unit is dominated by warm-season perennial grasses that provided fuel for surface fires. Frequent fires, occurring primarily between April and June, have been well documented for the semi-desert grasslands and Madrean pine-oak woodlands that border Madrean encinal woodlands; however, little is known about the frequency of fire in southwestern oak woodlands (Fulé et al. 2005; Humphrey 1952, Kaib et al. 1996, McPherson 1995, Swetnam and Baisan 1996; Swetnam et al. 1992; Wright 1980). Given that fires in semi- desert grasslands occurred on average every 2.5 to 10 years, covered hundreds of square miles, and often spread to upper elevation Madrean pine-oak systems, which experienced fires on average every 3 to 7 years, it is likely that Madrean encinal woodland also had frequent fires (Fulé and Covington 1998; Fulé and others 2005; Kaib et al. 1996; McPherson 1995; Swetnam and Baisan 1996; Swetnam et al. 1992). Given the fire return intervals of surrounding areas, it's likely that the fire return interval averaged no more than about 20 years, and was probably closer to 10 or 15. The historic fire regime resulted in patch sizes that ranged from 0.7 to 50 acres.

Madrean encinal woodland is moderately departed at the forest level with the Tonto showing a departure of 43 percent for seral state distribution. The majority of this departure is due to a shift from small closed to the medium/large closed state which was not present under reference conditions. This is the result of the small closed state (40 percent of the ecological response unit under reference conditions) developing uninterrupted without the disturbance required to open canopies. The small closed state has decreased to 12 percent on the Tonto, while the medium to large closed state has increased to 33 percent. Without the level of disturbance required to regulate early successional development, the proportions in the seedling, sapling, and small tree classes have also been reduced to 10 percent on the Tonto, while the grass/forb/shrub state has remained relatively constant showing a slight increase. The in-filling of the canopy gaps and increased density of brush species in the medium to large closed state has led to a reduction in the abundance and diversity of grass and forb species and a reduction in vegetative groundcover. However, patch size has remained within the natural range of variation at 30 acres.

Fire suppression and grazing have both contributed to a lengthening of the fire return interval to about 170 years instead of the reference condition of about 20 years. The combination closed canopies, increased coarse woody debris, and reduced vegetative ground cover makes it difficult to reintroduce low severity fire into this system as a management tool.

Madrean Pinyon–Oak Woodland

Madrean pinyon-oak woodland (MPO) is concentrated in the Madrean province and is dominated by an open to closed canopy of evergreen oaks with grassy understories. Madrean pinyon-oak woodland is dominated by both oaks and pinyon; juniper or Arizona cypress may be co-dominants as well. Species within this community present on the Tonto National Forest include Arizona white oak, alligator juniper, and less commonly Chihuahua pine. A shrub layer is present and often contains species such as beargrass, silktassel, occasionally birchleaf buckthorn, and ceanothus species. The herb layer is dominated by warm-season grasses such as threeawns, blue grama, sideoats grama, Arizona cottontop, curly-mesquite, green sprangletop, muhly grasses, and little bluestem.

Madrean pinyon-oak woodland is characterized by historic fire regime group III (I). Limited data are available that are specific to Madrean pinyon-oak woodland but, based on the Forest Inventory and Analysis–Forest Vegetation Simulator analysis (Wahlberg et al. 2017 (in draft)), and the fire frequencies of adjacent ecological response units, the fire frequencies probably vary quite a bit, ranging from 15 to 200 or more years, and averaging around 40 years. Adjacent ecological response units include interior chaparral, pinyon-juniper evergreen shrub (fire regime III); pinyon-juniper grass, mixed conifer with aspen, ponderosa pine-evergreen oak and juniper grass (fire regime II). Some areas contain a more contiguous herb layer that can support fire return intervals of around 15 years with low to moderate severity fires. Madrean pinyon-oak woodland likely supported patches of one-tenth to 1 acre in size, though larger patches may have been present. A mature forest state with open tree canopy cover from medium to very large trees with a grass dominated understory made up 60 percent of this ecological response unit. An early seral, recently disturbed state dominated by grasses accounted for 4 percent. A young tree state dominated by resprouting seedlings with both open and closed stands occupied 5 percent. Small trees with open tree canopy cover and a grass understory accounted for 13 percent while small trees with a closed canopy and grass understory occupied 3 percent. The remaining 4 percent is occupied by a mature forest state with closed tree canopy cover from medium to very large trees with a grass dominated understory.

On the Tonto National Forest, Madrean pinyon-oak woodland occurs on 6,394 acres, less than 0.1 percent of the forest, so it was not modeled. Current conditions on the Tonto National Forest show a shift from the mature, medium to very large, open tree state to the mature, medium to very large tree, closed state with only 11 percent in the open state and 2 percent in the closed state. The small tree with a closed canopy and grass understory has also increased to 12 percent while the small trees with open tree canopy cover and a grass understory has decreased to 2 percent. The early seral, recently disturbed state is near desired conditions at 3 percent and there are currently no acres in the young tree state dominated by resprouting seedlings. Currently, there is no information available on patch size or fire return interval.

Ponderosa Pine–Evergreen Oak

The ponderosa pine-evergreen oak (PPE) ecological response unit is dominated by ponderosa pine and can be distinguished from the ponderosa pine forest (PPF) by well-represented evergreen oaks (e.g., Emory oak and Arizona white oak), as well as alligator juniper, and pinyon pine. In terms of disturbance, the ponderosa pine forest averaged higher fire severity than the ponderosa pine forests above the Mogollon Rim, and greater patchiness with less horizontal uniformity and more even-aged conditions. Understory shrubs include manzanita, turbinella oak, skunkbush sumac, and mountain mahogany. Depending on site conditions, shrubs and perennial grasses have varying importance in vegetation response to disturbance. Ponderosa pine-evergreen oak can be split into two provisional subclasses that describe historical structure of this system: ponderosa pine-evergreen oak, perennial grass subclass and ponderosa pine-evergreen oak, evergreen shrub subclass.

Currently, much of this ecological response unit is highly departed from historic conditions. Typically, these changes include in-filling of the canopy gaps, increased density of tree groups; and reduced composition, density, and vigor of the herbaceous understory plants. Other significant changes are increased homogeneity of the shrub structural stages on the landscape, facilitating larger patch sizes of high-severity fire effects. Currently, many of these sites are closed-canopy forests, capable of supporting crown fires.

On the Tonto National Forest, there has been a distinct shift toward the medium/large closed canopy state, with deficiencies in the medium/large and small, open canopy state classes. The medium/large closed state has increased to 64 percent on the forest. The open medium/large state has decreased to 8 percent, much lower than the 60 percent that would be expected in the reference condition. Without fire to thin the smaller trees, the small closed state has increased to 13 percent on the forest, while the small open state has decreased to 7 percent. The seedling/sapling state class is also underrepresented, occupying only 1 percent of the ecological response unit acreage on the Tonto National Forest. There is a lack of open canopy, larger patch sizes, less groundcover, increased coarse woody debris, and understories that are now dominated by moderate- to high-density shrubs, with limited grass cover. Patch size has increased from reference conditions of 0.2 to 50 acres to an average of about 150 acres, and there has been a general loss of grass, forbs, and overall species diversity.

Woody fuel continuity has increased dramatically in ponderosa pine-evergreen oak, as open spaces fill in horizontally and vertically, resulting in higher burn severities from wildfire, while herbaceous surface fuels have decreased dramatically across this ecological response unit (Guiterman et al. 2015). In the period used for the Tonto National Forest Assessment of Ecological Conditions, twenty-seven percent of the ponderosa pine-evergreen oak on the Tonto National Forest burned with mixed severity, while 16 percent burned with high severity. Current mean fire return interval is now about 115 years compared to the 5 to 10 years that was typical under reference conditions (Kaib 2001; Huffman et al. 2018).

Some tree species (juniper and oak) and understory shrubs (manzanita and turbinella oak) that were historically controlled by frequent fire have now become well established at higher densities, adding to ladder fuels, and overall fuel loading. This is a particularly difficult challenge to address because most of these species sprout vigorously when top-killed, and the best control would have been to prevent them from becoming established outside of their natural patterns. Additionally, in the late seral stages, coarse woody debris have built up to almost 40 tons per acre in some places, high enough to make high burn severity (fire effects to soil) inevitable if it burns under the wrong conditions. The loss of herbaceous surface vegetation also affects the ability to re-introduce surface fire without mechanical treatments, because there is not enough light, flashy surface fuel (grass and forb cover) to carry the low-severity fire that is the only way to maintain ponderosa pine-evergreen oak in a resilient, sustainable condition.

Ponderosa pine-evergreen oak supports a range of fire regimes. In systems supporting a predominantly grass understory, fire regime group I historically burned frequently with low-intensity fire. In systems supporting a more robust shrub component, the fire regime group III historically burned with mixed severity. These fires maintained this ecological response unit in a predominantly open state with 60 percent in the medium/large open state and 24 percent in the small open state. The range in fire regimes also resulted in a range of patch sizes, with mixed-severity fires creating larger patch sizes, and low severity surface fire created smaller patches. Reference condition patch sizes ranged from 0.2 acres to 50 acres. Frequent fires also prevented the buildup of coarse woody debris and prevented the excessive establishment of sprouting, woody species.

Ponderosa Pine–Evergreen Oak: Perennial Grass Subclass

The perennial grass subclass is distinguished from the evergreen shrub subclass by a more continuous layer of perennial grasses in the understory and a relatively minor shrub component. Trees occur as individuals or in smaller groups and range from young to old but were historically more uneven-aged in structure. The understory is dominated by low to moderate density shrubs, with herbaceous plants in the interspaces. Fires is more frequent than the evergreen shrub subclass, and with lower severity. These disturbance patterns create and maintain the uneven-aged (grouped), low- to moderately-closed canopy nature of this type. Site potential and disturbance history also maintained oak, juniper, and pinyon as subdominant tree components, with herbaceous plants in the interspaces.

Ponderosa Pine–Evergreen Oak: Evergreen Shrub Subclass

The evergreen shrub subclass differs from the former subclass by site potential, typically favoring higher shrub cover, which supported and maintained more mixed severity fire than is characteristic in most ponderosa pine. This type is found on well-drained soils, frequently with coarse-textured or gravelly (stony) soil characteristics that favor shrub layer development (particularly oaks) over herbaceous plants. Trees occur as individuals or in small groups and patches and range from young to old, but typically groups or patches are even-aged in structure. The understory is dominated by moderate- to high-density shrubs, with limited grass cover. Typical disturbances (fire, insects, and disease) worked collectively to favor mixed-severity conditions (fire regime III, where sufficient tree canopy provides needle-cast to facilitate fire spread). Some high-density evergreen shrub patches exhibit infrequent, high severity fire (fire regime IV; high severity fire every 35 to 200 years).

Populations of weeping lovegrass are increasing in the ponderosa pine-evergreen oak ecological response unit, establishing or expanding where there is disturbance, and thriving in areas that have burned, replacing native grasses and forbs. Weeping lovegrass often reaches 4 feet high, and can produce flame lengths that exceed what would have been produced by native grasses, and producing undesirable fire behavior and effects. Figure 25 shows a meadow in the Sierra Anchas, in the ponderosa pine-evergreen oak type, that is dominated by weeping lovegrass. Some of the mature oaks in this meadow could be top-killed under extreme fire conditions because of the flame lengths produced by weeping lovegrass. The lovegrass in the foreground is about 4 feet tall.

Figure 25. An open area adjacent to Reynolds Creek in the Sierra Anchas that is dominated by weeping lovegrass
(Photo credit: Mary Lata, USDA Forest Service)

Ponderosa Pine Forest

Historical structure of southwestern ponderosa pine forest is characterized by multi-storied, open- canopy stands of medium to large trees with a well-developed, often grass-dominated understory. Overstory cover ranged from roughly 17 to 22 percent (White and Pickett 1985; Covington et al. 1997). Tree groups can vary greatly in size but in the Southwest, are generally 0.02 to 1.07 acres, with some as large as 2 acres (White and Pickett 1985; Kaufmann et al. 2007). There is typically a shrubby understory mixed with grasses and forbs, although this type sometimes occurs as savannah with extensive grasslands interspersed between widely spaced clumps or individual trees. Historical patch size ranged from 0.2 to 0.5 acres with a historic average fire return interval of 1 to 60 years with an average of about 7 years from mostly low-severity fire (Swetnam and Dieterich 1985; Moore 1993). As currently described, this ecological response unit is comprised of both the ponderosa pine bunchgrass and ponderosa pine/Gambel oak subclasses.

Ponderosa pine bunchgrass subclass is characterized by open stands supporting an understory of primarily herbaceous species, a grassy understory, and ample needle cast and duff are the primary carriers of fire, and support frequent, mostly low-severity fires. Common grass species include blue grama, Arizona fescue, and mountain muhley.

Ponderosa pine/Gambel oak subclass while structurally similar to its counterpart subclass, is typically found on alfisol or inceptisol soils and is primarily distinguished by the presence of the deciduous Gambel oak in the sub-canopy. Other common species include alligator juniper, two-needle pinyon, and New Mexico locust.

Ponderosa pine forest is one of the most departed ecological response units on the Tonto National Forest. Current conditions show a large proportion of this ecological response unit has shifted to the medium/large closed states (61 percent), with a smaller proportion now in the small closed state (21 percent). On the planning scale, only 11 percent of this ecological response unit is currently in the large, open, multi-storied state that dominated reference conditions. Much of what remains are even-aged, relatively young stands; a seral state that did not exist in reference conditions. There is a lack of open canopy, fewer large / old tree dominated stands, larger patch sizes, less groundcover and increased coarse woody material. Current patch size is near 363 acres.

Woody fuel continuity and total fuel load have increased in ponderosa pine forest, while herbaceous surface fuels has decreased dramatically across this ecological response unit as open spaces fill in horizontally and vertically, and surface fuel loads continue to accumulate, resulting in higher burn severities from wildfire. During the period used for the Tonto National Forest Assessment, 21 percent of the ponderosa pine forest on the Tonto National Forest burned with mixed severity, and 16 percent burned with high severity. Mean fire return interval is now 84 years as compared to 4 to 30 years in reference conditions. Forests often follow uncharacteristic trajectories after stand-replacing fire, transitioning to dense ponderosa pine that is vulnerable to another fire or to non-forested grass/shrub vegetation states (Savage 2005).

Mixed Conifer–Frequent Fire (Dry Mixed Conifer)

Typically, mixed conifer-frequent fire (dry mixed conifer (MCD)) was dominated by ponderosa pine in an open forest structure (less than 30 percent tree cover), with minor occurrence of aspen, Douglas-fir, white fir, and southwestern white pine (*Pinus strobiformis*). Aspen can occur within dissimilar inclusions and not as a seral stage in the mixed conifer-frequent fire ecological response unit. Typical mixed conifer-frequent fire stands were open with the majority of trees (60 percent) in the medium diameter size class (10 to 19.9 inches) and only 5 percent of this vegetation type in a late seral, closed canopy with large diameter trees (greater than 20 inches) state. Frequent fires kept fuel loads relatively constant spatially and temporally (Touchan et al. 1995; Morgan et al. 2001; Margolis and Balmat 2009) and encouraged understory herbaceous cover. Patch sizes ranged from 0.2 to 50 acres.

The more common historical mean fire intervals of high-frequency surface fires are similar to that of ponderosa pine forest and likely resulted from the spread of fires from low to higher elevation and the proximity of the two forest types (Allen et al. 1995). Frequent surface fires every 2 to 60 years, with an average of about 12 years, from low-severity surface fire and infrequent mixed-severity fire (Huffman et al. 2015; Heinlein et al. 2005; Touchan et al. 1995; Yocom-Kent et al. 2015) (figure 26).

Figure 26. The Juniper Fire burning in dry mixed conifer stand in the Sierra Anchas on the Tonto National Forest in May of 2016
(Photo credit: Mary Lata, USDA Forest Service)

The current condition on the Tonto National Forest demonstrates this shift away from medium and large open states toward closed states. Thirteen percent of this ecological response unit has moved into a medium and large, open canopy, single-storied or two-storied condition that was not common in the reference condition. Medium, large, and small closed states have also increased relative to reference conditions. The medium and large closed state has increased from 5 percent to 22 percent, and small closed state has also increased from 5 percent to 22 percent. The proportions in the medium and large, open-canopy, multi-storied state has decreased to only 4 percent from the 60 percent found in the reference conditions.

Without fire, shade-tolerant, less fire-resistant species are able to establish and mature more easily. White fir and Douglas-fir (more shade-tolerant than ponderosa pine) have in-filled and become more common as dominant species, increasing stand density and species homogeneity (Reynolds et al. 2013). Fire and drought tolerance have decreased since pre-settlement times, driven largely by increases in the relative importance of white fir and southwestern white pine, as well as shifts from shade intolerant species to shade tolerant species (Strahan et al. 2016). Both fire exclusion, resulting in current homogenous stands, and past management activities led to increases in patch size averaging nearly 59 acres at the plan scale.

Woody fuel continuity has increased in mixed conifer-frequent fire, while herbaceous surface fuels have decreased dramatically across this ecological response unit as open spaces fill in horizontally and vertically, while surface fuels continue to accumulate, resulting in higher burn severities from wildfire. Current mean fire return interval is about 115 years as compared to reference conditions with a range of 2 to 60 years, and averaging about 12.

Desert Ecological Response Units

Desert ecological response units comprise about 28 percent (830,154 acres) of the Tonto National Forest, more than grasslands, or forests, or shrublands. For two of the sub-class desert ecological response units, Sonoran mid-elevation desert scrub, and Sonoran paloverde-mixed cactus desert scrub, over 90 percent in the ecological subsection is on the Tonto National Forest. See table 67 for complete descriptions of the range of states (A through F) used in this section.

Characteristics Common to All Desert Ecological Response Units

Deserts are defined as regions with very low rainfall. The Sonoran Desert systems have denser vegetation than the Chihuahua or Mojave because of the effects of monsoonal rainfall. The most widely known species in these deserts is the saguaro cactus, which is unique to the Sonoran Desert, along with many other cacti and other species that have specialized adaptations to live in the harsh desert climate.

Fire was rare in these systems, and most desert species and ecosystems do not have adaptations that allow them to survive even low intensity fire. Historically, when there was fire, it would have been small, scattered, and patchy – the result of a lightning strike in a patch of vegetation. Invasive species, particularly red brome and, in the higher desert areas where there is a little more moisture, buffelgrass have become established at scales that are affecting fire effects and behavior. Patches of vegetation become joined by flammable fuels, and fires are larger.

Table 68. Summary of departure, fire return intervals, and threats for desert ecological response units (ERUs): Sonora–Mojave mixed salt desert scrub (SDS) and Mojave Sonoran desert scrub (MSDS)

Ecological Response Unit	Forest acres (percent)	Current Departure (percent) and Future Trend	Historic Fire Return Interval (years) and severity	Current fire return interval (years)	Threats	Primary Departure Characteristics
Desert ecological response units (Sonora–Mojave mixed salt desert scrub and Mojave Sonoran desert scrub)	677,727; (23 percent)	9 percent (low); away	Over 250; mixed severity	250	Soil disturbing activities (recreation, grazing); invasive species (flora and fauna); fire	Disturbed soils, accelerated erosion, increased cover of late seral grasses and shrubs. Invasives currently occupy about 1 percent of this ecological response unit

Sonora–Mojave Mixed Salt Desert Scrub

Trees are generally absent from the Sonora-Mojave mixed salt desert scrub (SDS) ecological response unit. Shrubs in these ecosystems can act as important nurse plants, affect (positive or negative) the establishment of certain species, and influence community dynamics. The mosaic of shrubs produces distinctive microhabitats (under canopy and interspaces) that have significant influences on seed distribution, germination, and survival of other species (McAuliffe 1995). Under reference conditions 85 percent of this ecological response unit would be in the late development open state B consisting of graminoids and shrubs with 10 to 25 percent in cover. The early development state A with fewer shrubs than the late development state (less than 10 percent cover) would account for the remaining 15 percent.

Desert shrublands have been largely influenced by climatic factors, varying soil properties, and, to a lesser extent, fire (Paysen et al. 2000). Desert communities largely evolved without fire as an ecological process, so most species are not fire adapted. Historically salt scrub communities lacked contiguous fuel sources, greatly limiting fires (Paysen et al. 2000; Wahlberg et al. 2017 (in draft)).

Historically, this vegetation type reached its dominance along the lower Gila and Salt Rivers in south-central Arizona (Creutzburg 2012). Today, much of this vegetation has been converted to agriculture. Exotic grasses that burn easily are becoming more common in the Sonoran Desert, resulting in more fires in these plant communities (Brooks and Pyke 2001). Exotic species, including filaree and prickly lettuce, and native species, such as Spaeralcea, contribute to fine fuels that are easily ignited in this vegetation type. While historic conditions would have limited the occurrence of fires in these systems, today many have the ability to support fires from the accumulation of exotics (annual grasses such as red brome) that provide contiguous fine fuels (Bunting et al. 2002; Pellant and Reichert 1984). The probability of wildland fire in desert systems is especially high following wet years where annual exotics reach significant fuel loads (Sparks et al. 1990).

The late development open state B (graminoids and shrubs make up 10 to 25 percent in cover) is slightly overrepresented at 92 percent, and the early development state A (fewer shrubs than the late development state) is somewhat underrepresented (7 percent) on the Tonto National Forest. Exotic states C and D have the highest potential to carry fire. Currently, about 1 percent of exotics are present at the plan scale. Seventy-two acres of invasive species have been mapped in this ecological response unit.

Mojave Sonoran Desert Scrub

Given the large extent of Mojave Sonoran desert scrub (MSDS) and range of features (topography, soil attributes, and precipitation) on the landscape, there are three provisional subclasses: Sonora-Mojave creosote-bursage desert scrub, Sonoran paloverde-mixed cactus scrub, and Sonoran mid-elevation desert scrub. The Sonora-Mojave creosote-bursage ecological response unit is treated together with the Sonoran paloverde-mixed cactus scrub ecological response unit (MSDS-SP) because there are only slight differences between these two systems and future models will combine these two provisional classes. The Sonoran mid-elevation desert scrub provisional subclass (MSDS-SOS) was not modeled because the appropriate model is not yet available (currently being developed).

A general vegetation description is given for Mojave Sonoran desert scrub (MSDS) followed by reference conditions applicable to both provisional subclasses, Sonoran paloverde-mixed cactus scrub and Sonora-Mojave creosote-bursage. Further vegetation description and conditions, reference and current, are provided for both provisional subclasses, Sonoran paloverde-mixed cactus scrub and Sonoran mid-elevation desert scrub.

Found primarily below 4,000 feet in elevation, Mojave Sonoran desert scrub is most common on the Tonto National Forest. Areas in this vegetation type vary from barren rocky substrates (less than 1 percent plant cover) to lands with deep, well-developed soils supporting dense succulents, desert grasses, perennial shrubs, and some herbaceous ephemerals that emerge during infrequent wet periods, then quickly mature, flower, and produce seed as drought conditions return. Where winters are mild, a sparse emergent layer of palo verde, ironwood, and saguaro cacti can be found among alluvial fans with dominant creosote and bursage shrubs. At higher elevations and on steep mountain slopes, creosote is replaced by up to 50 percent cover of small trees and shrubs such as fairyduster, brittlebush, and jojoba (Wahlberg et al. 2017 (in draft)). Covering 808,098 acres, this ecological response unit makes up a significant proportion (27 percent) of the Forest, covering more area than any other ecological response unit. Additionally, the acreage on the Tonto National Forest represents a large proportion of the Mojave Sonoran desert scrub acreage at the context scale (38 percent).

Desert shrublands have been largely influenced by climatic factors, varying soil properties, and, to a lesser extent, fire. Desert communities largely evolved without fire as an ecological process, therefore most desert species are not fire adapted. The herbaceous layer in these communities can reach high densities during wet years, producing high fuel loads capable of supporting major fires. The bimodal rainfall (winter and summer) in the Sonoran Desert allows for a greater structural diversity in vegetation than neighboring deserts such as the Great Basin, Mohave, and Chihuahuan Deserts (Brown 1982).

Drought is the primary natural disturbance associated with deserts. Desert annuals are more common in arid environments and make up a significant proportion of the Sonoran Desert. The quick germination and flowering strategies for these plants allow them to complete their life cycles quickly during favorable conditions and lie dormant during unfavorable conditions. Strong associations exist between many cactus and perennial species. Under reference conditions 75 percent of this ecological response unit would be in the late development open states B and C consisting of graminoids and shrubs with 10 to 25 percent in cover. The mid-seral state with 10 to 30 percent shrub and tree cover would contain 20 percent. The early development state A, herb dominated with less than 10 percent shrub and tree cover would account for the remaining 5 percent. Reference patch sizes would have been very large ranging from 4,000 to 8,000 acres. While the historic role of fire is thought to be minimal to absent in desert ecosystems, some areas may have experienced mixed-severity fires where less than 75 percent of the dominant overstory vegetation is replaced with fire frequencies or return intervals of 35 to 100 or more years.

The largest change to this community type in the Southwest has been conversion to grassland, a direct result of land management during the 19th century to increase forage for livestock and wildlife. Historical overgrazing and burning has resulted in higher shrub components than would be expected under reference conditions. Exotic grasses that burn easily are becoming more common in the Sonoran Desert, resulting in more fires in these plant communities (Brooks and Pyke 2001). Current conditions on the Tonto National Forest show more acres (83.8 percent) in the later seral stages B and C (open, cacti tree, and shrub cover up to 25 percent) and 14.6 percent in the mid-seral stages (10 to 30 percent shrub and tree cover). Exotics account for less than 1 percent of the land area at 0.5 percent. Patch size is within the historical range at approximately 4,500 acres. While overall departure is currently low, ground disturbance can lead to soil compaction and loss (as little as 5 to 10 cm at soil surface), hinder the recovery of plants, potentially eliminate long-lived dominates such as creosote and shift dominance to short-lived disturbance adapted species (including natives and exotics). At some sites depending on the level of disturbance, effects to these plant communities can last up to 40 years (Prose et al. 1987).

Past land management along with exotic grass invasion has supplied many areas with a contiguous fuel source producing larger more frequent fires. The cacti and succulent component is most negatively affected following fires, generally shifting dominance to the grass component. Fire effects are affected by past fire severity, fire frequency, species composition, structure, and presence of exotics. Invasive species encroachment along with altered vegetation structure (for example, increased shrub densities) are influencing uncharacteristic fire in these ecosystems. Current fire return interval is 250 years.

Soil condition for these communities are the most departed compared to all other ecological response units on the Tonto National Forest (reference soils report). Impaired soils have a direct effect on site productivity, which is captured in the low similarity to site potential. Grass species composition and abundance is the most dissimilar to site potential. Exotics were only detected in the Agua Fria zone. Five hundred and eighty-five acres of invasive species have been mapped in this ecological response unit.

The flammability of desert ecological response units on the Tonto National Forest vary tremendously from year to year, with the response of invasive annual grasses to winter precipitation (figure 27 and figure 28).

Figure 27. Photo point in salt desert scrub in 2011
(Photo credit: Eric Hoskins, USDA Forest Service)

Mojave Sonoran desert scrub is at higher elevations than frost-sensitive paloverde-mixed cacti scrub ecological response unit and generally below dense chaparral vegetation (Creutzburg 2012). Typical vegetation includes buckwheat, jojoba and creosote. In central Arizona, crucifixion thorn is a hallmark species (Creutzburg 2012). Most of this ecological response unit subclass occurs at mid to high elevations. While Mojave Sonoran desert scrub only makes up 4 percent of the Tonto National Forest, almost all of the context acres are located on the Tonto National Forest (99.3 percent).

Under reference conditions, 75 percent of this ecological response unit would be in the late development open states C consisting of shrubs greater than 2 meters high and tree cover of less than 10 percent. The mid-seral state, dominated by shrub cover greater than 10 percent would contain 20 percent of the land area. The early development state A, herb dominated with less than 10 percent shrub and tree cover would account for the remaining 5 percent. Reference patch sizes would have been very large ranging from 4,000 to 8,000 acres. Historical fire is thought to be minimal to absent for this ecological response unit.

Currently departure is moderate on the Tonto National Forest. The departure among seral state proportions shows the mid-development state (B) is highly overrepresented at 73.2 percent while the late development states (C) are poorly represented at 22.3 percent. Past livestock grazing may have influenced the lowered late development of shrubs and trees at some sites. Jojoba does have high forage value to livestock and wildlife. While jojoba is fairly resistant to moderate browsing, heavy browsing was documented to reduce shrub cover in southern Arizona (Roundy and Dobrenz 1989). All local zones have exotic states, with 72 acres of invasive species mapped within this ecological response unit. Patch size is with the historical range at approximately 4,500 acres.

Figure 28. The same salt desert scrub photo point in 2019
(Photo credit: Eric Hoskins, USDA Forest Service)

Exotics are also likely influencing wildfire and current departure. While many desert plants are not fire-adapted, jojoba sprouts from the root crown following fires; however, seeds may not survive severe fires, and establishment is greatly influenced by the availability of nurse plants (Matthews 1994). Fire can convert this vegetation type to shrub habitat dominated by turpentine bush (Creutzburg 2012), and similarity to site potential does show a general overrepresentation of turpentine bush.

Other Ecological Response Units

Ecological response units with fire regimes that do not include frequent fire exhibit low to moderately departure; none exhibit high departure. It takes longer for these ecological response units to exhibit departure because the disturbance regime, particularly fire, is less frequent, so fewer fire/disturbance cycles have been missed. These ecological response units are shown below in table 69. These ecological response units are forests, woodlands, and shrublands in which herbaceous surface vegetation is less important for fire behavior and effects, but still provides the majority of the diversity.

Table 69. Summary of departure, fire return intervals, and threats for other ecological response units

Ecological Response Unit	Acres on Forest (percent)	Current Departure (percent) and Future Trend	Historic Fire Return Interval in years (minimum/ maximum / typical) and severity	Current fire return interval (years)	Threats	Primary Departure Characteristics
Interior Chaparral	294,352 (11 percent)	10 percent (low); towards	30 / 100 / 50; mixed to high severity	128	Difficulty in achieving desired fire effects because of the intensity of the type of fire it's adapted to, and the difficulty in controlling it.	Decreased patch size; decreased diversity, particularly forbs; increased shrub density
Pinyon–Juniper Woodland	55,963 (2 percent)	23 percent (low) towards	35 / 200 / 125; Low to high severity	201	Invasive species; highly susceptible to insects and pathogens when stressed; climate change	Increased snags per acre; excessive coarse woody debris; decreased patch size; decreases in early seral species; decreased ground cover
Pinyon–Juniper Evergreen Shrub	402,035 (14 percent)	54 percent (moderate); towards	35 / 200 / 100; Mixed to high severity	215	Insufficient herbaceous surface fuels to carry low severity fire; Highly susceptible to insects and pathogens when stressed (includes pinyon bark beetles)	Increased canopy cover; increased density in tree groups and brush; reduced cover and diversity of herbaceous understory vegetation; excessive coarse woody debris
Mixed Conifer with Aspen	6,805 (less than 1 percent)	64 percent (moderate); unknown	50 / 200 / 100; Mixed to high severity	Not applicable*	Susceptible to uncharacteristic wildfire (patch sizes greater than 300 acres) resulting in the loss of Aspen and the mixed deciduous tree component.	Increased canopy cover; increased density in tree groups and brush; reduced cover and diversity of herbaceous understory vegetation
Totals	764,433	26 percent	Not applicable	Not applicable	Not applicable	Not applicable

*Not applicable because the acres were too small to sufficiently analyze fire return interval.

Interior Chaparral

Transitioning from low-elevation deserts, interior chaparral (IC) consists of woody evergreen shrubs at low slopes and mountain foothills. Typical shrub species include manzanita, crucifixion thorn, desert ceanothus, mountain mahogany, little-leaved mountain mahogany, Antelope bushes, silktassles, Stansbury cliffrose, shrub live oak, and sumacs (Wahlberg et al. 2017 (in draft)). Sparse tree cover is typical of this ecological response unit; therefore, some pinyon, juniper, or ponderosa pine associations with sparse tree cover are grouped with this ecological response unit. Interior chaparral makes up 11 percent of the Tonto National Forest.

Under reference conditions about 93 percent of this ecological response unit would be in the mature closed state (C and D) with 5 percent in the mid development stage with less than 30 percent shrub cover. The grass/forb/shrub state would account for the remaining 2 percent. Interior chaparral is mostly an 'on / off' fuel, with the dominant shrub species too sparse to carry fire during most of the year. When conditions are right, however, chaparral will burn with high intensity and a fast rate of spread, (Wahlberg et al. 2017 (in draft); Paysen et at. 2000). The historic fire regime for interior chaparral was high-severity fires with fire return intervals of 50 to 100 years, occasionally covering large areas (Cable 1975; Pase and Brown 1982). Species composition and site factors can have strong influences on fire behavior. Grasses are mostly limited to rocky outcrops, and annual and short-lived perennial forbs are fairly uncommon except for brief periods following fire (Brown 1982). Chaparral species grade into adjacent vegetation types and, in the absence of fire, have increased in abundance. Additionally, in the absence of fire, ponderosa pine is likely to have encroached into the chaparral (Huffman et al. 2018). While chaparral *structure* is relatively stable, species *composition* appears to be more dynamic; entire shifts in species dominance can occur following disturbance events (Schussman and Smith 2006).

Interior chaparral is far less accessible than other ecological response units for humans and ungulates, and has been less affected by human disturbance (including fire) and management than forest, woodland, grassland, or desert ecological response units. This is largely attributed to the relatively broad fire return interval chaparral is adapted to, the fast recovery in these systems, and resistance to grazing pressures because of the density of shrubs and steep slopes that are usually present. Most significant changes have been an overall increase in shrub densities (Huebner et al. 1999) and reduction of herbs. Huebner at al. (1999) documented little change from historic conditions among chaparral in central Arizona, though that was published in 1999, and the data that publication was based on was from before that.

The largest change is the increase in mid development states (B) where vegetation structure is open, with 10 to 30 percent cover and a slight reduction in the mature closed state (C, D). The reduction of mature closed states is most influenced by the suppression of fires that would have historically reached larger extents. Instead, smaller fires have produced openings, creating much smaller average patch sizes (359 acres) compared to reference conditions (930 to 2,120 acres). The risk of invasive species within interior chaparral are low and potential risks come from fires spreading into chaparral from neighboring vegetation types with increased fire loads (USDA Forest Service 2012b). Fifty-one acres of invasive species have been mapped in this ecological response unit. Figure 29 illustrates how chaparral intergrades with other ecological response units at higher and lower elevations and on different aspects.

Figure 29. Photograph looking north into the Sierra Anchas from the Parker Creek drainage
(Photo credit: Mary Lata, USDA Forest Service)

Pinyon–Juniper Woodland (PJO)

Typical species for pinyon-juniper woodland include twoneedle pinyon, single leaf pinyon, Utah juniper, oneseed juniper, and alligator juniper. Pinyon-juniper woodland is a broad grouping of different plant associations with trees occurring as individuals or in smaller groups and range from young to old, but more typically as large, even-age structured patches. Pinyon-juniper woodland characteristically has a moderate to dense tree canopy and a sparse understory of perennial grasses, annual and perennial forbs, and shrubs. Some types on broken or rocky terrain exhibit little to no natural fire, and insects and disease may be the only disturbance agents.

Historically, pinyon-juniper woodland was characterized by even-aged patches up to hundreds of acres. Old growth was concentrated in stands or larger areas, and very old trees (over 300 years) were present. Overall, 60 percent of trees were medium to large closed state (greater than 10 inches diameter at breast height and greater than 30 percent tree cover). Medium/large open state accounted for 10 percent seedlings/saplings open 5 percent. The small closed state accounted for 15 percent while the grass/forb/shrub state 10 percent. Reference patch size ranged from 50 to 400 acres.

Even though pinyon-juniper woodland supports moderate fuel loads of both dead and live material, the fuels are very patchily distributed. Patches of heavy fuels are typically separated by comparably sized patches of rock, bare ground, or sparse cover of herbs that do not carry fire readily. Because of the lack of horizontal fuel continuity, fire typically only spread when there were high winds and extremely low fuel moisture (Romme et al. 2009). Typical disturbances (fire, insects, and disease) were of high severity and occurred infrequently with a historic fire return interval of 30 to 200 years from stand-replacing fire. Most fires likely burned single trees or small patches but had little effect on woodland structure overall (Romme et al. 2009). Fire does not carry well in pinyon/juniper forest and woodland types unless there is a high wind, though it may creep around and cause occasional torching where there is sufficient litter or surface fuel. The productivity of understory vegetation decreases as stands mature. Eventually, the canopy closes, and litter becomes the primary contiguous surface fuel. Typically, in a mature pinyon-juniper stand, canopy base height is low, but surface fuel is usually insufficient to produce surface fire of high intensity, and pinyon-juniper foliage is often too moist to ignite easily. There is a dead and/or down component of mature pinyon-juniper forest and woodland systems that provides a receptive fuel bed for sparks and airborne embers, so the flammability and potential for spotting in these areas increases as stands mature. The pinyon-juniper woodland stands most likely to burn are the 15 to 25 percent that make up the earliest seral stages (A, C, and D), with mostly scattered trees and with herbaceous fuel between the trees, or have dense, mature trees capable of carrying crown fire during dry, windy conditions along with a significant dead woody component. Closed pinyon-juniper woodland stands do not have a fuel structure that will carry a surface fire, and will not burn until conditions are met to carry a mixed or high severity fire.

Current conditions on the Tonto National Forest show a shift toward the more open states in both the medium/large and small tree states. Medium/large open state is at 17 percent while the seedlings/saplings small trees state is at 20 percent. Closed states account for 47 percent with 17 percent in the small closed state and 30 percent in the medium/large closed state. The early development, post disturbance grass/forb/shrub state is slightly above reference condition levels at 16 percent. The departure rating for this ecological response unit on the Tonto National Forest is low.

Fire exclusion probably has had little effect on pinyon-juniper woodland since fire return intervals are naturally very long in this ecological response unit (Board et al. 2018; Romme et al. 2009). The current fire return interval of 201 years is well within the historic range. Drought conditions beginning in the late 1990s initiated a bark beetle outbreak in 2003. This has resulted in an increased number of snags and the accumulation of coarse woody debris. Coarse woody debris has increased to 17.3 tons per acre and the number of snags is now just over 10 per acre. This large loading in coarse woody debris is expected in vegetation types with long fire intervals but not in this ecological type, as it is site limited by nutrient and water availability. Patch size has also decreased, along with a decrease in the diversity of grasses and forbs and a reduction in vegetative ground cover.

Pinyon–Juniper Evergreen Shrub

This ecological response unit is generally found on lower slopes bordering chaparral at lower elevations and montane forests at higher elevations. Dominant tree and shrub species include twoneedle pinyon, single leaf pinyon, Utah juniper, oneseed juniper, alligator juniper, Manzanita spp., mountain mahogany, Antelope bushes, silktassles, Stansbury cliffrose, turbinella oak, and sumacs. Pinyon may be absent at some areas; however, juniper is always present. Oaks (Arizona white oak, grey oak, Emory oak) become more common among mild climate zones in central Arizona. The understory is dominated by low to moderate density shrubs, with herbaceous plants in the interspaces.

Information on the historic condition of this type is sparse. Pinyon-juniper evergreen shrub normally occurs as a mix of trees and shrubs with sparse herbaceous cover but can be characterized by a series of vegetation states that move from herbaceous dominated to shrub dominated to tree dominated over time, unless interrupted mixed or high severity fire. Under reference conditions 55 percent of this ecological response unit would be in the seedling, sapling, and small tree state. 40 percent would be in a medium /large open state and there would be no acres in the medium large closed or small closed states. The remaining 5 percent of the area would be in a recently disturbed grass and forb state. Disturbance patterns produced patch sizes from 50 to 200 acres.

Typical disturbances (fire, insects, and disease) are mixed severity and moderate, although some evergreen shrub woodland types exhibit infrequent fire/high severity effects (fire regime IV, 35- 200 years, replacement severity; for example, pinyon-juniper manzanita). Disturbance patterns create and maintain tree-age diversity and low to moderately closed canopy that is typical of this type. Historically this ecological response unit had greater than 10 percent tree canopy cover in later successional stages. Trees occur as individuals or in smaller groups and range from young to old, but typically small stands or clumps are even-aged in structure as a consequence of mixed- severity fire. The shrubs understory ranges from low to moderate density depending on the time since the last disturbance. Perennial native grasses and both annuals and perennial forbs comprise the remainder of the inter-canopy interspaces.

Current conditions on the Tonto show a shift toward the medium/large closed canopy state with the shrub densities increasing and herbaceous plant cover decreasing. The early development, post disturbance grass/forb/shrub state exceeds reference condition and is currently at 38 percent. The medium/large closed state is at 28 percent and the small closed state is at 14 percent, two states that would have been very rare under historic disturbance regimes. Only 9 percent of the acres are in the seedlings/saplings small tree state and 11 percent in the medium/large open state which would have been the most abundant states under historic conditions. The high percentage of the grass/forb/shrub state can be attributed to the 2005 Cave Creek Complex Fire in the Agua Fria zone, and several other fires which burned through this ecological response unit across the national forest with mixed to high severity effects.

Fire suppression and grazing have both contributed to a lengthening of the fire return interval to 215 years, well outside of the 35 to 100 or more years under reference conditions. This has allowed coarse woody debris to accumulate to 24 tons per acre and the number of snags greater than 8 inches to reach 5.6 per acre. This is good for wildlife habitat, but is likely to increase fire behavior to the point where wildfires is more resistant to control, and increase high severity fire and high burn severity (fire effects to soil). The in-filling of the canopy gaps and increased density of brush species in the medium/large closed state has led to a reduction in the abundance and diversity of grass and forb species. Recent fires have helped to reduce patch size to 40 acres which is only slightly smaller than the reference condition of 50 to 200 acres.

Mixed Conifer with Aspen (Wet Mixed Conifer)

On the Tonto National Forest, mixed conifer with aspen, or wet mixed conifer (MCW), generally occurs at elevations of 6,500 or higher. Tree species composition varies depending on seral stage, elevation, and moisture availability. Ponderosa pine occurs incidentally or is absent, while Douglas-fir, southwestern white pine, and white fir occur as dominant and or codominant conifer species. Understory vegetation is comprised of a wide variety of shrubs, graminoids, and forbs depending on soil type, aspect, elevation, disturbance history, and other factors. Distribution of aspen within this ecological response unit is limited by several factors including adequate soil moisture required to meet its high evapotranspiration demand, and major disturbances that clear areas of vegetation and stimulate root sprouting and colonization.

Disturbances typically occur at two temporal and spatial scales: large-scale infrequent disturbances (mostly fire), and small-scale frequent disturbances (fire, insect, disease, wind). Mixed conifer with aspen (wet mixed conifer) is characterized by historic fire return interval of 50 to 100 years with both mixed and high severity fire. Small scale, high-severity fire events play an important role in aspen regeneration and contribute to maintaining desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling. Historically, this ecological response unit supported patches ranging in size from 100 to 300 or more acres, resulting from high severity fire events. Mixed conifer with aspen is characterized by historic fire regime group III, with an average fire return interval of 50 to 100 years with mixed and high severity fire. Small scale, high severity fires play an important role in aspen regeneration within this ecological response unit.

Under desired conditions 40 percent of this ecological response unit would be in the late development very large state dominated by a mature, shade tolerant mix of conifer species with multiple stories, closed canopies and 20 or greater inch diameter trees. Mid development medium/large state dominated by trees 10.0 to 20.0 inches in diameter with both open and closed canopy account for 14 percent and include a mix of shade tolerant and shade intolerant species (ponderosa pine and Douglas-fir). Seedling/saplings with trees 0-to-9.0-inch diameter closed types with no aspen succession occupy 18 percent of the area and occur in single story and multiple story conditions. All aspen, deciduous tree mix, and evergreen-deciduous mix tree types with trees generally 5 to 9.9 inches in diameter in multiple or single storied stands occupy 21 percent. Early development grass and forbs types in 0-to-4.9-inch diameter tree types occupy 7 percent of the area.

Mixed conifer with aspen ecological response unit occurs on only 6,805 acres of the Tonto National Forest, which is less than 1 percent of the forest, so it was not modeled. Conditions were based on pre-2014 data that used for the Forest Assessment showed a shift toward the closed states with 52 percent in the seedling/sapling closed state with no aspen succession, and 42 percent in the medium/large closed canopy state. There were no acres in the very large or all aspen, deciduous tree mix states and, prior to 2016, only 4 percent was in the recently disturbed grass/forb state. The remaining 2 percent is in a very large, open canopy state that was very rare under the historic disturbance regime.

Mixed conifer with aspen is found in two places on the Tonto National Forest and, since seral state proportion was calculated for this ecological response unit, both areas have burned in wildfires, with a range of severities. Mixed conifer with aspen is found in:

- The Sierra Ancha mountain range along Rose Creek and Workman Creek. In 2016, the Juniper Fire burned through all but about 1,000 acres of the mixed conifer with aspen in the Sierra Anchas, with about 600 acres of high severity. Juniper burned with a mosaic, but with more mixed and high severity than is desirable in a location where the total acreage of mixed conifer with aspen is just a little over 4,000 acres. One high severity patch was close to 350 acres which, though within the historic range of variability for this ecological response unit, was probably not beneficial for the future of mixed conifer with aspen in the Sierra Anchas.
- The Pinal Mountains in Icehouse and Sixshooter canyons. In 2017, all but about 30 acres of the mixed conifer with aspen in the Pinals was within the perimeter of the Pinal Fire, though only about 50 acres were high or mixed severity, and some of it didn’t burn at all. The largest patch of high severity was less than 10 acres.

Those fires will have shifted the seral state distribution toward the more open states and grass. Actual impacts of these fires to this ecological response unit’s seral state proportions are unknown at this time. Because of the percent of mixed conifer with aspen that burned in 2016 and 2017 (about 75 percent) and the percent in 2016 that burned with high severity, desired condition for patch size for the Tonto National Forest has been decreased to about 250 acres.

Environmental Effects[101]

There are three focus areas for vegetation and fire that helped inform the objectives which are listed in table 70 and table 71. Plan objectives help set the baselines for priority areas and are designed to make progress towards attaining desired conditions.

[101] All assumptions and methods used for this analysis can be found in volume 4 of the environmental impact statement, appendix B.

Description of Alternatives for Vegetation and Fire

Alternative A

Alternative A is the Tonto National Forest's current 1985 forest plan, which has few articulated desired conditions for vegetation or fire, so it uses the desired conditions from the revised forest plan. There would be no changes in current management and the current forest plan would continue to be implemented. Alternative A is the point of reference for assessing action alternatives B through D.

There is an emphasis on reintroducing fire into fire dependent ecosystems and allowing it to resume its natural role, but no clear objectives for frequent fire systems. Objectives for fire are only specific to "providing a mosaic of age classes within the total type which would provide for a mix of successional stages, and to allow fire to resume its natural ecological role within ecosystems." Standards and guidelines for much of the vegetation are focused on habitat and increasing forage production. Objectives for vegetation management are not clearly identified as "objectives," though specifics are given for allowable treatments in specific vegetation types.

There are no clear objectives for restoration in desert ecosystems, though there is direction for active fire suppression, or if fire is identified as being able to meet resource needs.

There would be no changes in grazing management.

Alternative A also includes plan components specifically for northern goshawks that direct the Forest to survey for and establish post-fledging family areas and nest areas. These areas are subject to guidelines that limit human disturbance during the breeding season (March 1 through September 30), provide for greater canopy cover and smaller opening size, and prioritize preferred treatment methods (e.g., prescribed burning). These guidelines are likely to constrain some types of vegetation management activities in post-fledging family areas. However, the need to inventory all project acres prior to treatment poses a large logistical challenge and may result in delays to implementing vegetation projects.

Alternative B

Alternative B is the forest plan (a modified version of the preliminary proposed plan) and was developed to respond to key issues identified in the assessment, needs to change, and public engagement. Alternative B includes plan direction that allows for adaptive management to address changing conditions while managing for sustainable multiple uses.

Vegetation management would focus on restoring fire as a key ecosystem process in frequent-fire ecological response units, with a particular emphasis on forested, frequent fire ecological response units. This would be accomplished through a balance of mechanical treatments and wildland fire (wildfire and prescribed fire). Depending on the ecological response unit, a variety of other treatments, such as invasive species treatments, or reseeding native species, may be necessary to meet plan objectives. Fire would be actively suppressed in desert ecological response units, and plan objectives/restoration for deserts would be primarily focused on reducing disturbance to sensitive soils and treating invasive species (specifically exotic and invasive grass species).

Objectives would be established for frequent fire ecological response units to restore herbaceous surface vegetation and ground cover. The majority of the floral species diversity in these systems comes from the herbaceous surface vegetation, which is also the fuel for the frequent, mostly low intensity/low severity surface fires that are characteristic in these ecological response units. Objectives include a wide range of average, annual acres to be treated. These ranges were developed to incorporate both ecological and management realities. The high end of the ranges given for fire represents the acres that would be expected to burn each year if a specific ecological response unit was able to be managed based mostly on ecological objectives, with no constraints. The lower end represents the incorporation of the constraints described under 'Assumptions and Methods' (appendix B), and in some cases may not be sufficient to maintain current conditions, or would result in increased departure from desired conditions. The high and low ranges given for mechanical treatments represents the most optimistic and the most pessimistic outcomes, based on the constraints described under 'Assumptions and Methods' (appendix B), and the last decade of mechanical treatments on the Tonto National Forest.

As allotments become vacant, they will be evaluated for appropriate management options, such as conversion to a forage reserve, closure, or granted to a current or new permittee.

Alternative C

Alternative C was developed in response to public comments that expressed a desire to reduce human impacts on the forest. Based on feedback to the notice of intent, preliminary plan, and public engagement, this alternative emphasizes primitive recreation opportunities, increased protections to natural resources, use of natural processes for restoration, limiting some aspects of grazing, and prioritizing natural resources over some economic development opportunities.

Vegetation management in frequent-fire ecological response units relies on wildland fire as the primary restoration tool. Mechanical thinning would only be used in limited situations (e.g., wildland-urban interface areas or invasive species treatments). As a result, fewer commercial forest products would be available, and fewer suitable timber acres would be treated. Alternative C places more emphasis on restoring frequent fire woodland ecological response units through an increase in plan objectives for fire than the other alternatives. Objectives to restore grass and herbaceous cover for highly departed ecological response units (e.g., pinyon-juniper grass and juniper grass) are similar to alternative B. Objectives for desert ecosystems are the same as alternative B. Fire is actively suppressed, and restoration is primarily focused on reducing disturbance to sensitive soils and treating invasive species (specifically exotic and invasive grass species).

Acres of recommended wilderness would be significantly increased under this alternative. On those acres that were designated, there could be an increase in the flexibility for wildfire management, decrease in human starts in those areas, decreased potential for mechanical treatments, and complications to the implementation of prescribed fire in those areas.

Currently vacant open allotments, and allotments that become vacant would be closed, eventually phasing out permitted livestock grazing on the Tonto National Forest.

Alternative D

Alternative D was developed to address public comments that expressed a desire for easier access and multiple-use opportunities on the Tonto National Forest. Related comments received on the notice of intent, preliminary proposed plan, and public engagement focused on providing more accessible recreation opportunities, having fewer restrictions on land uses, and including no additional recommended wilderness acres. Alternative D also emphasizes active restoration techniques to achieve desired conditions and provides for more economic opportunities on the forest including grazing and mining.

Vegetation management in frequent-fire ecological response units focuses on restoring conditions primarily through mechanical treatments and focuses on increasing the supply of forest products. Prescribed burning is mainly focused in areas that have been previously thinned, and there would be fewer opportunities to use wildfires to meet resource objectives. Objectives to restore grass and herbaceous cover for highly departed ecological response units (e.g., pinyon-juniper grass and juniper grass) are similar to alternative B, however there would be fewer treatment objective acres (more treatment objective acres are allocated to forested ecological response units). Objectives for desert ecosystems are the same as alternative B, however there would be fewer treatment objective acres. Due to the increased use and limited restrictions in this alternative, treatment objectives would be mainly focused on highly impacted areas or high-risk areas. All vacant allotments would be granted to new or current permittees, increasing the levels of permitted grazing on every ranger district.

As in alternative A, alternative D would include guidelines that direct the Forest to identify post-fledging family areas and nest areas for northern goshawks. The alternative also includes specific desired conditions for vegetation in post-fledging family areas and direction to minimize human presence in these areas during the breeding season. These guidelines would likely constrain some vegetation management activities during the breeding season (March 1 through September 30). In addition, the guidelines require an inventory of project area prior to treatment. Such large-scale survey work is likely to have a large logistical impact and may delay vegetation treatments.

The following acronyms are used in table 70 and table 71:

PPF - ponderosa pine forest

PPE - ponderosa pine-evergreen oak

MCD - Mixed conifer–frequent fire

PJG - pinyon-juniper grass

JUG - juniper grass

MEW - Madrean encinal woodland

MPO - Madrean pinyon oak

MSDS - Sonoran Mid-Elevation Desert Scrub

SDS - Sonora-Mojave mixed-salt desert scrub

Table 70. Summary of objectives related to fire and vegetation by alternatives for forest and woodland ecological response units

Ecological Response Units	Alternative B	Alternative C	Alternative D
Forested	Restore or maintain conditions in frequent-fire forested ecological response units (PPF, PPE, and MCD), emphasizing treatments within PPE by: 1) Treating 50,000 to 122,000 acres over a 10-year period with mechanical thinning, and fire. (Assume about 22 percent prescribed fire). 2) Treating 105,000 to 325,000 acres over a 10-year period with fire. (Assume about 22 percent prescribed fire).	Restore or maintain conditions in frequent-fire forested ecological response units (PPF, PPE, and MCD) primarily using fire and emphasizing treatments within PPE by: 1)Treating 11,000 to 22,000 acres over a 10-year period with mechanical thinning and fire. (Assume about 22 percent prescribed fire). 2) Treating 144,000 to 423,000 acres over a 10-year period with fire. (Assume about 22 percent prescribed fire).	Restore or maintain conditions in frequent-fire forested ecological response units (PPF, PPE, and MCD) through more intensive mechanical treatments (forest products focus): 1) Treating 50,000 to 190,000 acres over a 10-year period with mechanical thinning and fire. (Assume about 22 percent prescribed fire). 2) Treating 16,000 to 62,000 acres over a 10-year period using fire. (Assume about 22 percent prescribed fire).
Woodland	Restore or maintain conditions in woodland ecological response units with frequent fire (PJG, JUG, MEW, MPO) by: 1) Treating 400 to 2,000 acres over a 10-year period with mechanical thinning and fire. 2) Treating 20,000 to 200,000 acres over a 10-year period with fire. (Assume about 22 percent prescribed fire).	Restore or maintain conditions in woodland ecological response units with frequent fire (PJG, JUG, MEW, MPO) by: 1) Treating 230,000 to 410,000 acres over a 10-year period with fire. (Assume about 22 percent prescribed fire).	There are no objectives for woodland ecological response units – treatments are prioritized for frequent-fire forested ecological response units and forest products (including commercial timber harvest).

Table 71. Summary of objectives related to fire and vegetation for semi-desert grasslands and desert ecological response units

Ecological Response Units	Alternatives B, C, and D
Semi-desert grasslands[1]	Restore at least 500 acres of semi-desert grasslands, over a 10-year period
Desert	Reduce the impact of invasive species (e.g., buffelgrass, fountain grass, and red brome) by surveying, inventorying, and treating 10,000 to 15,000 acres in desert ecological response units (MSDS, SDS) over a 10-year period

1 - Due to the challenge of restoring semi-desert grasslands, management approaches were developed for semi-desert grasslands and include working with partners and research institutions to develop effective management approaches for restoring semi-desert grasslands, developing and refining state-and-transition models to explore potential restoration pathways, and site-specific analysis of restoration potential to inform management.

Environmental Effects

Environmental effects are discussed below for each ecological response unit, with a focus on relevant ecological response unit characteristics and resource indicators.

Effects include those effects that result directly or indirectly from management actions. Examples of effects include the decrease in basal area after mechanical thinning, increased sunlight reaching the surface after a prescribed fire, or decreased shrub cover after mastication. Examples of indirect effects include increased soil temperatures when the surface is blackened following a fire, the establishment of native grasses when a population of invasive species is eradicated, or increased numbers of snags following a fire.

To improve the readability of this report, the following terms will be used for describing treatments:

Mechanical: vegetation treatments that are implemented with any kind of machine.

Fire only: vegetation treatments that do not include mechanical work of any kind, except for creating or maintaining fire lines.

Combined treatments: when fire and mechanical treatments would both be used on an area. There is no intent in this document to prioritize whether fire treatments or mechanical treatments would be implemented first; that would be a site-specific decision.

Wildland fire: this includes both prescribed fire and wildfire

Ecological Response Units with Frequent Fire

In frequent fire regimes the average fire return interval is no more than 35 years and, for most of the frequent fire ecological response units on the Tonto National Forest, it is often much shorter. Fire has a profound influence on ecosystem dynamics, including seedling dynamics, canopy structure dynamics, herbaceous surface vegetation cover and diversity, mosaic scale/patch size, nutrient cycling, soil properties, plant health and vigor, vertebrate and invertebrate diversity, and many other ecosystem properties and characteristics (Swetnam and Baison 1996). The effects of just one or two fires are insufficient to evaluate the role of fire in a frequent fire regime because it is the cumulative effects of multiple, mostly low severity fires that define those ecosystems. Outside of first or second entry burns, the effects of fire in a frequent fire ecosystem can be difficult to identify if only one or two fires are considered.

Frequent fire ecological response units always have a significant proportion of open seral states; conditions that are maintained by frequent fire regulating the mosaic of woody species when they are present. Herbaceous species, mostly grasses, are a significant proportion of surface fuels, augmented by needles and leaves from an open structure of woody overstory species in forests and woodlands. In grasslands, the dynamics are similar to frequent fire forests and woodlands with herbaceous surface vegetation as the dominant fuel, and the role of fire in regulating woody growth, though the presence of woody species plays a much lesser role, and is relatively insignificant in the ecosystem functioning when the distribution is in line with reference conditions.

The grass a critical component of the frequent fire systems on the Tonto National Forest, providing a primary fuel source in grasslands and savanna/woodland systems, and a co-primary fuel source in ponderosa pine systems. As such, grazing management has a very significant impact on if and how these ecological response units burn.

Effects Common to all Frequent Fire Ecological Response Units

Alternative A

Seral State Distribution–Closed Versus Open States

There would be an increase in the proportion of old and of closed seral states in all forested frequent fire ecological response units as the lack of fire allowed woody species to establish, expand, and encroach into previously open seral states. This increase in woody vegetation / fuels would allow wildfires to burn with increasingly high severity, creating more acres of open, grass/forb, or shrub states.

Grasslands, Herbaceous and Ground Cover

Grasses are a significant component of surface fuels and herbaceous vegetation in all frequent fire systems on the Tonto National Forest. They also stabilize soil and contribute significantly to soil structure, chemistry, and texture and they are a food source for many species, including livestock.

There would be an overall increase in the cover of woody species under this alternative, decreasing the light and precipitation reaching the ground. Shade tolerant, and fire intolerant species would increase, replacing fire adapted vegetation. Herbaceous surface vegetation would respond with a decrease in cover, diversity, and vigor.

Cover, vigor, and diversity would also decrease in response to increases in the nutrients locked in live and dead biomass, rather than being recycled via frequent fire. Soil properties (structure, chemistry, biotic) would be increasingly affected by the change in temperature (from decreased sunlight), decreased moisture (from intercepted precipitation), and decreased organic matter input from the roots of herbaceous surface vegetation, particularly grasses.

In some areas, the increase in surface fuel loading would result in high burn severity (fire effects to soil), and a complete lack of herbaceous surface vegetation for years in spots where all the soil organic matter (including seeds) would be incinerated near the surface. This would increase the potential for the loss of topsoil where the canopy had been closed for so long that the only ground cover was litter and duff. Where all the litter and duff burn at once on a steep slope, subsequent precipitation, particularly the heavy rains typical of monsoon, can erode the topsoil, potentially changing site potential permanently. Even on a flat surface, if all ground cover is removed, wind erosion can be significant, removing much of the topsoil. High burn severity can also provide a foothold for invasive species, such as various exotic thistles, red brome, leafy spurge, or other species of concern.

In grasslands and the more open areas of forest and woodland frequent fire ecological response units where shrubs would become established, the decrease in herbaceous surface vegetation would make it increasingly difficult for fire to burn into or under the shrubs at an intensity that would kill, or top-kill the shrub, further facilitating the expansion of shrubby areas once they become established.

For all frequent fire ecological response units, ground cover would decrease where herbaceous surface vegetation decreased. The ratio of ground cover composed of needle and leaf litter from trees and shrubs to that portion composed of herbaceous surface vegetation and the litter it creates would change. All litter compacts as it ages, which changes the character of the fires that burn though it. Additionally, in forested areas, duff layers can build up, increasingly suppressing surface vegetation, and leaving the primary surface fuels composed of compact needle litter, duff, and coarse woody debris. This kind of fuel bed supports fires that are of a different character than those that frequent fire ecological response units evolved with. In the frequent fire ecological response units on the Tonto National Forest, surface fuels that have a significant component of grass would have a short residence time, so heat going down into the soil would be minimal. Duff, compact needle litter, and/or woody debris have longer residence times, so more heat is transferred into soil. This can have adverse effects on species for which the meristematic tissue is close to the surface.

Livestock grazing would not change under this alternative, leaving a wide variety of range conditions on the ground, but a slow decline in range condition would be expected to continue. This would affect surface cover, soil condition, species composition and diversity, and the frequency and character of wildland fire.

Fire Regime and Patch Size

In frequent fire ecological response units, the frequent, low severity / low intensity fires maintain fuel conditions that create conditions for frequent, low severity / low intensity fires to burn – it is a cyclical, self-sustaining system. Under alternative A, fire return intervals would continue to be many times longer than those to which these ecological response units are adapted. This would result in more uncharacteristically severe fire in all frequent fire ecological response units because of greater continuity in the horizontal and vertical fuel profiles of trees and shrubs, as well as their increasing contributions to surface and canopy fuel loading.

As woody canopy cover increases, the volume and continuity of surface and canopy fuels would also change, affecting the fuel structure, and the characteristics of the fires that could burn. There would continue to be increases in litter (needles and leaves from woody species), duff, dead/down woody fuels, and decreases in the light, flashy surface fuels that are characteristic of frequent fire systems. This would increase the potential for high burn severity (effects to soil), and high severity surface fire (fire that doesn’t burn actively in the canopies, but is so hot, or has such a long duration, that canopy species are killed).

In frequent fire ecological response units, patch size would shift as the continuity of areas with closed canopies increases. In woodlands and forested frequent fire ecological response units, this would increase patch size, as the continuity of canopy fuels increased in a mosaic that had previously been a fine scale, with patches rarely larger than 50 acres, and commonly closer to 1 to 4 acres. In grasslands, the reverse would occur, as the previously large-scale mosaic of patch sizes around 1,000 acres decreased in size with continued encroachment of woody species. Eventually, the shift in species towards patches of woody species and less fire adapted species would result in larger patches of vegetation that would burn with high severity when they did burn, putting more heat into surface soil layers. The changes in herbaceous cover, particularly grasses, would change soil characteristics; more so as the less frequent fires that did burn put more heat into the soil.

Livestock grazing effects under this alternative would be similar to current conditions, which vary between and within allotments and vegetation types, and has a significant effect on surface fuels, and the characteristics of the current fire regime. In all ecological response units, heavy grazing decreases herbaceous surface fuels, and woody species are more likely to thrive because fires often cannot burn. Where grazing is moderate, but with little rest, there may be contiguous fuels, but it may not support fire behavior that is sufficiently intense to kill, or top kill woody species.

Ecosystem Function

In all frequent fire ecological response units, there would be changes to key ecosystem components that would result from interruption of the fire return intervals. Increased interception by increasing canopy cover would change the fundamental ecosystem dynamics at the surface; shading, precipitation, temperature, species composition and cover, air movement, humidity, and so on. Soil productivity would decrease, as would the vegetation composition needed to be resilient to the kinds of disturbances these ecological response units evolved with (fire, drought, insects, wind, and disease). The long-term effects for forested frequent fire ecological response units would be increasing potential for disturbances to result in an ecosystem type change, as high severity fire, drought, or insects/disease remove the majority of the dominant species, pushing the system towards a threshold towards a more permanent condition of becoming an herbaceous or shrub dominated system (Savage et al. 2013).

In some places (depending on the individual allotment, the management plan, and vegetation types), livestock grazing would continue to interrupt fire regimes, by adding additional constraints to burn windows and, at times, resulting in insufficient fuels to provide desired fire effects for wildland fire.

Alternative B

Seral State Distribution–Closed Versus Open States

Under alternative B, there would be some treatment in frequent fire ecological response units, though maybe as little as 500 acres in grasslands. This alternative would increase the amount of open seral states more than any other alternatives, improving the ratio of open seral states to closed seral states, and would move the overall seral state distribution of frequent fire ecological response units towards desired conditions faster than any other alternative.

Grasslands, Herbaceous and Ground Cover

Overall, alternative B would do more to improve herbaceous surface vegetation and ground cover in frequent fire ecological response units and forest ecological response units more than any other alternative.

Herbaceous surface vegetation would respond in the opposite way described in alternative A, with increasing cover and diversity in response to decreasing shrub and tree cover. Species composition would shift towards species that are not as shade tolerant and that are fire-adapted. There would be increases in forb diversity as well, with increases in those that are well adapted to fire, such as beardlip penstemon, blue flax, butterfly milkweed, and datura, as fire increases available nutrients, and scarifies/stratifies seeds.

For all frequent fire ecological response units, ground cover would increase where herbaceous surface vegetation increased. The component of ground cover composed of needle and leaf litter from trees and shrubs would come and go with fires, sometimes taking a few months to re-accumulate. That portion of ground cover composed of herbaceous surface vegetation and the litter it creates would respond more quickly, sprouting within a couple of weeks of a fire. The roughness and unevenness of the surface where bunch grasses dominate would provide some protection to soil until the ground cover was replaced, either by new herbaceous growth, or by needles/leaves. In first entry burns in frequent fire ecological response units with a moderate to closed canopy of trees or shrubs, scorched needles and leaves will replace burned ground cover completely within a year (figure 30 and figure 31).

In the short term, both mechanical treatments and fire would increase the potential for invasive species to become established, or for existing populations to expand, at least for the immediate post-treatment period.

Note the almost 100 percent litter cover on the forest floor, see figure 31, though much of the woody surface fuel load was consumed.

Figure 30. A transect in the Sierra Anchas on the Pleasant Valley District in an area from which fire had been withheld for decades (2016)

(Photo credit: Mary Lata, USDA Forest Service)

Figure 31. The same location 14 months after the Juniper Fire burned through with mostly low severity effects

(Photo credit: Mary Lata, USDA Forest Service)

As vacant allotments are evaluated for appropriate usage, some allotments would likely be closed, allowing herbaceous surface vegetation to recover fully. Some allotments would be designated as grass banks[102], and some would be granted to new or existing permittees. Overall, this would be expected to lead to an increase in acres that are not grazed, or are not grazed frequently. In these areas, there would be increased competition between herbaceous surface vegetation and woody species, particularly seedlings and new sprouts. These areas would be expected to have some increase in ground cover as well.

Fire Regime and Patch Size

Mechanical treatments would decrease the potential for crown fire immediately where implemented, because of decreased volume and decreased horizontal and vertical fuel continuity (including ladder fuels). Where wildland fire was implemented, it would change the fine fuel structure and surface fuels, consuming litter, duff, and coarse woody debris; killing or top killing ladder fuels and encroaching woody species, increasing herbaceous surface vegetation needed for the flashy, light surface fuels that are characteristic of frequent fire ecological response units. In the long run, there would be increased 'flashy' fire behavior, as the herbaceous surface fuels responded to increased nutrient cycling and decreased competition from woody species. This would increase flame length, rate of spread, and flammability in frequent fire systems, while simultaneously decreasing residence time and, thus, the amount of heat that would be transferred to tree boles or into the soil.

In forest and woodland frequent fire ecological response units, patch size would be the reverse of that described in alternative A, and would shift as the continuity of areas with closed canopies decreased moving the mosaic back towards the finer scale with which it evolved with patches rarely larger than 50 acres, and commonly closer to 1 to 4 acres.

In grasslands, the reverse would occur where treatments could be implemented, as fire and mechanical treatments reduce woody species, and provide nutrients to facilitate the recovery of surface vegetation.

Potential increases in some allotments where grazing is decreased, or no longer permitted would result in more contiguous, denser and taller herbaceous fuel loads. This would support higher intensity fires, with flame lengths that would be more efficient for restructuring fuels, including raising canopy base heights, killing/top-killing woody species, regulating seedlings to create a mosaic of saplings and pole trees. In most allotments, grazing would still have the flexibility to be used as a fuels treatment if, when, and where, it would be aligned with desired conditions for allotment management plans, vegetation, and fire.

Ecosystem Function

Under alternative B, there would be improvement across the forest and woodland frequent fire ecological response units as vegetation is reset on a trajectory towards desired condition. Increased flexibility for grazing management would provide more opportunities for resting pastures after grazing, or before and after fire as appropriate. That could improve the continuity, density, and diversity of surface vegetation, allowing fires to be of higher intensity, which would also make them more effective at controlling, or regulating, woody growth. There would, overall, be movement towards increased fire-adapted and decreased shade-adapted species, particularly grasses. This would support the kind of fire these systems are adapted to (high frequency, and mostly low severity and low intensity). Thinning out and opening up forest and woodland frequent fire ecological response units would decrease competition, increasing resilience to natural disturbances such as insects, disease, drought, and fire.

[102] A grass bank is a pasture that is not being grazed, but could be available for grazing if there was a fire, drought, or other occurrence that precluded a permittee from grazing their permitted pasture as described in their Allotment Management Plan.

Alternative C

Seral State Distribution–Closed Versus Open States

The effects of alternative C would be similar to those described for alternative B, but with more fire, and fewer options for mechanical treatments. Fire effects would be more extensive than in alternative B, with fire killing or top-killing woody vegetation on more acres. This would be particularly noticeable in shrubs, seedlings, and sprouts for which the stem diameter at the surface is smaller, and a larger percentage of the foliage would be exposed to lethal heat.

Grasslands, Herbaceous and Ground Cover

The effects of alternative C would be similar to those described for alternative B, but with more fire and fewer options for mechanical treatments. With more fire, there would be more overall improvement in herbaceous surface vegetation. The effects of decreasing livestock grazing as described in alternative B would be much more extensive, as grazing is decreased or removed across most of the forest.

Fire Regime and Patch Size

The effects of alternative C would be similar to those described for alternative B, but with more fire and fewer options for mechanical treatments. The continuity of light, flashy surface fuels would increase, allowing low intensity / low severity fire to burn across larger areas sooner than in other alternatives if there were burn windows available for the initial entry burns for which a primary objective would usually be thinning woody species.

The decrease in acres grazed would create more contiguous and denser herbaceous surface vegetation, allowing fires to burn with higher intensity that would better control woody growth. The increased continuity could also allow wildfires to spread further and more quickly. There would be fewer constraints on prescribed fire, both in terms of the timing/frequency of prescribed fire, and the likely removal of a lot of interior fencing, and fewer conflicts for permittees if their allotments burn.

Ecosystem Function

The effects of alternative C would be similar to those described for alternative B, but with more acres and effects of fire and fewer options for mechanical treatments.

Alternative D

Under alternative D, there are no treatment effects that would be common to all frequent fire ecological response units, because there are no objectives for frequent fire woodland ecological response units. However, increased grazing would reduce burn windows, and make it more difficult for wildland fire to be used as a tool (prescribed fire and wildfire). Increased grazing would result in decreases in fuels across larger areas, making it more difficult for fire to play its ecological roles.

Semi-Desert Grassland

The condition of many areas of semi-desert grassland (SDG) has not been adequately assessed across much of the extent of this ecological response unit to know where the ‘restorable’ and the ‘not-restorable’ acres are. Assessments that have been done have indicated there is a wide range of conditions. Some areas would likely respond well to restoration treatments, other areas are much further departed, and may not be restorable at all. Numerous attempts to restore semi-desert grassland regionally consist of prescribed fire, reduced grazing, and reseeding; however, it’s unclear whether or not these areas will return to their historic state (Brown and Makings 2014). Degraded site conditions allow the establishment and spread of exotic forb and grass species that can displace native species and increase fire frequency. For example, shrub encroachment may increase wildlife habitat for generalists but reduce habitat for grassland specialists (Knopf 1992). For those reasons, objectives for this ecological response unit include developing a series of restoration projects which would improve the ability of the Tonto National Forest to identify what conditions on the ground would respond best to what treatments. Such adverse conditions include, but are not limited to, woody encroachment, compacted soils, loss of topsoil, invasive species, and other existing conditions are out of the historic range of variability and departed from desired conditions for semi-desert grassland. Different conditions would require different treatments. For example, areas that are badly encroached by woody species may only need fire and/or some kind of mechanical treatment to allow surface vegetation to begin to recover. Other areas may be completely devoid of a native seed bank, and require seeding. The presence of invasive species, depending on the species, may require the treatment of the invasive species before other restoration efforts can be effective. Identifying where to implement which treatments will allow the Tonto National Forest to begin to effectively and efficiently restore those semi-desert grassland areas that can be restored.

This ecological response unit is a true grassland (at least 95 percent of the area should have less than 10 percent tree cover), so treatment options are relatively straightforward in areas that have been evaluated as restorable if the existing departure is mostly due to woody encroachment. Restoring the herbaceous surface vegetation could be considerably more difficult, depending on the existing species mix (the presence or absence of native and invasive species). It is likely that in this ecological response unit, as with many others, there are species that are missing. Even if there is healthy, contiguous native surface vegetation, there's a good chance that some species are missing because of historic land management practices. Grazing, for the grassland areas, would be the most influential process, but fire suppression would also have had an effect because there are species that need fire and/or smoke to thrive (Abella 2006; Ansley et al. 2006; Ghebrehiwot et al. 2013).

In areas where there is significant woody encroachment, some properties of the ecological response unit may have changed. Once established, woody plants alter soils and microclimate in their immediate vicinity, affecting soil nutrients dynamics. Woody plants can act as nutrient pumps, drawing nutrients from deep soil horizons, and laterally from areas beyond the canopy, and depositing them beneath the canopy via stem flow, litter fall, and canopy leaching. The canopy trap airborne particles and smoke residue on leaves; these, along with droppings from birds and other critters using the trees are washed to the surface below trees, increasing nutrients in the soil where the particles end up. For these reasons, soil carbon and nitrogen pools increase subsequent to woody plant colonization in grazed grasslands, creating “islands of fertility” that may be apparent for some years after a tree is cut/dies (Archer 2000). Fire and mechanical treatments will go a long way in this system though, in order to maximize the herbaceous response, it would be effective to avoid burning woody fuels in a way that would damage grass crowns or the seed bed. Lop and scatter, and/or mastication would be good if it doesn't leave too much fuel touching, or very low, in the fuel bed. Lop and leave (cutting trees leaving them whole, or in large pieces that hold a lot of the larger pieces up off the ground) would probably be one of the best options.

Alternative A

Under alternative A, semi-desert grassland would continue to move away from desired conditions at all scales, and there would be little to no progress made to identify where there are areas of semi-desert grassland that are restorable. There would be no expectations of restoration treatments, and the only changes would occur from wildfire, drought, or occasional treatments as deemed necessary by range managers.

Seral State Distribution–Closed Versus Open States

Under the current forest plan, modeled seral stage distribution (USDA Forest Service 2017a) would remain highly departed, increasing a little, but not significantly, from its currently highly departed state (table 72). Desired conditions include 90 percent to 100 percent open early seral stages. Under this alternative, these open, early seral stages would almost disappear completely, and semi-desert grassland would continue to move away from desired conditions, and towards seral states outside of historic range of variability that are dominated by shrubs and low seral exotic species.

Grasslands, Herbaceous and Ground Cover

The rate of treatment would remain minimal, and encroaching woody species would increasingly compete with herbaceous surface vegetation for light, nutrients, and water. Grass and forb diversity would remain significantly lower than reference conditions. There would be no change expected in grazing management under this alternative.

Exotic grasses would continue to expand, decreasing biodiversity, changing fire intensity (depending on the species), and facilitating the establishment of additional exotic species.

Ground cover would remain at, or below, the current level of about 14 percent; about half of the reference condition, except where exotic grasses become established where it could increase.

Fire Regime and Patch Size

Under this alternative, the fire regime departure would remain high, and the current fire regime in semi-desert grassland would continue to move away from desired conditions. The fire return interval is currently 210 years; over 10 times longer than reference conditions. This departure would continue to increase because of constraints for using wildland fire, and the effects of past and current management on the fuel loading, structure, and composition. Woody species would continue to compete with herbaceous surface vegetation, increasing the ratio of woody to herbaceous fuels. As shrubs increase in dominance, shrubby areas would burn less frequently, but with greater intensity when they did burn, continuing to move patch and fuel structure size away from desired conditions.

Fire effects would become patchier as shrubby fuels dominate more areas, and patch size would remain highly departed.

Where invasive grasses become established, fire intensity is likely to be different than it was historically, and species diversity would continue to decrease. The shift in fire behavior, and the associated change to fire effects, would depend on the species. Most invasive species would create more contiguous fuels but some, would have lower intensity than the native species of grasses and forbs they displace, and others, such as weeping lovegrass, could have higher intensity than the native species of grasses and forbs they displace.

Ecosystem Function

Ecosystem functions would continue to deteriorate under all alternatives. Mechanical treatments would mostly come from firewood cutting or range management activities when possible. Fire, as a key ecological disturbance, would not be able to play its natural role. This would lead to less herbaceous surface vegetation in many places, decreasing diversity and leaving soil increasingly vulnerable to erosion and compaction. Increasingly, semi-desert grassland would be unable to support wildlife and permitted livestock.

Alternative B

Thinning and/or burning would move semi-desert grassland towards desired conditions where it could be implemented. Mechanical treatments (for example thinning and mastication) can quickly open up canopies, allowing more light to reach the surface. In some areas, slash may be left on site to decrease additional costs incurred by slash disposal (burning, chipping, or hauling), and to discourage wildlife and livestock from grazing in some areas until the herbaceous surface vegetation has recovered (figure 32). Where fire is used, the nutrients that are recycled function as fertilizer, improving the health and vigor of most desirable surface vegetation, while acting as a check for woody species, cacti, yucca, and shade/fire intolerant species. Fire would also decrease excessive woody fuels at the surface where they are excessive and no longer desirable. This would improve the ability of wildlife and livestock to move across the landscape, but would also facilitate wildlife and livestock moving into areas that are just recovering from being in a poor condition. In those areas, managers would need to coordinate the timing of mechanical treatments, fire, and livestock grazing to ensure the best balance of restoration efforts and multiple use commitments for public lands.

In the semi-desert grassland shown in figure 32 the canopy had been almost closed prior to treatment and there was only minimal herbaceous surface vegetation.

Figure 32. Semi-desert grassland response to mechanical thinning 5 years after treatment
(Photo credit: Mary Lata, USDA Forest Service)

Seral State Distribution–Closed Versus Open States

Under this alternative, treated areas would move significantly towards desired conditions with increasing open seral states. Mechanical treatments would immediately decrease the cover of woody species. In areas where surface fuel is sufficient to support flame lengths high enough to kill or top-kill woody species, fire would also be an effective tool for opening up canopies. However, objectives for actually treating grasslands are minimal. If only the minimal treatments were implemented (500 acres), it would not significantly move the semi-desert grassland towards desired condition, except for the 500 acres that were treated. The focus for treating forested frequent fire ecological response units would limit the resources available for treating semi-desert grassland, so the overall change to this ecological response unit would probably not change from the current departure of 94 percent. On the majority of the semi-desert grassland, encroachment of woody species, would continue, and canopy cover by woody species would continue to increase.

Grasslands, Herbaceous and Ground Cover

On those acres where both mechanical treatments and fire would be implemented, increased sunlight to surface vegetation, and the decrease in competition for water and nutrients would increase cover and diversity of herbaceous surface vegetation. Where populations of invasive species can be treated, competition for light, water, and nutrients would also be decreased, benefitting native grasses and forbs. Any treatments in semi-desert grassland are likely to improve the cover and diversity of surface vegetation, and ground cover.

Fire Regime and Patch Size

Where there were restoration treatments, herbaceous surface fuels would increase and expand, increasing the continuity of surface fuels, and allowing fire to spread naturally across larger areas. However, the minimum required treatment acreage is 500, less than half the reference patch size, so patch size would continue to deteriorate. High severity effects would increase as canopy cover from woody species increased. This would create larger areas of high severity, changing the scale and patterns of the vegetative mosaic, and moving the treated areas away from desired conditions.

Ecosystem Function

The rate of treatment would be too low to affect the overall ecological response unit departure. Grassland ecosystem functioning would continue to deteriorate. Some grass species become decadent if they are not burned or grazed periodically, though the effects of each are different. Frequent fire in grasslands affects nutrient availability, as well as species composition and diversity. These would all be expected to decrease, except in areas where grasslands are treated.

Alternatives C and D

Effects would be as described in alternative B.

Seral State Distribution–Closed Versus Open States

Effects would be as described in alternative B.

Grasslands, Herbaceous and Ground Cover

For alternative C, effects would be as described under alternative B. For alternative D, the effects to, and of, invasive species would be as described in alternative A.

Ecosystem Function

Effects would be as described in alternative B.

Table 72. Comparison of expected effects (movement towards or away from desired conditions) in semi-desert grasslands for each alternative

Ecosystem Characteristic	Alternative A	Alternative B	Alternative C	Alternative D
Seral state distribution, open / closed states	Away	Away	Away	Away
Patch size	Away	Away	Away	Away
Fire regime	Away	Away	Away	Away
Grasslands, herbaceous, and ground cover	Away	Away	Away	Away
Ecosystem Function	n/a	n/a	n/a	n/a

Source: United States Department of Agriculture, 2017, Final Assessment Report of Ecological Conditions`, Trends`, and Risks to Sustainability: Tonto National Forest

Juniper Grass

Healthy, resilient juniper grass (JUG) is a mosaic of a successional stages that range from grasslands with less than 10 percent tree cover to late development, closed canopy woodland/forested areas. Shrubs are scattered or absent in all successional stages. Fire and all mechanical treatments would be appropriate and effective treatments for this ecological response unit, though potential fire effects would need to be considered when decisions are made about if, when, how much, and in what form woody material is left on site.

Alternative A

Under alternative A, modeled data indicates there would be an increase in medium and large trees, which could move juniper grass towards desired conditions for tree size distribution, with about 60 percent of trees medium to large. The effects of multiple missed fire cycles would become apparent in the herbaceous surface species composition, cover, and diversity.

Seral State Distribution–Closed Versus Open States

Modeled seral stage distribution, when defined primarily by tree cover, would move away from the earliest seral state, as woody species cover increases. The small closed state and the seedling and sapling small tree open state would remain relatively constant with a slight decrease in both states. The medium/large open state and the medium/large closed state are predicted to increase as tree diameters increase, with the majority of the increase occurring in the medium/large open state. The medium/large open state would move towards desired conditions. The medium/large closed state would exceed desired conditions, and the trend toward the closed state would be expected to continue.

Past wildfires and current management created and maintained higher proportions of juniper grass in the grass / forb / shrub state than is desirable. With continued fire suppression, livestock grazing and an absence of disturbance, the small closed state, and some of the medium/large open state, will continue to move into the medium/large closed state as the in-filling of the canopy gaps continues. With 34 percent of this ecological response unit remaining in a denser state in the future, it will continue to be susceptible to outbreaks of insects, pathogens and uncharacteristically high severity fire.

Grasslands, Herbaceous and Ground Cover

The majority of the diversity in juniper grass is found in the herbaceous surface vegetation. With no mechanical treatments, and minimal opportunities for wildland fire, the composition of herbaceous surface species would continue to shift to less fire tolerant species and more shade tolerant species. The increased cover of woody species would increase competition with herbaceous surface vegetation, decreasing herbaceous cover and diversity, and decreasing ground cover. Decreased ground cover would leave soils more vulnerable to erosion and disturbance from normal usage, as well as wind and water. There may be more opportunities for invasive species to become established where competition from native species has decreased.

Fire Regime and Patch Size

Fire return interval is currently 96 years, several times reference conditions. This would continue to increase, allowing woody species cover to increase. When fires did burn, particularly under pre-monsoon conditions when it’s hot and dry, fire intensity would increase with the continuity of woody species. This could eventually lead to a different fire regime, where fires are less frequent and more severe, and the light flashy fuels that drive most fire behavior in juniper grass are insufficient to support the historic fire regime. Patch size would increase as areas with woody cover became more contiguous, provide larger areas for higher intensity fire.

Ecosystem Function

The open structure that defines about 80 percent of juniper grass reference conditions would deteriorate, and eventually these areas would function more like Pinyon-Juniper Woodland, dominated by a closed canopy state, and sparse surface vegetation that supports some patchy, mostly low intensity/low severity fire except for infrequent patches of high severity / high intensity crown fire.

Alternative B

Alternative B would move more frequent fire woodland vegetation towards desired conditions than any of the other alternatives. Under this alternative, juniper grass could slowly improve as mechanical and fire treatments move seral stages towards the desired distribution. Tree structure would improve, allowing herbaceous surface vegetation to increase in cover and diversity, supporting the low intensity/low severity fire that should be characteristic in this ecological response unit.

Mechanical treatments, wildland fire, seeding, treating invasive species, and other restoration treatments would be expected to move about 20,000 to over 400,000 acres of woodlands towards desired condition over a 10-year period (this would be the total when combined with pinyon-juniper grass and Madrean encinal woodland ecological response units). The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Seral State Distribution–Closed Versus Open States

Alternative B would shift the distribution of seral stages towards desired conditions, with more area occupied by the open, mid-, and late-seral stages which are currently under-represented. Fire would be less effective at thinning those areas where trees are over-represented because those areas would have lower surface fuel loading, but it would contribute to regulating the mosaic of seedlings and saplings as they came in.

Grasslands, Herbaceous and Ground Cover

Where treatments were implemented, decreased shading by woody species would result in increased herbaceous surface vegetation diversity, and cover. This would also provide ground cover that would protect soils from disturbances that could lead to erosion by wind or water.

Competition from invasive species populations would decrease in areas where they were treated and new populations would occur less frequently as the vigor and cover of native vegetation improves, decreasing the potential for these populations to expand, or to disperse to new locations.

Fire Regime and Patch Size

The fire regime could move towards desired conditions under this alternative, depending on how many acres can be treated.

Fire frequency is currently 96 years, and could decrease to 29 years if maximum acres are treated. This would help control woody species and keep severity mostly low. The increased nutrient cycling should act as fertilizer for herbaceous surface vegetation, improving its vigor and continuity. That would also support fire behavior that would keep shrub cover in check, allowing frequent, mostly low severity fires to carry across these areas.

If only the minimum acres are burned each year, the fire return interval would increase to about 290 years, and effects would be most similar to alternative A, except where mechanical treatments were implemented.

Treatments would decrease patch size, and move the vegetation towards the finer-scale mosaic that comprises reference conditions for juniper grass; currently, patch size in juniper grass is much larger than is desired. Fire would regulate patterns of seedlings, saplings, and shrubs, decreasing patch size and moving it towards desired conditions.

Ecosystem Function

Most of this ecological response unit is found on mollisols; soils that are created and maintained by grassland vegetation, which affects erosion, soil productivity, infiltration and percolation, and multiple other soil functions that support juniper grass. Maintaining and/or restoring a healthy herbaceous matrix will allow fire to function in its ecological role(s), recycling nutrients, keeping woody species in check, regulating the mosaic of seedlings and saplings, scarifying the seeds of fire-adapted species, regulating litter accumulation, etc.

Alternative C

Effects would be as described in alternative B, although fire would be more widely used, and there would be only about 25 percent of the mechanical treatments as alternative B. Fire does not discriminate therefore with fire as the primary treatment tool, severity and mortality patterns in areas where fire would be the first entry for thinning would be less predictable.

Mechanical treatments, wildland fire, seeding, treating invasive species, and other restoration treatments would be expected to move between 230,000 and 410,000 acres of woodlands towards desired condition over a 10-year period (this would be the total when combined with pinyon-juniper grass and Madrean encinal woodland). The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Seral State Distribution–Closed Versus Open States

Effects would mostly be as described in alternative B, but with about 75 percent less mechanical treatment. Fire would more often used as a thinning agent to move earlier seral states to medium/large open, by preventing excessive areas to develop into closed conditions.

Grasslands, Herbaceous and Ground Cover

Effects would be as described in alternative B, although fire would be more widely used, and there would be fewer acres of mechanical treatments. Grazing would be significantly reduced under this alternative, allowing additional increases in herbaceous surface vegetation cover and diversity.

Fire Regime and Patch Size

Effects would be as described in alternative B, although fire would be more widely used, and there would be fewer acres of mechanical treatments. Fire frequency is currently 96 years and, under this alternative, fire frequency would decrease to 14 to 26 years, depending on annual acres treated, and moving towards the desired fire regime faster than in any other alternative. However, thinning large trees with fire would require more surface fuel loading, and higher fire intensities. Two or three entries would be required to address the residual woody biomass where fire was successfully used as a thinning agent, so there could be more mixed and high severity fire during initial entries.

Ecosystem Function

Effects would be as described in alternative B, although fire would be more widely used, and there would be fewer acres of mechanical treatments.

Alternative D

Seral State Distribution–Closed Versus Open States

Alternative D focuses prioritizes treatments for forested frequent fire ecological response units, so there are no treatment objectives. Therefore, the effects under this alternative would be the same as described for alternative A.

Grasslands, Herbaceous and Ground Cover

Alternative D focuses prioritizes treatments for forested frequent fire ecological response units, so there are no treatment objectives. Therefore, the effects under this alternative would be the same as described for alternative A.

Fire Regime and Patch Size

Alternative D focuses prioritizes treatments for forested frequent fire ecological response units, so there are no treatment objectives. Therefore, the effects under this alternative would be the same as described for alternative A.

Ecosystem Function

Alternative D focuses prioritizes treatments for forested frequent fire ecological response units, so there are no treatment objectives. Therefore, the effects under this alternative would be the same as described for alternative A.

Table 73. Comparison of expected effects (movement towards or away from desired conditions) to juniper grass for each alternative

Ecosystem Characteristic	Alternative A	Alternative B	Alternative C	Alternative D
Seral state distribution, open / closed states	Towards	Towards*	Towards	Towards
Patch size	Away	Towards*	Towards	Away
Fire regime	Away	Towards*	Towards	Away
Grasslands, herbaceous, and ground cover	Away	Towards*	Towards	Away
Ecosystem Function	Away	Towards*	Towards	Away

*Indicates a faster rate of change.

Pinyon–Juniper Grass

Alternative A

Under alternative A, based mostly on the distribution of tree sizes, there would be an increase in medium and large trees, which would move the pinyon-juniper grass ecological response unit (PJG) towards desired conditions for tree cover. The effects of multiple missed fire cycles would become apparent in the herbaceous surface species composition, cover, and diversity. The majority of the diversity in pinyon-juniper grass is found in the herbaceous surface vegetation.

Seral State Distribution–Closed Versus Open States

Management has created and maintained higher proportions of the grass/forb/shrub state than are desired. Under this alternative, pinyon-juniper grass would move towards reference conditions. With continued fire suppression and livestock grazing the small closed state and some of the medium/large open state will continue to move into the medium closed state as the in-filling of the canopy gaps continues. Over 30 percent of this ecological response unit would remain in a denser state and continue to be increasingly susceptible to outbreaks of insects, pathogens, and stand-replacing wildfire.

Overall, this would be an improvement as far as tree cover goes, but these seral stages are defined primarily by the woody component, and the effects of multiple missed fire cycles would become apparent in the herbaceous surface species composition, cover, and diversity. The majority of the diversity in pinyon-juniper grass is found in the herbaceous surface vegetation.

Grasslands, Herbaceous and Ground Cover

With no mechanical treatments, and minimal opportunities for wildland fire, the composition of herbaceous surface species would continue to shift to less fire tolerant species, and diversity would decrease. The increase in woody species would shade out herbaceous surface vegetation, decreasing herbaceous cover and diversity, and decreasing ground cover. Decreased ground cover would leave soils more vulnerable to erosion and disturbance from normal usage, as well as wind and water.

Fire Regime and Patch Size

Fire return intervals would continue to increase, allowing woody species cover to increase. When fires did burn, particularly under pre-monsoon conditions when it’s hot and dry, fire intensity would increase as more woody fuels were part of the fuel structure. This would eventually lead to a different fire regime, where fires are less frequent and more severe, and the light flashy fuels that drive most fire behavior in pinyon-juniper grass would not be able to support the historic fire regime. Patch size would increase as areas with woody cover became more contiguous, provide larger areas for higher intensity fire.

Ecosystem Function

The open structure that defines about 80 percent of pinyon-juniper grass would deteriorate, and eventually these areas would function more like Pinyon-Juniper Woodland, dominated by a closed canopy state, and sparse surface vegetation that supports patchy, mostly low intensity/low severity fire except for infrequent patches of crown fire.

Alternative B

Alternative B would move more woodland vegetation towards desired conditions than any of the other alternatives. Under this alternative, pinyon-juniper grass could slowly improve as mechanical and fire treatments move seral stages towards the desired distribution. The improving tree structure would allow herbaceous surface vegetation to increase in cover and diversity, supporting the low intensity/low severity fire that should be characteristic in this ecological response unit.

Mechanical treatments, wildland fire, seeding, treating invasive species, and other restoration treatments would be expected to move from about 20,000 to over 400,000 acres of woodlands (this would be the total when combined with pinyon-juniper grass and Madrean encinal woodland) towards desired condition over a 10-year period. The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Seral State Distribution–Closed Versus Open States

Alternative B would shift the distribution of seral stages towards desired conditions, with more area occupied by the open mid and late seral stages which are currently under-represented. Fire would be less effective at thinning those areas where trees are over-represented because those areas have less surface fuel loading, but it would contribute to regulate the mosaic of seedlings and saplings as they came in.

Grasslands, Herbaceous and Ground Cover

Where treatments were implemented, decreased shading by woody species would result in increased herbaceous surface vegetation diversity, and cover. This would increase ground cover that would protect soils from disturbances that could lead to erosion by wind or water. Competition from invasive species populations would decrease in areas where they were treated and new populations would occur less frequently as the vigor and cover of native vegetation improves, decreasing the potential for these populations to expand, or to disperse to new locations.

Fire Regime and Patch Size

Fire frequency would move towards desired conditions under this alternative. Fire frequency is currently about 215 years, 10 to 20 times the reference fire return interval. Under alternative B, if the maximum acres were burned, fire return interval would decrease to about 29 years, moving towards desired conditions, which would help control woody species, and keep severity mostly low. The increased nutrient cycling should act as fertilizer for herbaceous surface vegetation, improving its vigor and continuity. That would also support fire behavior that would keep shrub cover in check, allowing frequent, mostly low-severity fires to carry across these areas. If only the minimum acres were burned, fire return intervals would move away from desired conditions, to about 290 years. If that happened, the effects of alternative B would be similar to alternative A, except where there were mechanical treatments.

Treatments would decrease patch size, and move the vegetation towards the finer-scale mosaic that comprises reference conditions for this ecological response unit. Currently, patch size in pinyon-juniper grass is much larger than is desired. Fire would regulate patterns of seedlings, saplings, and shrubs, decreasing patch size and moving it towards desired conditions.

Ecosystem Function

Soils that support grassland vegetation usually have mollic characteristics; high levels of organic matter in the surface horizon. Healthy grass cover affects erosion, soil productivity, infiltration and percolation, and multiple other soil functions that support pinyon-juniper grass. Maintaining and/or restoring a dense herbaceous matrix will allow fire to function in its ecological role/s, recycling nutrients, keeping woody species in check, regulating the mosaic of seedlings and saplings, scarifying the seeds of fire-adapted species, regulating litter accumulation, etc.

Mechanical, fire, seeding, treating invasive species, and other treatments would be expected to move from about 20,000 to over 400,000 acres of woodlands (this would be the total when combined with juniper grass and Madrean encinal woodland) towards desired condition over a 10-year period. The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Alternative C

Effects would be as described in alternative B, although fire would be more widely used, and there would be only about 25 percent of the mechanical treatments as in alternative B. Fire does not discriminate so, with fire as the primary treatment tool, severity/mortality patterns in areas where fire would be the first entry for thinning would be less predictable.

Mechanical treatments, wildland fire, seeding, treating invasive species, and other restoration treatments would be expected to move between 230,000 and 410,000 acres of woodlands towards desired condition over a 10-year period (this would be the total when combined with juniper grass and Madrean encinal woodland). The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Seral State Distribution–Closed Versus Open States

Effects would be as described in alternative B, although fire would be more widely used, and there would be no expectation of mechanical treatments. Fire would be used to move earlier seral states to medium/large open, by preventing excessive areas to develop into closed conditions.

Grasslands, Herbaceous and Ground Cover

Effects would be as described in alternative B, although fire would be more widely used, and there would be no expected mechanical treatments.

Fire Regime and Patch Size

Effects would be as described in alternative B, although fire would be more widely used, and there would be fewer acres of mechanical treatments. Under this alternative, fire frequency would move towards desired conditions faster than in any other alternative, getting down to a fire return interval of about 14 to

26 years. However, thinning large trees with fire would require more surface fuel loading, and higher fire intensities. Two or three entries would be required to address the residual woody biomass where fire was successfully used as a thinning agent, so there could be more mixed and high severity fire during initial entries.

Ecosystem Function

Effects would be as described in alternative B, although fire would be more widely used, and there would be no expectation of mechanical treatments.

Alternative D

Seral State Distribution–Closed Versus Open States

Alternative D focuses prioritizes treatments for forested frequent fire ecological response units, so there are no treatment objectives. Therefore, the effects under this alternative would be the same as described for alternative A.

Grasslands, Herbaceous and Ground Cover

Alternative D focuses prioritizes treatments for forested frequent fire ecological response units, so there are no treatment objectives. Therefore, the effects under this alternative would be the same as described for alternative A.

Fire Regime and Patch Size

Alternative D focuses prioritizes treatments for forested frequent fire ecological response units, so there are no treatment objectives. Therefore, the effects under this alternative would be the same as described for alternative A.

Ecosystem Function

Alternative D focuses prioritizes treatments for forested frequent fire ecological response units, so there are no treatment objectives. Therefore, the effects under this alternative would be the same as described for alternative A.

Table 74. Comparison of expected effects (movement towards or away from desired conditions) to pinyon-juniper grass for each alternative.

Ecosystem Characteristic	Alternative A	Alternative B	Alternative C	Alternative D
Seral state distribution, open / closed states	Towards	Towards*	Towards	Away
Patch size	Away	Towards*	Towards	Away
Fire regime	Away	Towards*	Towards	Away
Grasslands, herbaceous, and ground cover	Away	Towards*	Towards	Away
Ecosystem Function	Away	Towards*	Towards	Away

*Indicates a faster rate of change. Two asterisks indicates the fastest rate of change.

Madrean Encinal Woodland

Alternative A

Under alternative A, the Madrean encinal woodland (MEW) ecological response unit would be expected to move towards the medium/large closed state, away from desired conditions. The effects of multiple missed fire cycles would become apparent in the herbaceous surface species composition, cover, and diversity. The majority of the diversity in Madrean encinal woodland is found in the herbaceous surface vegetation, which would decrease under this alternative.

Seral State Distribution–Closed Versus Open States

Under this alternative, Madrean encinal woodland would be expected to move away from desired conditions for seral state distribution as canopy cover increases in the absence of reoccurring disturbances. The small closed state and the seedling/sapling open states would not change much. Currently, 33 percent of Madrean encinal woodland is in the medium/large closed state, which is not within the historic range of variability for this ecological response unit, but would increase under this alternative. As the medium/large closed canopy state increases, grass and forb production would decrease and shrub development would increase.

Grasslands, Herbaceous and Ground Cover

With no mechanical treatments, and minimal opportunities for wildland fire, the composition of herbaceous surface species would continue to shift to less fire tolerant species. Increased woody species cover would shade out herbaceous surface vegetation, decreasing herbaceous cover and diversity, and decreasing ground cover. Species composition is currently moderately departed, but would move towards highly departed for forbs, which provide the majority of the plant biodiversity.

Ground cover is currently at about 63 percent of reference conditions, but would decrease as herbaceous surface vegetation is shaded out and/or suppressed by increasing leaf litter. Decreased ground cover would leave soils more vulnerable to erosion and disturbance from normal usage, as well as wind and water.

Fire Regime and Patch Size

Fire return intervals would continue to increase, allowing woody species cover to increase. As the woody component of the fuel structure increased, fires intensity would increase, creating higher severity effects, and potentially high burn severity (fire effects to soil). This could eventually lead to a different fire regime, where fires are less frequent and more severe, and the light flashy fuels that drive most fire behavior in Madrean encinal woodland would not be able to support the historic fire regime.

Patch size would increase as areas with woody cover became more contiguous, creating larger areas for higher intensity fire. Patch size is currently within the historical range, but would increase as canopies close in and canopy gaps become smaller. Coarse woody debris is predicted to increase and may contribute to increased risk of uncharacteristic wildfire.

Ecosystem Function

The open structure that should be about 65 percent of Madrean encinal woodland would deteriorate, and eventually these areas would be dominated by a closed canopy state, and patchy and/or sparse surface vegetation that would support patchy, mostly low intensity/low severity fire except for infrequent patches of crown fire.

Alternative B

Alternative B would move more woodland vegetation towards desired conditions than any of the other alternatives. Under this alternative, Madrean encinal woodland could slowly improve as mechanical and fire treatments move seral stages towards the desired distribution. The improving tree structure would allow herbaceous surface vegetation to increase in cover and diversity, supporting the low intensity/low severity fire that should be characteristic in this ecological response unit.

Mechanical, fire, seeding, treating invasive species, and other treatments would be expected to move from about 20,000 to over 400,000 acres of woodlands (this would be the total when combined with juniper grass and pinyon-juniper grass) towards desired condition over a 10-year period. The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation

Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Seral State Distribution–Closed Versus Open States

Alternative B would shift the distribution of seral stages towards desired conditions, with more area occupied by the open mid and late seral stages which are currently under-represented. Currently, 33 percent of Madrean encinal woodland is in a medium/large closed state, which is out of historic range of variability for Madrean encinal woodland. This could decrease significantly, where mechanical treatments would be able to quickly restructure the tree distribution. Fire could be effective, though less predictable as a thinning agent, particularly in where trees are over-represented because those areas have less surface fuel loading, though it would contribute to regulate the mosaic of seedlings and saplings.

Grasslands, Herbaceous and Ground Cover

Where treatments were implemented, decreased shading by woody species would result in increased herbaceous surface vegetation diversity, and cover. This would increase ground cover, protecting soils from disturbances that could lead to erosion from normal usage, as well as wind and water.

Fire Regime and Patch Size

The current fire return interval for Madrean encinal woodland is about 170 years, around 10 times the reference condition. Under alternative B, fire return intervals could decrease to as low as 29 years, moving towards desired conditions, severity would move towards desired conditions where surface fuels were sufficient to allow fire to regulate trees and shrubs. Where mechanical treatments were implemented, changes to the woody component of the fuel structure could occur quickly. Fire would help increase the cover and diversity of surface vegetation and keep shrub cover in check, allowing frequent, mostly low severity fires to carry across these areas. Fire would regulate patterns of seedlings, saplings, and shrubs, maintaining patch size and the mosaic that comprises Madrean encinal woodland reference conditions. Mechanical treatments and wildland fire would decrease patch size by killing or top-killing some trees and shrubs, particularly those on the outside of tree/shrub groups. This would move vegetation towards the finer-scale mosaic that comprises reference conditions for this ecological response unit.

The minimum treatment objective would produce an average fire return interval of about 290 years, and the effects of this alternative would then be similar to those described under alternative A, except where there were mechanical treatments.

Ecosystem Function

A healthy grass cover in openings affects erosion, soil productivity, infiltration and percolation, and multiple other soil functions that support Madrean encinal woodland. Maintaining and/or restoring a dense, herbaceous matrix between stands of oaks will allow fire to function in its ecological role/s of recycling nutrients, keeping woody species in check, regulating the mosaic of seedlings and saplings, scarifying the seeds of fire-adapted species, regulating litter accumulation, etc.

Alternative C

Effects would be as described in alternative B, although fire would be more widely used, and there would be only about 25 percent of the mechanical treatments as in alternative B. Fire does not discriminate so, with fire as the primary treatment tool, severity/mortality patterns in areas where fire would be the first entry for thinning would be less predictable.

Mechanical treatments, wildland fire, seeding, treating invasive species, and other restoration treatments would be expected to move between 230,000 and 410,000 acres of woodlands towards desired condition over a 10-year period (this would be the total when combined with juniper grass, Madrean pinyon-oak, and pinyon juniper-grass). The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Seral State Distribution–Closed Versus Open States

Effects would be as described in alternative B, although fire would be more widely used, and there would be no expectation of mechanical treatments. Fire does not discriminate so, with fire as the primary treatment tool, severity/mortality patterns in areas where fire would be the first entry for thinning would be less predictable. Fire would be used to move earlier seral states to medium/large open, by preventing areas from developing into closed conditions.

Grasslands, Herbaceous and Ground Cover

Effects would be as described in alternative B, although fire would be more widely used, and there would be no expectation of mechanical treatments.

Fire Regime and Patch Size

Effects would be as described in alternative B, although fire would be more widely used, and there would be no expectation of mechanical treatments. Fire return intervals would move towards desired conditions more quickly under this alternative than under any of the others, decreasing to less than 30 years. However, thinning trees with fire would require more surface fuel loading, and higher fire intensities. Two or three entries would be required to address the residual woody biomass where fire was successfully used as a thinning agent.

Ecosystem Function

Effects would be as described in alternative B, although fire would be more widely used, and there would be no expectations of mechanical treatments.

Alternative D

Seral State Distribution–Closed Versus Open States

Alternative D prioritizes treatments for forested frequent fire ecological response units, so there are no treatment objectives. Therefore, the effects under this alternative would be the same as described for alternative A.

Grasslands, Herbaceous and Ground Cover

Alternative D prioritizes treatments for forested frequent fire ecological response units, so there are no treatment objectives. Therefore, the effects under this alternative would be the same as described for alternative A.

Fire Regime and Patch Size

Alternative D prioritizes treatments for forested frequent fire ecological response units, so there are no treatment objectives. Therefore, the effects under this alternative would be the same as described for alternative A.

Ecosystem Function

Alternative D prioritizes treatments for forested frequent fire ecological response units, so there are no treatment objectives. Therefore, the effects under this alternative would be the same as described for alternative A.

Table 75. Comparison of expected effects (movement towards or away from desired conditions) to Madrean encinal woodland for each alternative

Ecosystem Characteristic	Alternative A	Alternative B	Alternative C	Alternative D
Seral state distribution, open / closed states	Away	Towards*	Towards	Away
Patch size	Away	Towards*	Towards	Away
Fire regime	Away	Towards*	Towards	Away
Grasslands, herbaceous, and ground cover	Away	Towards*	Towards	Away
Ecosystem Function	Away	Towards*	Towards	Away

* Indicates a faster rate of change.

Madrean Pinyon-Oak

Madrean pinyon-oak only comprises about 6,300 acres of the Tonto National Forest, so there was no analysis done for the Assessment. Descriptions below are based on extrapolations from (Wahlberg et al. 2017 (in draft)) and the fire regimes of adjacent areas. Adjacent ecological response units include interior chaparral, pinyon-juniper evergreen shrub (fire regime III); pinyon-juniper grass, Madrean encinal woodland, ponderosa pine-evergreen oak and juniper grass (fire regime II), so there is likely a lot of variability within the fire regime of this ecological response unit.

Alternative A

Seral State Distribution–Closed Versus Open States

Currently, there are no data to indicate expected trajectories, but in frequent fire systems, there are some effects that would be expected. Under alternative A, Madrean pinyon-oak would be expected to move towards medium/large closed states, and away from open states as canopy cover increases in the absence of reoccurring disturbance. As the medium/large closed canopy state increases, grass and forb production would decrease and shrub development would increase.

Grasslands, Herbaceous and Ground Cover

With no mechanical treatments, and minimal opportunities for wildland fire, the composition of herbaceous surface species would continue to shift to less fire tolerant species. Increased woody species cover would shade out herbaceous surface vegetation, decreasing herbaceous cover and ground cover. The majority of the diversity in Madrean pinyon-oak is found in the herbaceous surface vegetation, which would decrease under this alternative.

Ground cover would decrease as herbaceous surface vegetation is shaded out and/or suppressed by increasing litter. Decreased ground cover would leave soils more vulnerable to erosion and disturbance from normal usage, as well as wind and water.

Fire Regime and Patch Size

Fire return intervals would continue to increase, allowing woody species cover to increase. As the woody component of the fuel structure increased horizontally and vertically, fires intensity would increase, creating higher severity effects, and potentially high burn severity (fire effects to soil). This could eventually lead to a different fire regime, where fires are less frequent and more severe, and the light flashy fuels that drive behavior in the open areas of Madrean pinyon-oak would not be able to support the historic fire regime.

Patch size would increase as areas with woody cover became more contiguous, creating larger areas for higher intensity fire. Madrean pinyon-oak has a great deal of variability and, over time, it is likely that groups and openings are a shifting mosaic responding, at least in part, to fire. Patch size would be likely to increase as canopies close in and canopy gaps become smaller. Coarse woody debris would also be likely to increase and could contribute to increased risk of uncharacteristic wildfire.

The effects of multiple missed fire cycles would become most apparent in areas dominated by herbaceous surface fuels, as those areas would contract as woody species become established.

Ecosystem Function

The open structure that should be about 60 percent of Madrean pinyon-oak would decrease, and eventually these areas would be dominated by a closed canopy state that would support high severity fire. The patchy and/or sparse surface vegetation that would support patchy, mostly low intensity/low severity fire except for infrequent patches of crown fire would decrease. Decreased ground cover, combined with increased fire intensity could result in permanent changes to soil conditions and site potential.

Alternative B

Alternative B would move more woodland vegetation towards desired conditions than any of the other alternatives. Under this alternative, Madrean pinyon-oak could slowly improve as mechanical and fire treatments move seral stages towards the desired distribution, maintaining the mosaic of open and closed conditions. In this ecological response unit, the horizontal continuity is an important component of the mosaic which would be maintained better under this alternative than under the others.

Mechanical, fire, seeding, treating invasive species, and other treatments would be expected to move from about 20,000 to over 400,000 acres of woodlands (this would be the total when combined with juniper grass, Madrean encinal woodland, and pinyon-juniper grass) towards desired condition over a 10-year period. The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Seral State Distribution–Closed Versus Open States

Alternative B would be able to manage the desired mosaic better than the other alternatives to maintain about 60 percent open conditions. Fire could be effective, though less predictable as a thinning agent, particularly in where trees are over-represented because those areas have less surface fuel loading, though it would contribute to regulate the mosaic.

Grasslands, Herbaceous and Ground Cover

Where treatments were implemented, decreased shading by woody species would result in increased herbaceous surface vegetation diversity, and cover. This would increase ground cover, protecting soils from disturbances that could lead to erosion from normal usage, as well as wind and water.

Fire Regime and Patch Size

The current fire return interval for Madrean pinyon-oak is not currently known, but based on the adjacent ecological response units, it is likely to be higher than reference conditions. Under alternative B, fire return intervals could decrease to as low as 30 years, moving towards desired conditions, severity would move towards desired conditions where surface fuels were sufficient to allow fire to regulate trees and shrubs. Where mechanical treatments were implemented, changes to the standing woody component of the fuel structure could occur quickly. Fire would help increase the cover and diversity of surface vegetation and keep shrub cover in check, maintaining openings. Fire would regulate patterns of seedlings, saplings, and shrubs, maintaining patch size and the mosaic that comprises Madrean pinyon-oak reference conditions.

The minimum treatment objective would produce an average fire return interval of about 290 years, and the effects of this alternative would then be similar to those described under alternative A, except where there were mechanical treatments.

Ecosystem Function

A healthy grass cover affects erosion, soil productivity, infiltration and percolation, and multiple other soil functions that support Madrean encinal woodland. Maintaining and/or restoring a dense herbaceous matrix between open stands of oaks will allow fire to function in its ecological role(s) of recycling nutrients, keeping woody species in check, regulating the mosaic of seedlings and saplings, scarifying the seeds of fire-adapted species, regulating litter accumulation.

Alternative C

Effects would be as described in alternative B, although fire would be more widely used, and there would be only about 25 percent of the mechanical treatments as in alternative B. Fire does not discriminate so, with fire as the primary treatment tool, severity/mortality patterns in areas where fire would be the first entry for thinning would be less predictable.

Mechanical treatments, wildland fire, seeding, treating invasive species, and other restoration treatments would be expected to move between 230,000 and 410,000 acres of woodlands towards desired condition over a 10-year period (this would be the total when combined with juniper grass, Madrean encinal woodland, and pinyon-juniper grass). The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Seral State Distribution–Closed Versus Open States

Effects would be as described in alternative B, although fire would be more widely used, and there would be no expectation of mechanical treatments. Fire does not discriminate so, with fire as the primary treatment tool, severity/mortality patterns in areas where fire would be the first entry for thinning would be less predictable. Fire would be used to move earlier seral states to medium/large open, by preventing excessive areas to develop into closed conditions.

Grasslands, Herbaceous and Ground Cover

Effects would be as described in alternative B, although fire would be more widely used, and there would be no expectation of mechanical treatments.

Fire Regime and Patch Size

Effects would be as described in alternative B, although fire would be more widely used, and there would be no expectation of mechanical treatments. Fire return intervals would move towards desired conditions more quickly under this alternative than under any of the others, decreasing to less than 30 years. However, thinning trees with fire would require more surface fuel loading, and higher fire intensities. Two or three entries would be required to address the residual woody biomass where fire was successfully used as a thinning agent.

Ecosystem Function

Effects would be as described in alternative B, although fire would be more widely used, and there would be no expectations of mechanical treatments.

Alternative D

Seral State Distribution–Closed Versus Open States

Alternative D focuses on treatments for forested frequent fire ecological response units, so there are no treatment objectives. Therefore, the effects under this alternative would be the same as described for alternative A.

Grasslands, Herbaceous and Ground Cover

Alternative D focuses on treatments for forested frequent fire ecological response units, so there are no treatment objectives. Therefore, the effects under this alternative would be the same as described for alternative A.

Fire Regime and Patch Size

Alternative D focuses on treatments for forested frequent fire ecological response units, so there are no treatment objectives. Therefore, the effects under this alternative would be the same as described for alternative A.

Ecosystem Function

Alternative D focuses on treatments for forested frequent fire ecological response units, so there are no treatment objectives. Therefore, the effects under this alternative would be the same as described for alternative A.

Table 76. Comparison of expected effects (movement towards or away from desired conditions) to Madrean pinyon-oak for each alternative

Ecosystem Characteristic	Alternative A	Alternative B	Alternative C	Alternative D
Seral state distribution, open / closed states	Away	Towards*	Towards	Away
Patch size	Away	Towards*	Towards	Away
Fire regime	Away	Towards*	Towards	Away
Grasslands, herbaceous, and ground cover	Away	Towards*	Towards	Away
Ecosystem Function	Away	Towards*	Towards	Away

* Indicates a faster rate of change. Two asterisks indicates the fastest rate of change.

Ponderosa Pine–Evergreen Oak

The ponderosa pine-evergreen oak (PPE) ecological response unit is one of the most departed ecosystems on the Tonto National Forest, and one of the biggest challenges to restore. Across most of the ponderosa pine-evergreen oak ecosystem, sprouting woody species became established at uncharacteristic densities over the last few decades as fire return intervals were interrupted. The lack of fire allowed canopy cover to increase, and the increased shading held the newly established sprouting species in check, preventing them from maturing as fast, or becoming as large. Now, when canopies are opened up, these sprouting species are released, and often respond by growing rapidly into an understory layer of ladder fuels in less than 5 years. That means that almost everywhere that canopy cover is thinned to reference conditions in ponderosa pine-evergreen oak, a minimal fire frequency must be maintained to prevent an increased potential for high severity fire until the shrub layer can be reduced to a level maintainable with less frequent fire. Closed stands would remain at risk of high severity fire, though less so with less understory shrub cover. Many areas with ponderosa pine-evergreen oak are in areas with difficult access, limiting treatment options, particularly for mechanical treatments.

In the ponderosa pine-evergreen oak ecological response unit, ponderosa pine is on the drier extreme of its range, while the shrubs, juniper, and other competing species are mostly in the middle of their range. Fire is one of the great equalizers in this system and, without it, ponderosa pine would almost certainly be eliminated by high-severity fires fueled by the over-represented shrub component. The important objective for treatment in this ecological response unit is to significantly decrease the potential for active crown fire, both short and long term. There is a great deal of concern about the response of shrubs if this pine ecosystem is thinned too heavily. Not because it wouldn't represent historic and resilient conditions, but because it would be very difficult to keep fire frequency at a level that would actually decrease or maintain shrub cover from pre-treatment levels. For the short term, decreasing but not removing all of the shrub component, while providing some additional structural adjustments to the pine would be the most beneficial.

Alternative A

Under this alternative, ponderosa pine-evergreen oak would initially continue to move towards desired conditions, but eventually there would either be too much area opened up to manage appropriately with the current levels of burning, or thinning would need to be done to a lower level to allow the overstory to inhibit sprouting, woody understory species. Without fire, it is unlikely that extensive dense stands of ponderosa pine could be sustained so under alternative A, it would be expected that there would be extensive mortality through fire, pathogens, or density related mortality in ponderosa pine-evergreen oak. Post-mortality biomass may be a different type of ecosystem, such as a persistent shrub type, grass-dominated system, or unnaturally dense ponderosa pine (Savage and Mast 2005).

Seral State Distribution–Closed Versus Open States

Under this alternative, seral state distributions would continue to move slowly towards desired conditions. There would be a gradual decrease in the closed states and a corresponding increase in the open states. The small closed state and the medium/large closed state would each decrease. The small open state and the medium/large open states would increase. However, even with the expected changes to seral stage distribution, departure for ponderosa pine-evergreen oak would remain at high.

Grasslands, Herbaceous and Ground Cover

Sprouting woody species have, so far, been kept at manageable levels in most treated areas, freeing up space for increased grass and forb production. However, as more areas are treated/opened up, shrubs and alligator juniper will also increase, making it more critical that they are actively managed to for the desired cover percentage (less than 30 percent). The need to for fire will also increase and, at current levels, will eventually not be able to keep up with the minimal frequency needed to maintain the system, or move it towards desired conditions at the landscape scale.

Fire Regime and Patch Size

As stands are treated and opened up, patch size can be reduced, though stands that are opened up will have a greater need for frequent fire for at least a decade to keep sprouting, woody species in check. With current treatment rates, fire return intervals would improve a little. Fire severity would depend, at least in part, on the ability of the Tonto National Forest to keep fire frequent enough to maintain or improve conditions.

Ecosystem Function

There would be slow progress towards desired conditions, with the rate of progress depending in part on the Forest's ability to keep frequent fire in these areas. As areas open up from thinning, there would be more and more area in need of frequent fire. Where site potential favors the evergreen shrub subclass, the adjacent ponderosa pine-evergreen oak matrix would need to be treated to allow the evergreen shrub subclass to be managed with mixed severity fire.

Alternative B

Effects would be similar to those described in alternative A, but the increased pace of treatments in alternative B would reduce the time required to achieve a more resilient and resistant condition on a trajectory towards desired conditions. The acres on which frequent fire is needed to maintain progress towards desired conditions will increase. Even at treatment rates above the minimum set in the objectives, it will be a challenge to keep up the minimal fire frequency needed to maintain the ponderosa pine-evergreen oak, or move it towards desired conditions at the landscape scale.

Mechanical and fire treatments, seeding, treating invasive species, and other treatments would be expected to move from 155,000 to 455,000 acres of frequent fire forested ecological response unit acres towards desired conditions over a 10-year period (this would be the total when combining ponderosa pine-evergreen oak, ponderosa pine forest, and mixed conifer-frequent fire). The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Seral State Distribution–Closed Versus Open States

Under this alternative, the currently over-represented closed states would be replaced with a corresponding increase in under-represented open states. Using all treatment options in ponderosa pine-evergreen oak (wildfire, prescribed fire, mastication, and thinning) and increasing the rate of treatment would move more acres towards desired conditions for seral state distribution faster than any other alternative. Changes in canopy cover may need to be managed for canopy conditions more closed than they would have been historically, at least initially, in order to manage the response of sprouting woody species.

Where site potential favors the evergreen shrub subclass, treatment objectives would allow for mixed severity fire where coarse-textured or gravelly soil characteristics favor shrubs over herbaceous species. In these areas, needle cast and needle drape may be more important components of the fuel structure than herbaceous surface fuels to carry fire.

Grasslands, Herbaceous and Ground Cover

Herbaceous surface vegetation would increase in response to decreased shrub and tree cover. As areas are treated/opened up, sprouting woody species will also increase, so it would be critical that treatment objectives consider the sprouting response. First, second, and maybe even third entry treatments would need to be more frequent than subsequent treatment frequencies in order to kill, rather than just top kill, some of the sprouting woody species to move species composition and structure on a more permanent trajectory towards desired conditions. As more acres are treated, the acres on which fire is needed to maintain progress towards desired conditions will increase. Even at treatment rates above the minimum set in the objectives, it will be a challenge to keep up the minimal fire frequency needed to maintain ponderosa pine-evergreen oak, or move it towards desired conditions at the landscape scale.

Ground cover would be expected to decrease for a period of time immediately following thinning, though, in the long term, it would increase where there is increased herbaceous surface vegetation. Where site conditions favor the evergreen shrub subclass, ground cover would be provided more by needle cast and leaf litter than by herbaceous surface vegetation.

Populations of weeping lovegrass are as described in Affected Environment under ponderosa pine-evergreen oak alternative A. The difference would be that, under alternative B, there would be some potential to begin to address the problem. This species is able to establish and thrive in areas that would normally favor the evergreen shrub subclass, where herbaceous surface vegetation is less common.

Fire Regime and Patch Size

With current treatment rates, fire frequency would increase, and potential fire severity would decrease in the ponderosa pine-evergreen oak matrix. Under this alternative, fire return intervals would decrease to 7 to 20 years from the current fire return interval of about 155 years. Maintaining the lower severity potential would depend, in large part, on the ability of the Tonto National Forest to keep fire frequent enough to maintain or improve conditions. In the evergreen shrub subclass, the more open conditions in the adjacent ponderosa pine forest perennial grass subclass would make it easier to manage with mixed severity fire because of decreased potential for crowning/torching in the surrounding areas.

As stands are treated and opened up, patch size could be reduced, though stands that are opened up will have a greater need for frequent fire to continue on a trajectory towards desired conditions. Where conditions favor the evergreen shrub subclass, patch size would be larger.

Ecosystem Function

The long-term rate of progress in ponderosa pine-evergreen oak will depend on keeping frequent fire where forests have been opened up. First, second, and even third entries with fire or mechanical treatments would need to be more frequent than subsequent maintenance treatments in order to keep treated areas on a trajectory towards desired conditions. If the time between treatments is too long, sprouting species and/or regeneration from non-sprouting tree species could begin to move the area back away from desired conditions.

Alternative C

Effects would be as described in alternative B, although fire would be more widely used, and there would only be about 25 percent of the mechanical treatments as in alternative B. Fire does not discriminate so, with fire as the primary treatment tool, severity / mortality patterns in areas where fire would be used for thinning would be less predictable. The increased pace of fire treatments in alternative C would reduce the time required to achieve a more frequent fire regime that would be able to maintain, or move the ponderosa pine-evergreen oak towards desired conditions, though there could be more mixed and high severity fire effects from the initial entries with fire.

Mechanical treatments would be limited, though fire treatments would be expanded over alternative C. When combined with other treatments (seeding, treating invasive species, grazing management, and other management actions) would be expected to move about 150,000 to 450,000 acres of frequent fire forested ecological response unit acres towards desired conditions over a 10-year period (this would be the total when combining ponderosa pine-evergreen oak, ponderosa pine forest, and mixed conifer-frequent fire). The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Seral State Distribution–Closed Versus Open States

Effects would be similar to those described under alternative B, though it could take longer to reach desired conditions where treatments require multiple entries with wildland fire. Changes in canopy cover may need to be managed for canopy conditions more closed than they would have been historically, at least initially, in order to manage the response of sprouting woody species.

Grasslands, Herbaceous and Ground Cover

Decreased shrub and tree cover would increase grass and forb cover and diversity. Initially, as areas are treated / opened up, sprouting woody species will also increase, making it more critical that they are actively managed. Treatment frequency will need to be greater in order to kill, rather than just top kill, some of the sprouting woody species to move species composition towards desired conditions. Populations of weeping lovegrass are described in alternative A. The difference would be that, under alternative B, there would be some potential to begin to address the problem.

Fire Regime and Patch Size

The focus on treating acres with fire under this alternative would mean a greater increase in fire frequency than under other alternatives. As fire frequency increased from its current fire return interval of about 115 years, to 7 to 20 years, potential fire severity would decrease. Maintaining the lower severity potential would depend, in large part, on the ability of the Tonto National Forest to keep fire frequent enough to maintain or improve conditions. As stands are treated and opened up, patch size could be reduced, though stands that are opened up will have a greater need for frequent fire to continue on a trajectory towards desired conditions.

Ecosystem Function

The long-term rate of progress in ponderosa pine-evergreen oak would depend on keeping frequent fire where forests have been opened up. First, second, and even third entries with fire or mechanical treatments would need to be more frequent than subsequent maintenance treatments in order to keep treated areas on a trajectory towards desired conditions. If the time between treatments is too long, sprouting species and/or regeneration from non-sprouting tree species could begin to move the area back away from desired conditions.

Alternative D

Under this alternative, mechanical treatments would be the primary tool for treatments, with prescribed fire implemented mostly where there were also mechanical treatments. Opportunities for treating areas with wildfire would be similar to alternative B, with some differences between the two alternatives depending on where there had been mechanical treatments. Acres expected to be treated with only fire would be less than 20 percent of those proposed for alternatives B and C.

Mechanical treatments would be limited, though fire treatments would be expanded over alternative C. When combined with other treatments (seeding, treating invasive species, grazing management, and other management actions) would be expected to move about 66,000 to 152,000 acres of frequent fire forested ecological response unit acres towards desired conditions over a 10-year period (this would be the total when combining ponderosa pine-evergreen oak, ponderosa pine forest, and mixed conifer-frequent fire). The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Seral State Distribution–Closed Versus Open States

Effects would be similar to those described under alternative B, though it could take longer to reach desired conditions where treatments require multiple entries with wildland fire. Changes in canopy cover would need to be managed for canopy conditions more closed than they would have been historically, at least initially, in order to manage the response of sprouting woody species. This would be particularly true under alternative D because of the deceased focus on wildland fire.

Grasslands, Herbaceous and Ground Cover

Decreased shrub and tree cover would increase grass and forb cover and diversity. Initially, as areas are treated/opened up, sprouting woody species will also increase, making it more critical that they are actively managed. Treatment frequency will need to be greater in order to kill, rather than just top kill, some of the sprouting woody species to move species composition towards desired conditions. The effects to, and of, invasive species would be as described in alternative A.

Fire Regime and Patch Size

The focus on mechanical treatments, and much more limited fire treatments would effectively decrease undesirable fire behavior and effects immediately following treatments. Maintaining the lower severity potential would depend, in large part, on the ability of the Tonto National Forest to keep areas treated, mechanically or with fire, frequently enough to maintain or improve conditions. Currently, the fire return interval for ponderosa pine-evergreen oak is about 115 years. Under alternative D, it would decrease from 12 to 46 years, depending on how many acres could burned each year. If the fire return interval were on the long end (46 year), much of the improved condition gained from mechanical treatments and fire would be lost in the interim years with no fire. As stands are treated and opened up, patch size could be reduced, though stands that are opened up will have a greater need for follow-up treatments to maintain a trajectory towards desired conditions.

Ecosystem Function

The long-term rate of progress in ponderosa pine-evergreen oak would depend on keeping areas treated, mechanically or with fire, particularly in areas where forests have been opened up. First, second, and even third entries with fire or mechanical treatments would need to be more frequent than subsequent maintenance treatments in order to keep treated areas on a trajectory towards desired conditions. If the time between treatments is too long, sprouting species and/or regeneration from non-sprouting tree species could begin to move the area back away from desired conditions.

Table 77. Comparison of expected effects (movement towards or away from desired conditions) to ponderosa pine-evergreen oak for each alternative

Ecosystem Characteristic	A	B	C	D
Seral state distribution, open / closed states	Towards	Towards**	Towards*	Towards*
Patch size	Towards	Towards**	Towards*	Towards*
Fire regime	Towards	Towards**	Towards*	Towards
Grasslands, herbaceous, and ground cover	Towards	Towards**	Towards*	Towards*
Ecosystem Function	Towards	Towards**	Towards*	Towards

* One asterisk indicates a faster rate of change.

** Two asterisks indicate the fastest rate of change.

Ponderosa Pine Forest

Alternative A

Current management is beginning to move the ponderosa pine forest (PPF) ecological response unit towards reference conditions, but too slowly to make any significant difference in the next couple of decades. The rate of improvement in canopy closure would be too slow to address the increasing potential for uncharacteristically large and severe fires. Such fires would have the potential to produce a type-change in ponderosa pine forest, resulting in these areas becoming grassland, shrubland, or other uncharacteristic vegetative state.

Seral State Distribution–Closed Versus Open States

Closed canopy, even-aged states would continue to slowly decrease as open, multi-storied states would slowly increase. However, these changes would be too slow to make a significant difference in ponderosa pine forest over the life of the forest plan, leaving much of the ponderosa pine forest at risk of type conversion.

Grasslands, Herbaceous and Ground Cover

Improvements in herbaceous surface vegetation cover and diversity would be very slow; dependent on canopies opening up, which would occur too slowly to make a significant difference during the next 10-year period.

Ground cover would depend on herbaceous surface fuel cover and the rate of pine litter accumulation. Following fire, litter coverage will be reduced for a period of time, depending on herbaceous surface fuel cover, tree canopy cover, and canopy base height. If canopy base height is low, scorched needles will fall within a year, providing some ground cover.

Fire Regime and Patch Size

The slow rate of improvement in canopy closure would mean that, for at least the next 10-year period, patch size would remain uncharacteristically large, and surface fuel loading would continue to accumulate, increasing the likelihood of high-intensity, high-severity fire. Where fire effects are uncharacteristic, there is potential for significantly altered stand structures, or type conversion to grass, shrub, or other uncharacteristic condition.

Ecosystem Function

Areas of ponderosa pine forest that are opened up would be more easily maintained with current management than ponderosa pine-evergreen oak because of the much lower presence of sprouting woody species. However, alligator juniper, in particular, has been a problem in managing the ponderosa pine forest for much of the Mogollon Rim area.

Figure 33 illustrates alligator juniper response in the Sierra Anchas one year after the Juniper Fire. As depicted, in its current condition this area would not carry fire well for another 2 to 4 years.

Figure 33. Alligator juniper response in the Sierra Anchas one year after the Juniper Fire
(Photo credit: Mary Lata, USDA Forest Service)

Alternative B

Under alternative B, ponderosa pine forest would move towards desired conditions. The increased rate of treatment would allow this ecological response unit to move quickly towards desired conditions where it was accessible for mechanical treatments and fire. Where acres are accessible for both mechanical treatments and wildland fire, the primary limitations on reaching desired conditions would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Mechanical and fire treatments, seeding, treating invasive species, and other treatments would be expected to move from 150,000 to 450,000 acres of the frequent-fire forested ecological response unit towards desired conditions over a 10-year period (this would be the total when combining ponderosa pine-evergreen oak, ponderosa pine forest, and mixed conifer-frequent fire). The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Seral State Distribution–Closed Versus Open States

The expected increased rate of treatment should result in significant changes in seral stage distribution, moving this ecological response unit closer to desired conditions as closed canopy, even-aged states are replaced by open, multi-storied states. Movement towards the desired seral stage distribution would happen faster under this alternative than under any other.

Grasslands, Herbaceous and Ground Cover

Herbaceous surface cover would move towards desired conditions for both cover and diversity and canopies are opened up, allowing light and precipitation to increase at the ground level. Native bunchgrasses would be expected to increase, along with total herbage available for native and domestic ungulates.

Ground cover would be as described in alternative A, though the increased rate of treatment would expand the effects over a larger area.

Fire Regime and Patch Size

The increased rate of treatment would mean that, over the next 10-year period, fire return intervals would decrease from the current rate of about 84 years to a fire return interval of 7 to 20 years, and the potential for undesirable fire effects and behavior would decrease. The increased frequency would result in decreased patch size, as accumulations of surface fuels, and patches of contiguous canopy fuels decrease. There would be a significantly reduced potential for high severity fire that could alter stand structure, or produce a type conversion.

Ecosystem Function

Under alternative B, ecosystem functions in ponderosa pine forest would begin to function normally, as fire could begin to resume its natural roles. Nutrients locked up in fuel accumulations would be recycled, acting as a fertilizer on surface vegetation, and increasing the vigor and resilience of herbaceous surface vegetation. Combined with some pine litter, the surface fuel load would be able to regulate the mosaic of woody vegetation, the horizontal and vertical fuel structure, and maintain the open, uneven-aged stands that characterize a healthy ponderosa pine forest.

Alternative C

The effects of alternative C would be similar to those under alternative B, though there would be about 25 percent fewer acres with mechanical treatments, and at least 40 percent more treated with fire. Fire does not discriminate, therefore with fire as the primary treatment tool, severity / mortality patterns in areas where fire would be used for thinning would be less predictable. The increased pace of fire treatments in alternative C would reduce the time required to achieve a more frequent fire regime that would be able to maintain, or move the ponderosa pine-evergreen oak towards desired conditions, though there could be more mixed and high severity fire effects from the initial entries with fire.

Mechanical and fire treatments, seeding, treating invasive species, and other treatments would be expected to move from 155,000 to 445,000 acres of frequent fire forested ecological response unit towards desired conditions over a 10-year period (this would be the total when combining ponderosa pine-evergreen oak, ponderosa pine forest, and mixed conifer-frequent fire). The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Seral State Distribution–Closed Versus Open States

Effects would be similar to those described for alternative B, though there would more acres of fire effects, and fewer acres with the effects of mechanical effects.

Grasslands, Herbaceous and Ground Cover

The effects under alternative C would be similar to the effects described under alternative B. The differences would be in the increased acres where fire would be used as a tool for thinning in area that were closed canopy. At least three entries would be required to address the residual woody biomass where fire was successfully used as a thinning agent.

Ground cover would be as described in alternative A, though the increased rate of treatment would expand the effects over a larger area.

Fire Regime and Patch Size

Effects would be similar to those described under alternative B, though the focus on fire treatments would mean that, over the next 10-year period, fire return intervals would decrease from the current condition of about 84 years, to a range from 7 to 20 years, depending on how many acres could be treated each year. This would significantly decrease the potential for undesirable fire effects and behavior would decrease. Under alternative C, fire frequency could increase more than under other alternatives, resulting in decreased patch size, as accumulations of surface fuels, and patches of contiguous canopy fuels decrease. There would be a significantly reduced potential for high severity fire that could alter stand structure, or produce a type conversion.

Ecosystem Function

The expected effects under alternative C, would be similar to those described in alternative B. Ecosystem functions in ponderosa pine forest would make significant progress towards normal functioning as the fuel structure of ponderosa pine forest moved toward the reference conditions that could support the mostly low severity/low intensity fire that was characteristic in this ecological response unit. The decreased use of mechanical treatments would leave more acres in a condition that would require either higher fire severity, or more entries to achieve results similar to those that could be achieved when fire is combined with mechanical treatments. Nutrients locked up in fuel accumulations would be recycled, acting as a fertilizer on surface vegetation, and increasing the vigor and resilience of herbaceous surface vegetation. Combined with some pine litter, the surface fuel load would be able to regulate the mosaic of woody vegetation, the horizontal and vertical fuel structure, and maintain the open, uneven-aged stands that characterize a healthy ponderosa pine forest.

Alternative D

Under this alternative, mechanical treatments would be the primary tool for treatments, with prescribed fire implemented mostly where there were also mechanical treatments. Opportunities for treating areas with wildfire would be similar to alternative B, with some differences between the two alternatives depending on where there had been mechanical treatments. Acres expected to be treated with only fire would be less than 20 percent of those proposed for alternatives B and C.

Prescribed fire would mostly be limited to where there were also mechanical treatments, though there would be more acres of mechanical treatments in this alternative than in the others. When combined with other treatments (seeding, treating invasive species, grazing management, and other management actions) would be expected to move about 66,000 to 152,000 acres of frequent fire forested ecological response unit acres towards desired conditions over a 10-year period (this would be the total when combining ponderosa pine-evergreen oak, ponderosa pine forest, and mixed conifer-frequent fire). The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Seral State Distribution–Closed Versus Open States

Effects would be similar to those described under alternative B, though it would take longer to reach desired conditions where treatments require multiple entries with fire. With decreased options for fire, some areas would need more continuous mechanical treatments to maintain, limiting the new acres that could be treated. Under this option, it would be difficult to maintain treated areas because the acres needing maintenance treatment would continue to accumulate and, with fire options more limited than in other alternatives, maintaining and moving acres towards the desired distribution would be a challenge.

Grasslands, Herbaceous and Ground Cover

Decreased shrub and tree cover would increase grass and forb cover and diversity. Initial treatment frequency would need to be greater in order to kill, rather than just top kill, some of the sprouting woody species and ponderosa pine seedlings to move species composition towards desired conditions.

The effects to, and of, invasive species would be as described in alternative A.

Fire Regime and Patch Size

The focus on mechanical treatments, and more limited fire treatments would effectively decrease the potential for high severity fire immediately following treatments. Maintaining the lower severity potential would depend, in large part, on the ability of the Tonto National Forest to keep areas treated, mechanically or with fire, frequently enough to maintain or improve conditions. Under alternative D, fire return intervals would decrease from the current condition of about 115 years, to a range from 12 to 46 years. If the minimum acres were treated, producing a fire return interval of about 46 years, much of the progress from treatments would be lost in the interim.

As stands are treated and opened up, patch size could be reduced, though stands that are opened up will have a greater need for follow-up treatments to maintain a trajectory towards desired conditions.

Ecosystem Function

The long-term rate of progress in ponderosa pine forest would depend on keeping areas treated, mechanically or with fire, particularly in areas where forests have been opened up. First, second, and even third entries with fire or mechanical treatments would need to be more frequent than subsequent maintenance treatments in order to keep treated areas on a trajectory towards desired conditions. If the time between treatments is too long, seedlings, particularly ponderosa pine, and sprouting species, particularly alligator juniper, would begin to move the area back away from desired conditions.

Table 78. Comparison of expected effects (movement towards or away from desired conditions) to ponderosa pine forest for each alternative

Ecosystem Characteristic	Alternative A	Alternative B	Alternative C	Alternative D
Seral state distribution, open / closed states	Towards	Towards**	Towards*	Towards*
Patch size	Towards	Towards**	Towards*	Towards*
Fire regime	Towards	Towards**	Towards*	Towards
Grasslands, herbaceous, and ground cover	Towards	Towards**	Towards*	Towards*
Ecosystem Function	Towards	Towards**	Towards*	Towards

* One asterisk indicates a faster rate of change.

** Two asterisks indicates the fastest rate of change.

Mixed Conifer–Frequent Fire (Dry Mixed Conifer)

Mixed conifer with frequent fire occurs across the landscape embedded, and closely intergraded, with ponderosa pine forest, ponderosa pine-evergreen oak, and other ecosystems, and rarely occurs in large patches. That means the health and resilience of mixed conifer-frequent fire is closely tied to what happens with adjacent ecological response units. Mixed conifer is often found in drainages and on steeper slopes where access can be difficult.

Alternative A

Under alternative A, there would be a continued lack of frequent, low intensity and low severity fire. This would allow the horizontal and vertical infill by understory trees to continue, especially fire sensitive, shade-tolerant species that were historically suppressed.

Seral State Distribution–Closed Versus Open States

With no change in current management, mixed conifer-frequent fire seral state distribution would continue to move towards closed canopy states. Early development states, mainly the closed canopy seedling/sapling state, would increase, and the medium to large closed states would increase even more. With little fire, the medium to large open states, which would have made up 60 percent of the reference landscape, would continue to decrease from the current condition of only 4 percent.

Grasslands, herbaceous, and ground cover

Grass and forb production and diversity would continue to decrease as canopies continued to close. There would be a corresponding decrease in ground cover, leaving soil increasingly vulnerable to disturbance and erosion.

Fire Regime and Patch Size

Fire frequencies would continue to decrease under this alternative. Current management is slowly moving ponderosa pine forest type towards desired conditions, but only occasional areas of mixed conifer-frequent fire are included in these treatments, and treatment would not increase. This would result in increased potential for uncharacteristically large and severe areas of high severity fire effects.

As the canopies close and densities increase, patch sizes will continue to increase as the increasingly large areas of dense vegetation provide larger areas with potential for high severity fire.

Ecosystem Function

Ecosystem functions in mixed conifer-frequent fire would deteriorate under this alternative. The ability of herbaceous surface vegetation to carry mostly low intensity and low severity surface fire would continue to decrease as canopies closed up. Snags and coarse woody debris accumulation would continue to increase to levels well above historical levels as between tree competition would increase mortality rates. These more contiguous, dense stands would be unlikely to persist since it would increase the risk of widespread mortality from fire, insects, and disease. As stands closed up, the potential for larger patches of severity would continue to increase.

Alternative B

Under alternative B, mixed conifer-frequent fire would move towards desired conditions. The increased rate of treatment, and the inclusion of mixed conifer-frequent fire with the other frequent fire forested ecological response units would allow this ecological response unit to move quickly towards desired conditions where it was accessible for mechanical treatments and fire. Where acres are accessible for both mechanical treatments and wildland fire, the primary limitations on reaching desired conditions would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Mechanical and fire treatments, seeding, treating invasive species, and other treatments would be expected to move from 150,000 to 450,000 acres of frequent fire forested ecological response unit towards desired conditions over a 10-year period (this would be the total when combining ponderosa pine-evergreen oak, ponderosa pine forest, and mixed conifer-frequent fire). The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Seral State Distribution–Closed Versus Open States

The expected increased rate of treatment should result in significant changes in seral stage distribution, particularly where mechanical treatments can be combined with fire, moving this ecological response unit closer to desired conditions as closed canopy, even-aged states are replaced by open, multi-storied states. Movement towards the desired seral stage distribution would happen faster under this alternative than under any other.

Grasslands, herbaceous, and ground cover

Herbaceous surface cover would move towards desired conditions for both cover and diversity as canopies are opened up, allowing light and precipitation to increase at the ground level.

Mixed conifer-frequent fire is less homogenous than ponderosa pine forest because of the presence of Douglas-fir and white fir. Both of these conifers have shorter, flatter, needles than ponderosa pine, so the needle litter they produce is more compact, and does not burn as readily or as completely as ponderosa pine litter. This litter also reduces evaporation from soils and duff under the trees so, where there are mature trees and/or clumps of these conifers, there will be patches that burn slightly differently than the surrounding surface fuels of ponderosa pine litter and grass.

Ground cover would be as described in alternative A, though the increased rate of treatment would expand the effects over a larger area.

Fire Regime and Patch Size

The increased rate of treatment would mean that, over the next 10-year period, fire frequency would increase, with a fire return interval decreasing from the current state of about 115 years, to a range between 7 and 20 years. This would significantly decrease the potential for undesirable fire effects and behavior would decrease. The increased frequency would result in decreased patch size, as accumulations of surface fuels, and patches of contiguous canopy fuels decrease. There would be a significantly reduced potential for high severity fire that could alter stand structure, or produce a type conversion.

Ecosystem Function

Under alternative B, ecosystem functions in dry mixed conifer would begin to function normally, as fire could begin to resume its natural roles. Nutrients locked up in fuel accumulations would be recycled, acting as a fertilizer on surface vegetation, and increasing the vigor and resilience of herbaceous surface vegetation. Combined with some pine litter, the surface fuel load would be able to regulate the mosaic of woody vegetation, the horizontal and vertical fuel structure, and maintain the open, uneven-aged stands that characterize healthy dry mixed conifer.

Alternative C

The effects of alternative C would be similar to those under alternative B, though there would be approximately less than 25 percent as many acres treated with mechanical treatments, and at least 40 percent more treated with fire. Fire does not discriminate so, with fire as the primary treatment tool, severity/mortality patterns in areas where fire would be used for thinning would be less predictable. The increased pace of fire treatments in alternative C would reduce the time required to achieve a more frequent fire regime that would be able to maintain, or move the dry mixed conifer towards desired conditions, though there could be more mixed and high severity fire effects from the initial entries with fire.

Mechanical and fire treatments, seeding, treating invasive species, and other treatments would be expected to move from 155,000 to 445,000 acres of frequent fire forested ecological response unit towards desired conditions over a 10-year period (this would be the total when combining ponderosa pine-evergreen oak, ponderosa pine forest, and dry mixed conifer). The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Seral State Distribution–Closed Versus Open States

Effects would be similar to those described for alternative B, though there would more acres of fire effects, and fewer acres with the effects of mechanical treatments.

Grasslands, herbaceous, and ground cover

The effects under alternative C would be similar to the effects described under alternative B. The differences would be in the increased acres where fire would be used as a tool for thinning in areas that contain closed canopy. At least three entries would be required to address the residual woody biomass where fire was successfully used as a thinning agent.

Ground cover would be as described in alternative B, though the increased rate of treatment would expand the effects over a larger area.

Fire Regime and Patch Size

Effects would be similar to those described under alternative B. Under alternative C, fire frequency could increase more than under other alternatives, reducing fire return intervals from the current condition of about 115 years, to a range between 7 and 20 years. This would decrease patch size, as accumulations of surface fuels, and patches of contiguous canopy fuels decrease. There would be a significantly reduced potential for high severity fire that could alter stand structure, or produce a type conversion. The patchiness that is produced by the presence of shorter needled conifers may be increased when fire is used as a thinning agent.

Ecosystem Function

The expected effects under alternative C, would be similar to those described in alternative B. Ecosystem functions in dry mixed conifer would make significant progress towards normal functioning as the fuel structure of dry mixed conifer moved toward reference conditions that would support the mostly low severity/low intensity fire that was characteristic in this ecological response unit. The decreased use of mechanical treatments would leave more acres in a condition that would require either higher fire severity, or more entries to achieve results similar to those that could be achieved when fire is combined with mechanical treatments. Nutrients locked up in fuel accumulations would be recycled, acting as a fertilizer on surface vegetation, and increasing the vigor and resilience of herbaceous surface vegetation. Combined with some conifer litter, the surface fuel load would be able to regulate the mosaic of woody vegetation, the horizontal and vertical fuel structure, and maintain the open, uneven-aged stands that characterize a healthy dry mixed conifer.

Alternative D

Under this alternative, mechanical treatments would be the primary tool for treatments, with prescribed fire implemented mostly where there were also mechanical treatments. Opportunities for treating areas with wildfire would be similar to alternative B, with some differences between the two alternatives depending on where there had been mechanical treatments. Acres expected to be treated with only fire would be less than 20 percent of those proposed for alternatives B and C. Dry mixed conifer often occurs in drainages and on steep slopes so, when prescribed fire is mostly confined to where there have been mechanical treatments, the rate of treatment for dry mixed conifer would be very slow. Fire return intervals would decrease from the current condition of about 115 years, to a range between 12 and 46 years.

Prescribed fire would mostly be limited to where there were also mechanical treatments, though there would be more acres of mechanical treatments in this alternative than in the others. When combined with other treatments (seeding, treating invasive species, grazing management, and other management actions) would be expected to move about 66,000 to 152,000 acres of frequent fire forested ecological response unit acres towards desired conditions over a 10-year period (this would be the total when combining ponderosa pine-evergreen oak, ponderosa pine forest, and dry mixed conifer). The amount of treatment would depend on the constraints described in Resource Assumptions and Methods for Vegetation Ecological Response Units and Fire and Fuels (volume 4, appendix B), as well as opportunities for treating areas with wildfire.

Seral State Distribution–Closed Versus Open States

The effects of this alternative would be similar to those described under alternative B, though it would take longer to reach desired conditions where treatments require multiple entries. With decreased options for fire, some areas would need more continuous mechanical treatments to maintain, limiting the new acres that could be treated. Under this option, it would be difficult to maintain treated areas because the acres needing maintenance treatment would continue to accumulate and, with fire options more limited than in other alternatives, maintaining and moving acres towards the desired distribution would be a challenge. Additionally, many of the acres needing treatment would be difficult to access, particularly for mechanical treatment.

Grasslands, herbaceous, and ground cover

Decreased shrub and tree cover would increase grass and forb cover and diversity. Treatment frequency will need to be greater in order to kill, rather than just top kill, some of the sprouting woody species and seedlings, particularly ponderosa pine, to move species composition towards desired conditions.

The effects to, and of, invasive species would be as described in alternative A.

Fire Regime and Patch Size

The focus on mechanical treatments, and more limited fire treatments would effectively decrease the potential for high severity fire immediately following treatments. Maintaining the lower severity potential would depend, in large part, on the ability of the Tonto National Forest to keep areas treated, mechanically or with fire, frequently enough to maintain or improve conditions.

As stands are treated and opened up, patch size could be reduced, though stands that are opened up will have a greater need for follow-up treatments to maintain a trajectory towards desired conditions.

Ecosystem Function

The long-term rate of progress in dry mixed conifer would depend on keeping areas treated, mechanically or with fire, open. First, second, and even third entries with fire or mechanical treatments would need to be more frequent than subsequent maintenance treatments in order to keep treated areas on a trajectory towards desired conditions. If the time between treatments is too long, seedlings, particularly ponderosa pine, and sprouting species such as alligator juniper or New Mexican locust, could begin to move the area back away from desired conditions.

Table 79. Comparison of expected effects (movement towards or away from desired conditions) to mixed conifer with frequent fire for each alternative

Ecosystem Characteristic	Alternative A	Alternative B	Alternative C	Alternative D
Seral state distribution, open / closed states	Towards	Towards**	Towards*	Towards*
Patch size	Towards	Towards**	Towards*	Towards*
Fire regime	Towards	Towards**	Towards*	Towards
Grasslands, herbaceous, and ground cover	Towards	Towards**	Towards*	Towards*
Ecosystem Function	Towards	Towards**	Towards*	Towards

* One asterisk indicates a faster rate of change.

** Two asterisks indicates the fastest rate of change.

Desert Ecological Response Units

Effects Common to All Desert Ecological Response Units

The ability for desert plant species to recover from fire depends on genetic variation, resprouting ability, seed characteristics, and delayed mortality (Paysen et al. 2000). The herbaceous layer in these communities can reach high densities during wet years, producing high fuel loads capable of supporting major fires. The bimodal rainfall (winter and summer) in the Sonoran Desert allows for a greater structural diversity in vegetation than neighboring deserts such as the Great Basin, Mohave, and Chihuahuan Deserts (Brown 1982). Livestock grazing in deserts primarily affects fire though soil disturbance, which allows faster/more establishment of invasive species.

Alternative A

There is little direction within the current forest plan for desert ecosystems. Current direction focuses on the improving habitat for javelina, Gambel’s quail and cottontail rabbits. Wildland fire suppression strategy is to minimize damage within this ecosystem.

Seral State Distribution–Closed Versus Open Conditions

Under current management the type conversion to exotic grasslands resulting from larger more frequent fires can be expected to continue. The increase in the amount and extent of disturbance would increase the opportunities for exotics to become established. The shrub components are predicted to increase slightly over the next ten years before declining as a result of the increased disturbance regime.

Grasslands, Herbaceous, and Ground Cover

Projections of increased aridity in the Southwest (Seager et al. 2007) are likely to have negative impacts on certain species, such as shallow-rooted species (grasses and forbs), that are dependent on precipitation-derived moisture. This, in turn, could further degrade site productivity, soil health, structure, and ecological integrity. When site conditions deteriorate opportunities for exotics to establish increase.

Fire Regime/Patch Size

These ecological response units historically lacked contiguous fuel, limiting fire size. Exotic grasses that burn easily are becoming more common in the Sonoran Desert, resulting in more fires in these plant communities (Brooks and Pyke 2001). Past land management along with exotic grass invasion has supplied many areas with a contiguous fuel source producing larger more frequent fires. The cacti and succulent component is most negatively affected following fires, generally shifting dominance to the grass component in a positive feedback loop.

Patch size for desert ecological response units historically ranged from around 4,200 to 8,000 acres or more. The current patch size is within the historic range at around 4,500 acres. This is likely to increase under current management as fire size increases, but remain within the historical range. Effects of grazing on fire regime / patch size would result primarily from the spread of invasive species and soil disturbance. In some years, invasive grasses are dense and tall, and can carry intense fire through large areas of deserts, producing high severity effects (figure 27 and figure 28). Livestock could be used to decrease the fuel loads where management plans are sufficiently flexible to allow it.

Ecosystem Function

Vulnerability to climate change is high. Recovery from fire is slow among desert shrublands and depends on factors such as topography, species composition, and amount of precipitation following fire. Changing precipitation regimes in the Southwest (Seager et al. 2012), along with higher fuel loads, are likely to have negative impacts to the ecological integrity of these systems. While typical flora of these communities are species well adapted to very low soil moisture levels (e.g., creosote), projections of increased aridity in the Southwest (Seager et al. 2007) are likely to have negative impacts on certain species, such as shallow-rooted species, those that dependent on precipitation-derived moisture. This could result in a lowered abundance of certain native grass and forb species.

Alternative B

Plan objectives for all alternatives is to restore or maintain desired conditions in desert ecological response units (Mojave Sonoran desert scrub and Sonora-Mojave mixed salt desert scrub) by treating 10,000 to 15,000 acres. The primarily focus is on reducing disturbance to sensitive soils and treating invasive species (specifically exotic and invasive grass species).

Seral State Distribution–Closed Versus Open States

Under this alternative, areas containing exotic species would be treated using an integrated pest management approach. This treatment would move treated areas towards desired conditions by reducing the amounts of exotic species, maintaining the open seral states and reducing the risk of fire using a combination of fire, manual, mechanical and possibly chemical treatments.

Grasslands, herbaceous, and ground cover

Where populations of invasive species are treated, competition for light, water, and nutrients would be decreased, benefitting native grasses and forbs. Under the integrated pest management approach treated areas can then be seeded with native species that are underrepresented helping to maintain the high seral open state of the desired condition.

Fire Regime and Patch Size

Where invasive and exotic species are treated, herbaceous surface fuels would be reduced to historical levels, allowing fire to spread naturally where and when it did occur. The occasional fire would cover a much smaller area due to the discontinuous surface fuels and be easier to suppress. With a large historical patch size of 4,200 to 8,000 acres treatments would have little effect on patch size.

Ecosystem Function

The reduction of invasive and exotic species would reduce the risk of fire, improve conditions for native grasses and forbs and return fire to its natural role.

Alternative C

Seral State Distribution–Closed Versus Open States

Effects would be as described in alternative B.

Grasslands, herbaceous, and ground cover

Effects would be as described in alternative B.

Fire Regime and Patch Size

Effects would be as described in alternative B.

Ecosystem Function

Effects would be as described in alternative B.

Alternative D

Seral State Distribution–Closed Versus Open States

Effects would be as described in alternative B.

Grasslands, herbaceous, and ground cover

Effects would be as described in alternative B.

Fire Regime and Patch Size

Effects would be as described in alternative B.

Ecosystem Function

Effects would be as described in alternative B

Table 80. Comparison of expected effects to desert ecological response units for each alternative

Ecosystem Characteristic	Alternative A	Alternative B	Alternative C	Alternative D
Seral state distribution, open / closed states	Away	Towards	Towards	Towards
Patch size	No Change	No Change	No Change	No Change
Fire regime	Away	Towards	Towards	Towards
Grasslands, herbaceous, and ground cover	Away	Towards	Towards	Towards
Ecosystem Function	Away	Towards	Towards	Towards

Figure 34. Pre-treatment conditions in a firebreak in interior chaparral (foreground and to the right) and pinyon-juniper evergreen shrub (background and to the left)
Photo Credit: Greg Sawyer, USDA Forest Service

Figure 35. Post-treatment in a firebreak in interior chaparral (foreground and to the right) and pinyon-juniper evergreen shrub (background and to the left)

Other Ecological Response Units

Other ecological response units are not as departed as frequent fire ecological response units because they have missed fewer disturbance cycles. The fire regimes include less frequent fire, more mixed and high severity, and larger patch sizes. Fuel structure is less dependent on herbaceous surface vegetation, and will often require a stiff breeze, or be burning on a slope, to burn well. Within each ecological response unit, ecological characteristics vary more than in frequent fire ecological response units and, on the Tonto National Forest, many of these ecological response units are tightly intermixed, with ecotones that grade from one ecological response unit into another and back again. This intergrading makes it difficult at times to positively identify the ecological response unit at a specific location, but also provides a highly variable mosaic of seral states and patch sizes across the landscapes where these ecological response units occur (see figure 34 and figure 35).

There are fewer options for fire management because of the difficulty in implementing prescribed fire when high intensity is needed. Additionally, where these ecological response units interface with highly departed areas of frequent fire ecological response units, there is a risk of uncharacteristically high severity fire where a fire in an "other" ecological response unit is burning at a high intensity and moves into highly departed frequent fire ecological response unit. In some of these areas, mostly in the Pleasant Valley and Payson Ranger Districts, there are fire breaks in strategic places on the periphery of the wildland-urban interface. These areas are managed by regular thinning that keeps the fire potential at a manageable level (figure 34 and figure 35). This management is necessary to meet fire management objectives, but keeps these areas in a state outside of the historic range of variability.

Interior Chaparral

There is little information available for the chaparral on the Tonto National Forest. Interior chaparral (IC) covers a wide area, and there is a lot of variability in species composition within the area; species composition affects flammability, and probably fire return intervals as well. Overall, the fire regime for interior chaparral is infrequent (35 to 100 year fire return interval) with mixed or high-severity, but there are more oak in the species composition of interior chaparral on the Tonto National Forest than in other areas. This probably means that it burns more frequently than other interior chaparral, which would produce a smaller patch size. For all action alternatives (B, C, and D), where interior chaparral intersects with wildland-urban interface, or where characteristic fire behavior or effects would threaten other values, characteristic ecosystem function would be modified to promote low intensity / low severity fire, but with sufficient cover to meet the needs of a variety of wildlife species.

There are no objectives for interior chaparral under any of the alternatives. However, work could still occur as projects were proposed if resources were available, when adjacent or nearby ecological response units receive treatment, from opportunities presented by wildland fire (wildfire, or areas included in burn units for adjacent target ecological response units), or when management action was deemed necessary by land managers. Since there are no treatment objectives for this ecological response unit, predicting the amount of work that would be accomplished would be highly speculative.

In order to maintain or move towards desired conditions, there would need to be an average of between 2,900 and 9,800 acres treated per year, with an average around 5,900.

Alternative A

Interior chaparral is a resilient ecological response unit that recovers relatively quickly from disturbances, particularly fire or mechanical treatments such as mastication. Under current management it is trending towards reference conditions. The only disturbances that would be significant enough to move the seral stage distribution would most likely be wildfire events.

Seral State Distribution–Closed Versus Open States

Under this alternative, interior chaparral could move towards or away from reference conditions, depending mostly on the occurrence of natural disturbances, such as wildfire. Under current management, there would be an increase in the mature, closed state, which is currently lower than the desired proportion of 93 percent. Interior chaparral is more flammable in later seral stages (see Fire Regime and Patch Size below).

Grasslands, herbaceous, and ground cover

Herbaceous surface vegetation is usually sparse in interior chaparral, with occasional denser cover where there has been a recent disturbance, such as fire (Paysen et al. 2000). With a few exceptions where there may be mechanical treatments around values at risk, or in fire breaks, changes to current conditions would depend almost exclusively on opportunities presented by the wildfires.

Ground cover is currently at about 54 percent; about 77 percent of reference conditions, and would fluctuate with shrub cover and herbaceous surface vegetation cover.

Fire Regime and Patch Size

Fire frequency in interior chaparral can vary from frequent (less common, mostly where there is greater cover of herbaceous surface vegetation) to over 100 years; the current fire return interval is about 128 years. Species composition can have a significant effect on how it burns, and can shift with time since fire. In older chaparral, the dead wood component enhances flammability, increasing the likelihood of burning, and the potential fire intensity when it does burn. Interior chaparral is considered an ‘on / off’ fuel by most fire managers; that is, it either burns with high intensity, or it won't burn, making it a challenge for fire managers.

Under alternative A, the likelihood of interior chaparral being treated would depend almost exclusively on opportunities provided by wildfires. However, because of the extreme nature of fire behavior in chaparral when conditions are right for it to burn, it would remain a challenge for managers. Mastication would be the most likely treatment.

Wildfires such as the Pinal Fire (figure 36, figure 37), that burned almost 3,000 acres of interior chaparral, would remain the primary opportunity for moving patch size towards desired conditions. Where there are fires within the reference patch size/s, it will help break up potential fire spread for several years, as different seral stages have different flammability. This can provide effective firebreaks over several years, as areas with different age classes are created by wildfires, each having slightly different potential fire behavior and effects.

The departure of the proportion of chaparral that would be in a mature closed state is most influenced by the suppression of fires that would have historically reached larger extents. Instead, smaller fires have produced openings, creating much smaller average patch sizes (359 acres) compared to reference conditions (930 to 2,120 acres).

Figure 36. Interior chaparral in May of 2017, a few days before burning in the Pinal Fire
Photo credit: Mary Lata, USDA Forest Service

Figure 37. Interior chaparral one year after the Pinal Fire
Photo credit: Mary Lata, USDA Forest Service

Ecosystem Function

The change in management to more holistic approaches that was initiated under the current forest plan in 1985, that included learning how to use wildland fire safely and effectively, would continue to allow interior chaparral to trend towards reference conditions over time. The initial response of interior chaparral to the type of fire it has evolved with includes a short period of increased erosion for a year or two immediately after the fire as vegetation is just beginning to respond (figure 36, figure 37). Forested frequent fire ecological response units are generally upslope from interior chaparral when they occur in the same area. Under alternative A, it would be increasingly difficult to allow large areas of interior chaparral to burn, because of the potential for negative effects in adjacent ecological response units that are highly departed. A fire burning with high intensity in interior chaparral (which is healthy for most interior chaparral), would move uphill quickly, burning with high intensity as it moves into forested ecological response units with unnaturally closed canopies, ladder fuels, and high surface fuel loading.

So, from an ecological perspective, high intensity wildland fire in patch sizes that are within reference conditions are healthy for interior chaparral, but can rarely be allowed because of the potential effects to adjacent ecological response units or values at risk. Mechanical treatments would not be ecologically sound but, where needed to protect values at risk, would move treated areas towards desired conditions for fire management.

Alternative B

Seral State Distribution–Closed Versus Open States

There are few ‘treatments’ that would truly benefit interior chaparral from an ecological perspective since, in reference conditions, at any one time more than 90 percent of it would be in a late, closed seral state. Any areas that did receive treatment under alternative B, would most likely be to reduce hazardous fuels in the wildland-urban interface or for access to fence lines or water and, most likely, would originate from wildfire or wildfire control actions. The most likely effects would be high severity (if it was fire) or high intensity from mastication (if it was mechanical). Both would move acres away from desired seral state distribution by increasing acres in the early grass/forb/shrub open stage, which is already over-represented, but prescribed fire or mechanical treatments would be unlikely to treat enough acres to affect seral stage distribution.

Changes to the overall departure of seral stage distribution for interior chaparral would depend on the occurrence of wildfires.

Grasslands, herbaceous, and ground cover

Where there were treatments (mechanical or fire), the movement towards more open seral states would increase the herbaceous surface cover and ground cover. However, many species in interior chaparral depend on the heat and/or smoke from fire to trigger seeds to germinate, so the species composition and cover resulting from mechanical treatments would not be the same as that resulting from fire, particularly the intense, high severity fires that are characteristic in interior chaparral.

Fire Regime and Patch Size

Areas of interior chaparral that were treated mechanically would move away from the natural fire regime in several regards. The flammability of chaparral is related to species composition and the ratio of dead/decadent material to live. As described above, fire effects are needed to trigger the response of the natural species composition to disturbance. With only mechanical treatments, depending on how the residual material is disposed of, there could be insufficient fuel to produce the fire effects needed to move an area towards the natural fire regime. However, the objectives in treating interior chaparral would most likely be to reduce potential fire intensity, not to restore or maintain the natural fire regime or patch size.

Prescribed fire in interior chaparral would be difficult to implement because it is only flammable when the fuel moisture is low, mostly for a period of time in the summer, and a period of time in the fall. When it does burn, it burns with high intensity, and can be difficult to manage without extreme effort.

Ecosystem Function

Under alternative B, there would be little change in interior chaparral at any scale, unless there was a large wildfire. Treatments that did occur would be likely to be small, localized treatments. Departure for interior chaparral would be expected to remain low for ecosystem functions, as occasional wildfires maintain the large areas of the ecological response unit, and the effects of small treatments that do occur are localized.

Alternative C

Seral State Distribution–Closed Versus Open States

The effects of alternative C would be expected to be the same as under alternative B, though there would be fewer opportunities for mechanical treatments.

Grasslands, herbaceous, and ground cover

The effects of alternative C would be expected to be the same as under alternative B, though there would be fewer opportunities for mechanical treatments.

Fire Regime and Patch Size

The effects of alternative C would be expected to be the same as under alternative B, though there would be fewer opportunities for mechanical treatments.

Ecosystem Function

The effects of alternative C would be expected to be the same as under alternative B, though there would be fewer opportunities for mechanical treatments.

Alternative D

Seral State Distribution–Closed Versus Open States

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for fire.

Grasslands, herbaceous, and ground cover

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for fire.

Fire Regime and Patch Size

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for fire.

Ecosystem Function

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for fire.

Table 81. Expected effects (movement towards or away from desired conditions) of each alternative on interior chaparral

Ecosystem Characteristic	Alternative A	Alternative B	Alternative C	Alternative D
Seral state distribution, open / closed states	Towards	Towards	Towards	Towards

Ecosystem Characteristic	Alternative A	Alternative B	Alternative C	Alternative D
Patch size	Towards	Towards	Towards	Towards
Fire regime	Towards	Towards	Towards	Towards
Grasslands, herbaceous, and ground cover	Towards	Towards	Towards	Towards
Ecosystem Function	Towards	Towards	Towards	Towards

Pinyon–Juniper Woodland

The fire regime for pinyon-juniper woodland (PJO) is mixed or high-severity fire regime. For all action alternatives (B, C, and D), where pinyon-juniper woodland intersects with wildland-urban interface, or where characteristic fire behavior or effects would threaten other values, characteristic ecosystem function would be modified to promote low intensity / low severity fire, but with sufficient cover to meet the needs of a variety of wildlife species.

Departure for this ecological response unit is low. The lack of fire in an ecological response unit with an average fire return interval of about 125ish years won't have changed much, but the part of the mosaic that was created and maintained by more frequent fire will have filled in, increasing the patch size and the potential size of high severity fires. Those areas, mostly in the 10- to 100-acre size range, would have had open tree canopies similar to the early seral stages of juniper grass (JUG) and pinyon juniper grass (PJG). A significant difference between pinyon-juniper woodland and juniper grass / pinyon juniper grass is the part of the mosaic, well over half, that is composed of persistent closed canopy pinyon juniper forest. For this vegetation type, consideration must be given to the overall mosaic; how much of the earlier seral stages are missing or under-represented, and if/where the mosaic could be re-created if it's gone.

There are no objectives for pinyon-juniper woodland under any of the alternatives. However, work could still occur as projects were proposed if resources were available, when adjacent or nearby ecological response units receive treatment, opportunities presented by wildland fire (wildfire, or areas included in burn units for adjacent target ecological response units), or when other management action was deemed necessary by land managers. Since there are no treatment objectives for this ecological response unit, trying to predict the amount of work that would be accomplished would be highly speculative.

In order to maintain or move towards desired conditions, there would need to be an average of between 280 and 1,600 acres treated per year, with an average around 450.

Alternative A

Seral State Distribution–Closed Versus Open States

Modeling predicts continued growth into the medium/large state class with the majority moving into the medium/large open state class. Under current management, proportions of medium/large open and medium/large closed state are predicted to be nearly equal by year 100. Grass/forb/shrub, small closed, and seedling/saplings are predicted to decrease to levels near or slightly lower than reference conditions in the next 100 years under current management.

Under alternative A, based mostly on the distribution of tree sizes and canopy closure, there would be an increase in medium and large trees, in both the open and closed canopy states. With the majority of the increase occurring in the medium/large open state. This would move pinyon-juniper woodland towards desired conditions as far as tree size goes, but not in terms of canopy closure. The medium/large closed state would remain well below reference conditions of 60 percent. Once the system is opened, as it has been by the insect outbreak in 2003, the closing of canopies can require extended periods of time with no fire.

Grasslands, herbaceous, and ground cover

Open canopies and smaller patch sizes would allow the expansion of woody species into openings. As shrub cover increases, grass and forb production is reduced and less space is available for tree seedling establishment. This would continue to lead to a decrease in the diversity of grasses and forbs and a reduction in vegetative ground cover.

Fire Regime and Patch Size

Fire exclusion probably has had little effect on most pinyon-juniper woodland, since overall fire return intervals are naturally very long in this ecological response unit (Romme et al. 2003, Allen et al. 2009). The current fire return interval of 201 years is well within the historic range of 200 plus years that applies to most of the area. Some areas of pinyon-juniper woodland are a fire regime III, with more frequent fire return interval (35 to over 100 years) and mixed severity. These areas are part of the mosaic of pinyon-juniper woodland, though there are no data to identify where, in what proportion it occurs, or what the existing fire return interval is for these areas.

The stand structure and extent of most pinyon-juniper woodland were more likely driven by climate fluctuation and insect and disease outbreaks than by fire. Drought conditions beginning in the late 1990s initiated a bark beetle outbreak in 2003. This recent insect outbreak has resulted in a decrease in a patch size and an accumulation of coarse woody debris.

Ecosystem Function

Vegetation maturation, decadence, and overall readiness for ignition are some of the factors that influence fire in this ecological response unit. Typical disturbances (fire, insects, and disease) were of high severity and occurred infrequently. The recent insect outbreak has resulted in an increased number of snags and the accumulation of coarse woody debris. Coarse woody debris has increased to 17.3 tons per acre and the number of snags is now just over 10 per acre well above the reference condition of 4.0 tons per acre and 3 snags per acre. With the high fuel loads and maturing vegetation, it is very likely that, under alternative A, portions of this ecological response unit would experience a high severity fire event during the next 10-year period.

Alternative B

Seral State Distribution–Closed Versus Open States

Effects of alternative B would be as described in alternative A, though with some increased potential for changes relating to treatments that might occur as described above (page 342). The medium/large closed state would remain well below reference conditions of 60 percent. Once this ecological response unit is opened up, as it was by the insect outbreak in 2003, the closing of canopies requires extended periods of time. Mechanical and fire treatments can be used to open canopies, but only time and growth can close canopies.

Grasslands, herbaceous, and ground cover

Under alternative B, mechanical and fire treatments could be used to reduce shrubs that may have become established in openings for treatments that might occur as described above (page 342). This would increase the resources available for establishment of grasses and forbs thus improving ground cover. The response of grasses and forbs would be highly variable depending on site conditions, as the production of herbaceous surface vegetation would be limited by nutrient and water availability, but some areas would move towards desired conditions.

Fire Regime and Patch Size

Effects of alternative B would be similar to those described in alternative A, depending on if and how much areas is treated. Pinyon-juniper woodland naturally has a long fire return interval and the current fire return interval is within the historic range of variation for most of the pinyon-juniper woodland. Treated areas of pinyon-juniper woodland could move away from the natural fire regime because the objectives in treating pinyon-juniper woodland would most likely be to reduce potential fire intensity for control issues, not to restore or maintain the natural fire regime or patch size. Prescribed fire in pinyon-juniper woodland is difficult to implement because of the lack of horizontal fuel continuity, fire spread typically occurs only under conditions of strong winds and extremely low fuel moisture (Romme et al. 2009). Pinyon-juniper woodland is only flammable when the fuel moisture is low, mostly for a period of time in the summer, and in the fall. Most pinyon-juniper woodland is considered an 'on / off' fuel by most fire managers; that is, it either burns with high intensity, or it won't burn, making it a challenge for fire managers.

Ecosystem Function

Under alternative B, there would be little change in pinyon-juniper woodland at any scale, unless there was a large wildfire. Treatments that did occur would be likely to be small, localized treatments. Departure for pinyon-juniper woodland would be expected to remain low for ecosystem functions, as occasional wildfires maintain the large areas of the ecological response unit, and the effects of small treatments that do occur are localized.

Alternative C

Seral State Distribution–Closed Versus Open States

The effects of alternative C would be expected to be the same as under alternative B, though there would be fewer opportunities for mechanical treatments.

Grasslands, herbaceous, and ground cover

The effects of alternative C would be expected to be the same as under alternative B, though there would be fewer opportunities for mechanical treatments.

Fire Regime and Patch Size

The effects of alternative C would be expected to be the same as under alternative B, though there would be fewer opportunities for mechanical treatments.

Ecosystem Function

The effects of alternative C would be expected to be the same as under alternative B, though there would be fewer opportunities for mechanical treatments.

Alternative D

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for prescribed fire. Wildfire would still occur, and could be used if conditions were appropriate for beneficial fire behavior and effects.

Seral State Distribution–Closed Versus Open States

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for prescribed fire.

Grasslands, herbaceous, and ground cover

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for prescribed fire.

Fire Regime and Patch Size

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for prescribed fire.

Ecosystem Function

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for prescribed fire.

Table 82. Comparison of the expected effects (movement towards or away from desired conditions) of each alternative on pinon juniper woodland (PJO)

Ecosystem Characteristic	Alternative A	Alternative B	Alternative C	Alternative D
Seral state distribution, open / closed states	Towards	Towards	Towards	Towards
Patch size	Away	Towards	Towards	Towards
Fire regime	No Change	Away	Away	Away
Grasslands, herbaceous, and ground cover	Away	Towards	Towards	Towards
Ecosystem Function	No Change	No Change	No Change	No Change

Pinyon–Juniper Evergreen Shrub

The fire regime for pinyon-juniper evergreen shrub (PJC) is mixed or high-severity fire regime. For all action alternatives (B, C, and D), where pinyon-juniper evergreen shrub intersects with wildland-urban interface, or where characteristic fire behavior or effects would threaten other values, characteristic ecosystem function would be modified to promote low intensity / low severity fire, but with sufficient cover to meet the needs of a variety of wildlife species.

There are a wide variety of vegetation associations included in this ecological response unit, with a mosaic that is probably maintained by a variety of fire types, along with site potential. Lighting would provide ignitions throughout this ecological response unit, but many areas could not carry fire very far without dry conditions and wind or slope. Where shrub density is low and surface vegetation is co-dominated by herbaceous plants, fire would carry with more moderate conditions, but such areas are patchy, rarely larger than 10 acres. It is quite likely that there are a number of 'starts' from lightning that never go anywhere, but only burn a tree or two and are out before anyone notices, either because of rain, or because fuel structure is insufficient to carry fire. However, with the interruption of the fire regime over a century or more, this vegetation type has become more homogeneous and, overall, much denser. There has been in-filling of canopy gaps with more and denser tree groups. Surface vegetation has decreased both in cover and species richness.

There are no objectives for pinyon-juniper evergreen shrub under any of the alternatives, this does not mean that no work will be done in this ecological response unit. Work will occur as opportunities arise or projects are proposed and resources are available to complete the work. Treatments will also occur when adjacent and surrounding ecological response unit’s receive treatment, from opportunities presented by wildland fire (wildfire, or areas that would be included in a burn unit for a target vegetation type), or management actions deemed necessary by land managers. Since there are no objectives for this ecological response unit determining the amount of work that will be accomplished would be highly speculative.

In order to maintain or move towards desired conditions, there would need to be between about 2,000 and 15,000 acres treated per year, with an average around 4,000.

Alternative A

Seral State Distribution–Closed Versus Open States

Current conditions on the Tonto National Forest would continue to shift toward the medium/large closed canopy state with the shrub densities increasing and herbaceous plant cover decreasing. The medium/large open state and the medium/large closed state would increase as tree diameter increased, with the majority of the increase occurring in the medium/large open state. However, the medium/large closed state, a condition that was not found in the reference condition, would be expected to continue to increase. The early development, post disturbance grass / forb /shrub state exceeds reference condition and is currently at 38 percent. The amount of grass / forb / shrub state on the plan scale would decrease over time as seedlings and small trees became established moving closer to desired conditions. Seral state distribution and open conditions would improve slightly under current management.

Grasslands, herbaceous, and ground cover

The in-filling of canopy gaps and increasing density of brush species would continue, leading to a reduction in the composition, diversity, density and vigor of the herbaceous understory vegetation in these states, moving away from conditions that already have a low similarity to site potential.

Ground cover would reflect the difference in herbaceous surface vegetation and tree cover.

Fire Regime and Patch Size

Fire suppression and grazing have both contributed to a lengthening of the fire return interval to 215 years instead of the 35 to over 100 years found under reference conditions. This has allowed the coarse woody debris to build up to 23.9 tons per acre and the number of snags greater than 8inches to reach 5.6 per acre. This is likely to increase fire behavior to the point where wildfires is more resistant to control. Recent fires have helped to reduce patch size to 40 acres which is only slightly smaller than the reference condition of 50 to 200 acres.

Ecosystem Function

Disturbance patterns, mainly fire, create and maintain tree-age diversity and low to moderately closed canopy that is typical of this type. With the interruption of the fire regime this vegetation type has become more homogeneous and, overall, much denser. Many of these closed canopy sites will have insufficient herbaceous vegetation to carry low or mixed severity fire. As a result, these closed canopy sites will continue to be stressed and the potential for insect, pathogens and high severity wildfire will continue to be very high.

Alternative B

Seral State Distribution–Closed Versus Open States

Under alternative B, the small closed and medium / large closed states would be opened up with mechanical treatments and/or mixed severity fire to re-create a mosaic more representative of historic conditions and decreasing the potential for high severity fire to spread over large areas. Any areas that intersect with the wildland-urban interface or threaten other values would receive a more intense treatment under alternative B to reduce hazardous fuels and to promote low intensity / low severity fire.

From an ecological perspective, mechanical treatments could include the whole suite of available treatments from mastication to thinning, though when selecting a treatment, consideration should be given to the potential effects from fire or bugs in relation to the amount and type of material left on site.

Grasslands, herbaceous, and ground cover

Where there were treatments (mechanical or fire), the movement towards more open seral states would increase the herbaceous surface cover and ground cover. However, many species in pinyon-juniper evergreen shrub depend on the heat and/or smoke from fire to trigger seeds to germinate, so the species composition and cover resulting from mechanical treatments would not be the same as that resulting from fire.

Fire Regime and Patch Size

Changes to the fire regime under alternative B would depend on how many acres were treated. Without fire, the infilling of canopy gaps would continue to increase the horizontal continuity of areas that could burn with high severity. While high severity fire effects are a normal part of the fire regime for pinyon-juniper evergreen shrub, the size of areas of high severity (patch size) is also an important part of the fire regime. Currently, the patch size is a little below reference conditions, so patches of high severity fire could be beneficial for shifting patch size, depending on if they burned in the under-represented medium/large open seral states, or the over-represented grass / forb / shrub state.

Fire return interval is currently about 215 years; a little longer than what would be the maximum under the natural fire regime for pinyon-juniper evergreen shrub. If about 4,000 acres were burned annually, it would shift the fire return interval to an average of about 100 years. This would help control the in-filling of the canopy gaps and density of the brush species required to maintain or create the open canopy conditions. The increased nutrient cycling from burning should act as fertilizer for herbaceous surface vegetation, improving its vigor and continuity.

Ecosystem Function

Using combined treatments to open up closed canopy states and create a mosaic of conditions that are more representative of the historic conditions would begin to allow fire to function in its ecological role/s of recycling nutrients, maintaining an open canopy, and regulating the establishment and cover of woody species. As a result, the potential for insect, pathogens and high severity wildfire will begin to decline.

Alternative C

Seral State Distribution–Closed Versus Open States

The effects of alternative C would be expected to be the same as under alternative B, though there would be fewer opportunities for mechanical treatments and progress toward desired conditions would be slightly slower. Mixed severity fire would be beneficial if the higher intensity fire is targeted at areas that need thinning and avoids old trees. Fire does not discriminate so, with fire as the primary treatment tool, severity / mortality patterns in areas where fire would be used for thinning would be less predictable. Other areas may have insufficient herbaceous vegetation to carry low or mixed severity fires. In these areas pinyon-juniper evergreen shrub can behave much like interior chaparral, either burning with high intensity, or it won't burn, making it a challenge for fire managers.

Grasslands, herbaceous, and ground cover

The effects of alternative C would be expected to be similar to effects under alternative B. Since many herbaceous species in pinyon-juniper evergreen shrub depend on the heat and/or smoke from fire to trigger seeds to germinate, the species composition and cover resulting fire are likely be slightly different and establish quicker.

Fire Regime and Patch Size

The effects of alternative C would be expected to be the same as under alternative B, though there would be fewer opportunities for mechanical treatments.

Ecosystem Function

The effects of alternative C would be expected to be the same as under alternative B, though there would be fewer opportunities for mechanical treatments.

Alternative D

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for prescribed fire. Wildfire would still occur, and could be used if conditions were appropriate for beneficial fire behavior and effects.

Seral State Distribution–Closed Versus Open States

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for prescribed fire. When and where treatments occurred, there would be more of a focus on treating the medium large closed states for the production of fuelwood and less opportunity to treat the small closed state.

Grasslands, herbaceous, and ground cover

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for prescribed fire.

Fire Regime and Patch Size

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for prescribed fire.

Ecosystem Function

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for prescribed fire.

Table 83. Comparison of the expected effects (movement towards or away from desired conditions) of each alternative on pinyon-juniper evergreen shrub

Ecosystem Characteristic	Alternative A	Alternative B	Alternative C	Alternative D
Seral state distribution, open / closed states	Towards	Towards**	Towards*	Towards
Patch size	No Change	Towards	Towards	Towards
Fire regime	Away	Towards	Towards	Towards
Grasslands, herbaceous, and ground cover	Away	Towards*	Towards**	Towards
Ecosystem Function	Away	Towards	Towards	Towards

* One asterisk indicates a faster rate of change.

** Two asterisks indicates the fastest rate of change.

Mixed Conifer with Aspen

The fire regime for mixed conifer with aspen (MCW) is mixed or high-severity fire regime. For all action alternatives (B, C, and D), where characteristic fire behavior or effects would threaten other values, characteristic ecosystem function would be modified to promote low intensity / low severity fire, but with sufficient cover to meet the needs of a variety of wildlife species.

There are no objectives for mixed conifer with aspen under any of the alternatives, this does not mean that no work will be done in this ecological response unit. Work will occur as opportunities arise or projects are proposed and resources are available to complete the work. Treatments could also occur when adjacent and surrounding ecological response units receive treatment, from opportunities presented by wildland fire (wildfire, or areas that would be included in a burn unit for a target vegetation type), or management actions deemed necessary by land managers. Since there are no objectives for this ecological response unit determining the amount of work that will be accomplished would be highly speculative.

Prior to 2016 (see descriptions of more recent fires in this ecological response unit on page 289), there would need to have been about 35 to 135 acres treated per year, with an average around 68 to move this ecological response unit towards desired conditions. About 85 percent (approximately 5,700 acres) of all mixed conifer with aspen on the Tonto National Forest burned in 2016 and 2017, about 1 percent of it burned with high severity, so there is no need for fire in mixed conifer with aspen for the next few decades.

Alternative A

Seral State Distribution–Closed Versus Open States

Mixed conifer with aspen ecological response unit occurs on only 6,805 acres of the Tonto National Forest, which is less than 1 percent of the forest. Conditions were based on pre-2014 data that was used for the Assessment showed a shift toward the closed states with 52 percent in the seedling/sapling closed state with no aspen succession, and 42 percent in the medium/large closed canopy state. There were no acres in the very large or all aspen, deciduous tree mix states and only 4 percent in the recently disturbed grass/forb state. The remaining 2 percent is in a very large, open canopy state that was very rare under the historic disturbance regime. The increase in closed states would lead to a loss in age class diversity, loss of early successional species, and a reduction in herbaceous understory.

Seral state proportions will have shifted toward the more open states and grass states depending on the severity of the fires that occurred in these areas. Actual impacts of these fires to this ecological response unit's seral state proportions are unknown at this time. Seral state distribution may have benefited from the recent fires and moved toward desired conditions in many areas.

Grasslands, herbaceous, and ground cover

Prior to the recent fires the majority of the wet mixed conifer (94 percent) were in closed states where there is a reduction in the amount of sunlight reaching the ground. This can lead to a reduction in the composition, density and vigor of the herbaceous understory vegetation in these states. The early development, post disturbance grass / forb / shrub state was also slightly lower than the 7 percent found in the desired condition at 4 percent. Conditions of the herbaceous understory and ground cover within the mixed conifer with aspen were shifting away from desired conditions.

Conditions of the herbaceous understory and ground cover should start to improve depending on the severity of the fire that occurred in these areas. Actual impacts of these fires to this ecological response unit's herbaceous understory and ground cover are still unknown at this time. The amount of the early development grass/forb/shrub state has increased and may now exceed desired conditions.

Fire Regime and Patch Size

The mixed conifer with aspen ecological response unit is characterized by historic fire return interval of 50 to 100 years from mixed and high severity fires. Small areas of high severity play an important role in aspen regeneration. Historically, this ecological response unit supported patches ranging in size from 100 to over 300 acres, resulting from high severity fires.

Under current management and prior to the recent fires the fire regime was trending away from desired condition due to the lack of fire treatment. The managed wildfires helped to improve conditions by restructuring the age class distribution, reducing canopy cover, improving conditions for the herbaceous understory and providing space for regeneration of early successional species. Patch size may have increased in some areas due to the recent fires with some patches as large as 350 acres. Patch sizes over

300 acres are not uncommon in mixed conifer with aspen, but with such a small amount of mixed conifer with aspen on the Tonto patch sizes in the range of about 100 acres would be more desirable.

Ecosystem Function

Under alternative A, management of this ecological response unit is not expected to change over current levels, leading to a continued loss in age class diversity, increased canopy cover, loss of early successional species, and a reduction in herbaceous understory. It is expected that the vegetation condition would remain moderately departed while trending away from the desired conditions. Over the next 50 years, it is expected that conditions would worsen and vegetation would become highly departed with a continued trend away from desired conditions. Fire return interval is expected to remain moderately departed and begin to trend away from the desired conditions due to a lack of fire treatment (prescribed and wildfires managed for resource objectives) objectives or anticipated fire treatments.

Alternative B

Seral State Distribution–Closed Versus Open States

Under alternative B, mixed conifer with aspen would begin to move towards desired conditions. However, given the lack of objectives the amount of treatment is not expected to increase substantially over current levels.

On the Tonto this ecological response unit is located on mountain tops, in drainages and on northern aspects with steep slopes that are not accessible by most machinery. Approximately 10 percent (600 acres) of the mixed conifer with aspen on the Tonto occur in areas that can be accessed by machinery. In the areas that can be treated using both mechanical and fire, seral state distribution would move toward desired conditions faster than fire alone. Fire would be the only management tool available for the remaining 6,200 acres. With so few acres available for a combination of mechanical and fire treatments the rate of change in seral state distribution is not expected to be any faster than alternative C using fire as the primary management tool.

Grasslands, herbaceous, and ground cover

Depending on how many acres were treated under alternative B, herbaceous surface cover would move towards desired conditions for both cover and diversity as canopies are opened up, allowing light and precipitation to increase at the ground level.

Fire Regime and Patch Size

Changes to the fire regime under alternative B would depend on how many acres were treated, but would likely trend toward desired condition. Without mechanical or fire treatments, the infilling of canopy gaps would continue to increase the horizontal continuity of areas that could burn with high severity. While high severity fire effects are a normal part of the fire regime for mixed conifer with aspen, the size of areas of high severity (patch size) is also an important part of the fire regime. With so few acres of mixed conifer with aspen on the Tonto, patch sizes in the range of about 100 acres would be more desirable than larger patches over 300 acres that are possible with continuous closed canopy stands.

Ecosystem Function

Given the lack of objectives, treatment is not expected to increase substantially over current levels under alternative B. The departed condition related to underrepresented early successional species, excessive density, poor age class diversity, and deficit understory vegetation is expected to persist across much of the ecological response unit. However, under alternative B clear direction is provided with regard to desired conditions at multiple scales including structure, composition, tree density ranges, and the proper role of disturbance agents like fire and insects. This direction would ensure that any treatments within this ecological response unit would maintain or move the area toward the desired conditions

Alternative C

Seral State Distribution–Closed Versus Open States

The effects of alternative C would be expected to be similar to effects under alternative B, though there would be fewer opportunities for mechanical treatments.

Grasslands, herbaceous, and ground cover

The effects of alternative C would be expected to be similar to effects under alternative B, though there would be fewer opportunities for mechanical treatments.

Fire Regime and Patch Size

The effects of alternative C would be expected to be similar to effects under alternative B, though there would be fewer opportunities for mechanical treatments.

Ecosystem Function

The effects of alternative C would be expected to be similar to effects under alternative B, though there would be fewer opportunities for mechanical treatments.

Alternative D

Given the limited amount of operable ground, the ability to increase mechanical treatments for the production of forest products would be limited and the effects of alternative D would be expected to be the same as under alternative B. There may be fewer opportunities for prescribed fire, but managed wildfire would still occur, and could be used if conditions were appropriate for beneficial fire behavior and effects.

Seral State Distribution–Closed Versus Open States

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for prescribed fire.

Grasslands, herbaceous, and ground cover

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for prescribed fire.

Fire Regime and Patch Size

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for prescribed fire.

Ecosystem Function

The effects of alternative D would be expected to be the same as under alternative B, though there may be fewer opportunities for prescribed fire.

Table 84. Comparison of the expected effects (movement towards or away from desired conditions) of each alternative on mixed conifer with aspen (wet mixed conifer)

Ecosystem Characteristic	Alternative A	Alternative B	Alternative C	Alternative D
Seral state distribution, open / closed states	Away	Towards	Towards	Towards
Patch size	Away	Towards	Towards	Towards
Fire regime	Away	Towards	Towards	Towards
Grasslands, herbaceous, and ground cover	Away	Towards	Towards	Towards

Ecosystem Characteristic	Alternative A	Alternative B	Alternative C	Alternative D
Ecosystem Function	Away	Towards	Towards	Towards

Comparison Across Alternatives

This section compares environmental effects of four alternatives that address the management of vegetation and fire on the Tonto National Forest. The analysis was conducted by comparing the expected response of key vegetation focus areas that were identified as "needs to change" topics (USDA Forest Service 2017b) using the key ecological characteristics (found in appendix B). The differences between the alternatives are discussed below, and summarized at the end of this section.

For all alternatives, the constraints described in the Assumptions and Methods section of appendix B, volume 4 of the final environmental impact statement would apply. The following definitions are restated here for ease of reading:

Mechanical: vegetation treatments that are implemented with any kind of machine.

Fire only: vegetation treatments that do not include mechanical work of any kind, except for creating or maintaining fire lines.

Combined treatments: when fire and mechanical treatments will both be used in an area. There is no intent in this document to prioritize whether fire treatments or mechanical treatments will be implemented first; that would be a site-specific decision.

Wildland fire: this is prescribed fire and/or wildfire.

Other ecological response units: are those that do not have specific resource objectives, and include: wet mixed conifer, interior chaparral, pinyon-juniper woodland, and pinyon-juniper evergreen shrub.

Seral state distribution, open/closed states

This section addresses classification of vegetation size classes and dominance but, in the context of this comparison, does not necessarily address other ecological characteristics, such as invasive species, soil conditions, or potential fire behavior and effects. It does not address the role of old trees, or old growth.

Alternative A

Modeling shows seral state distribution would slowly improve for pinyon-juniper grass, juniper grass, and ponderosa pine-evergreen oak as existing trees matured, moving into later seral stages which are currently under-represented. Improved seral state distribution would include the distribution of open/closed canopy, and size classes for trees; other ecosystem characteristics would show little improvement, and many would continue to deteriorate. This condition (seral state distribution moving towards desired condition vs. surface vegetation and fire regime moving away) would be likely to end with a high severity wildfire.

For semi-desert grasslands, Madrean encinal woodland, ponderosa pine forest, and mixed conifer-frequent fire, modeling shows seral state distribution would move away from desired conditions, mostly through the increase of closed seral states.

This alternative would have the highest amount of undesirable closed-canopy conditions in all ecological response units.

In desert ecological response units, departure would be expected to remain low for seral state distribution, except if and when there are fires with uncharacteristic effects.

"Other" ecological response units currently have low to moderate departure, and would be expected to slowly move away from desired conditions over the next 10-year period with the exception of interior chaparral and wet mixed conifer. Under current management interior chaparral is moving towards desired conditions for seral state distribution. However, there are no modeling data currently available for wet mixed conifer and, given the total acres of the ecological response unit on the forest, and the acres that have burned with high severity in the last three years, additional high severity fires of almost any size in this ecological response unit could be detrimental.

Alternative B

In frequent-fire forested ecological response units (mixed conifer-frequent fire, ponderosa pine forest, ponderosa pine-evergreen oak), modeling shows seral state distribution would improve significantly as combined treatments were implemented on 50,000 to 122,000 acres, as well as 105,000 to 325,000 acres of fire only treatments over 10 years.

In frequent-fire woodland ecological response units, there would be 400 to 2,000 acres of combined treatments, as well as 20,000 and 200,000 acres of fire only treatments. In frequent fire woodland ecological response units, the effectiveness of the treatments would depend on how many acres are treated. If the upper range of the "fire only" treatments were implemented, there would be significant improvement in seral stage distribution. If the lower end were implemented, the current positive trend indicated by modeling in pinyon-juniper grass and juniper grass would be augmented, but more slowly.

Overall, in these systems, 20 percent to 72 percent of the frequent-fire forest and woodland could receive at least one treatment in a 10-year period. There would be decreases in the currently over-represented medium / large closed states that would be replaced with the currently under-represented medium / large open states. Mechanical treatments and fire would allow multi-storied open states to begin to develop, as the proposed treatments restored a more typical disturbance regime. This would increase surface vegetation cover and diversity, as well as the light, flashy, surface fuel loading that supports the kind of fire these areas are adapted to.

The seral state distribution in semi-desert grasslands would continue to move away from desired conditions as woody species cover increased because there might be only 500 acres of semi-desert grasslands treated (0.14 percent of all semi-desert grasslands on the Tonto National Forest).

In desert ecological response units, seral state distribution would maintain a low departure as open seral states are maintained with a combination of mechanical, chemical, and fire treatments.

"Other" ecological response units would be affected by alternative B primarily if adjacent areas are treated, otherwise effects would be similar to alternative A. For example, if there was a need to include a portion of interior chaparral or pinyon-juniper evergreen shrub in a prescribed fire unit, or if there were a small inclusion of pinyon-juniper evergreen shrub in a cutting unit, those areas could be treated. Wildfire would also be an agent for treatment, should there be an opportunity. The few changes that could happen under alternative B would be expected to be beneficial to the distribution of seral states. Effects to all these ecological response units would be similar to those described for frequent fire ecological response units, meaning that less canopy cover generally increases herbaceous surface vegetation when there is potential for that. In some seral stages, pinyon-juniper evergreen shrub and interior chaparral do not support significant herbaceous surface vegetation, even when departure is very low.

Alternative C

Under alternative C, forested frequent fire ecological response units would receive at least 11,000 acres of combined treatments (mechanical plus fire), which is about 22 percent of the minimum number of acres that would receive mechanical treatments under alternatives B and D. There would be at least 144,000 acres of "fire only" treatments.

Frequent fire woodland ecological response units would receive no mechanical treatment, but would receive at least 230,000 acres of "fire only" treatments.

There could be at least 100,000 more acres of fire only treatments than in alternative B, and more than 120,000 more than alternative D. If those acres were all treated, there could be greater improvement in seral state (as defined by this analysis) distribution than in other alternatives. "Seral state", as used in this analysis, refers mostly to the distribution of woody species, mostly trees. To achieve a seral state distribution similar to what could be achieved with one mechanical entry, will generally take two or more entries with fire. Fire does not discriminate so, with fire as the primary treatment tool, severity/mortality patterns in areas where fire would be the first entry for thinning would be less predictable. Under alternative C, fire would be a primary tool for thinning, but could take longer to reach desired conditions than with combined treatments.

The effects of alternative C on semi-desert grasslands and desert ecological response units would be identical to that described for alternative B.

Under alternative C, the effects to "other" ecological response units would be expected to be the same as those described under alternative B, but with greater potential for fire, and less potential for mechanical treatments.

Alternative D

Seral stage distribution would improve significantly where there would be combined treatments in frequent fire forested ecological response units. There could be more acres of mechanical treatments under this alternative than under other alternatives, moving more acres faster towards desired seral state distribution (as defined by this analysis – mostly a description of tree distribution) in the short term than other alternatives. Prescribed fire would be confined mostly to those acres that would also have mechanical treatments. Fire only treatments would be implemented on about 15 percent of those that would be treated with fire only under alternative B, and 11 percent of those in alternative C.

For frequent fire woodland ecological response units, effects would be as described under alternative A because resources would be committed to increasing products from forested ecological response units.

The effects of alternative D on seral state distribution for semi-desert grasslands and desert ecological response units would be identical to that described for alternative B.

Under alternative D, the effects to "other" ecological response units would be expected to be the same as those described under alternative B, but with greater potential for mechanical treatments, and less potential for fire treatments.

Summary

Under alternative A, modeling indicates there would be ovement towards desired seral state distribution for some frequent fire ecological response units (ponderosa pine-evergreen oak, pinyon-juniper grass, juniper grass, Madrean pinyon-oak) and backwards for others (mixed conifer-frequent fire, ponderosa pine forest, Madrean encinal woodland, semi-desert grasslands).

Alternative B would treat between 51 percent and 146 percent of the frequent fire woodland ecological response units in the 10-year period. Treating 146 percent would mean that 46 percent could receive more than one treatment. In reality, the number would probably be somewhere in the middle.

Under alternative B, there would be less certainty about the effects on frequent fire woodland ecological response units, because the wide range of treatment objective acres would mean that somewhere between 3 and 39 percent (20,400 to 202,000 acres) would be treated.

Alternative C would have potential to treat more acres than the other alternatives, but mostly with "fire only" treatments. There would be limited options for mechanical treatments in frequent fire forested ecological response units, and no mechanical treatments in frequent fire woodland ecological response units. Between 51 and 146 percent of frequent fire forested ecological response units would be treated; the same range of acres as alternative B, but there would be only 22 percent of the mechanical treatments.

Under alternative C, between 51 and 145 percent of frequent fire woodland ecological response units could be treated, but there would be no mechanical acres, only "fire only". 'Fire only' treatments require more entries to get to a similar open state than when fire and mechanical are combined. Additionally, the burn windows for first entry burns would be fewer because of the need for higher intensity / higher severity fire to do the thinning. Mortality patterns created with fire are less predictable, but would be more natural, depending on the circumstances of the burn.

Alternative D would be more limiting that the others because there would be a very limited amount of wildland fire outside of areas with mechanical treatments, and there are no objectives for treating frequent fire woodland ecological response units because available resources would be committed to producing products from forested ecological response units.

Under all alternatives, semi-desert grasslands continues to depart from desired conditions.

Under alternatives B, C, and D, the Tonto National Forest would refine methods for identifying restorable acres, and methods for restoring semi-desert grasslands. Under alternative A, there would be no improvement.

Alternatives B, C, and D would benefit desert ecological response units, alternative A would not.

The effects to "other" ecological response units would be minimal, and identical to alternative A, except where there could be incidental treatments associated with work in adjacent ecological response units, or fuels reduction in wildland-urban interface areas, or where needed to protect values at risk.

Grasslands, herbaceous vegetation, and ground cover

Semi-desert grasslands is the only grassland ecological response unit on the Tonto National Forest, though open grassy areas are an important component of all frequent fire ecological response units.

Alternative A

Under alternative A, canopy cover would continue to increase, maintaining the downward trend of the cover and diversity of herbaceous surface vegetation in frequent fire ecological response units. Closed canopies would increasingly intercept light and precipitation, as well as produce copious amounts of litter, which physically suppress vegetation. The lack of fire allows more woody sprouts to mature, further increasing canopy closure, and decreasing nutrient availability in the soil. Lack of fire also allows fire-intolerant species to thrive, displacing the fire adapted herbaceous species association that had been in place. The decrease in herbaceous surface vegetation would also change fire behavior and effects. A surface fuel layer composed primarily of a healthy, contiguous layer of herbaceous surface vegetation augmented by some needle litter would produce the kind of fire behavior and effects that frequent fire ecological response units are adapted to.

Semi-desert grasslands would continue to move away from desired conditions, and the Tonto National Forest would not spend resources identifying where there are restorable acres, refining restoration methods for semi-desert grasslands, or restoring semi-desert grasslands. The only changes would occur from wildfire, drought, or occasional treatments deemed necessary by range managers.

For all ecological response units, ground cover would decrease as herbaceous surface vegetation decreased. Where canopy cover is high, there would be ground cover from needle and leaf litter, but it would also suppress herbaceous surface vegetation. Ground cover would decrease in most ecological response units, or would increase so slowly that soil would be at risk of erosion and other detrimental disturbances for the next 10-year period.

In some cases, depending on the ecological response unit, the soil, and the species, ground cover may increase with the presence of invasive species, such as weeping lovegrass. However, this could negatively affect fire regimes and species diversity.

In desert ecological response units, ground cover departure from reference conditions would be expected to stay low.

“Other” ecological response units could receive only minimal treatments (as described under ‘Seral state distribution, open/closed states’ in alternative B), and changes would be as described there, canopies that are opened up could result in increased surface vegetation and ground cover where soils support it.

There would be no change to current grazing management, so range condition would continue to slowly decline, resulting in decreased cover of herbaceous surface vegetation and diversity. This decreases surface fuel loading as well, making it harder for fires that do burn to meet objectives.

Alternative B

For all frequent fire ecological response units, both mechanical and fire treatments would decrease canopy cover, increasing the light and precipitation reaching the surface, as well as decrease the rate of production of needle and leaf litter. Herbaceous surface vegetation would respond by an increase in cover and diversity. The reintroduction of fire would add nutrients to the soil, effectively fertilizing surface vegetation each time it burned, and improving the vigor of surface vegetation. Fire would also scarify some species, by smoke and/or heat, further increasing the diversity of herbaceous surface vegetation.

There would be a least 500 acres of semi-desert grasslands restoration treatments over the 10-year period covered by this plan; on those acres that are treated, the effects would be as described above. Additionally, the Tonto National Forest would refine methods for identifying restorable acres, and methods for restoring semi-desert grasslands.

For all frequent fire ecological response units, ground cover would be increase where herbaceous surface vegetation increased. The component of ground cover composed of needle and leaf litter from trees and shrubs would come and go with fires, sometimes taking a few months to re-accumulate. That portion of ground cover composed of herbaceous surface vegetation and the litter it creates would respond more quickly, and the roughness of the surface where herbaceous surface vegetation is burned would provide a little protection to soil until the ground cover was replaced, either by new herbaceous growth, or by needles/leaves. In first entry burns in frequent fire ecological response units that have a significant overstory of trees, scorched needles and leaves will replace burned ground cover completely within a year.

Mechanical treatments would increase the potential for invasive species, but there would be more treatment of invasive species under this alternative than under any others.

In desert ecological response units, where populations of invasive species are treated, competition for light, water, and nutrients would be decreased, benefitting native species. Under the integrated pest management approach treated areas can then be seeded with native species that are underrepresented helping to maintain the high seral open state of the desired condition.

The effects to "other" ecological response units would be minimal, and identical to alternative A, except where there could be incidental treatments associated with work in adjacent ecological response units, or fuels reduction in wildland-urban interface areas, or where needed to protect values at risk. Where there were treatments, the effects would be as described under 'Seral state distribution, open/closed states' under alternative B.

Some vacant allotments could be closed, or could be permitted. If a vacant allotment was closed, herbaceous surface vegetation would likely increase, providing additional surface fuels for fire, and increasing effectiveness at regulating woody species.

Alternative C

Under alternative C, forested frequent-fire ecological response units would receive at least 11,000 acres of mechanical treatments combined with fire, which is about 22 percent of the minimum number of acres that would receive mechanical treatments under alternatives B and D. There would also be at least 144,000 acres of "fire only" treatments.

Frequent fire woodland ecological response units would receive no mechanical treatment, but would receive at least 230,000 acres of "fire only" treatments.

Overall, there could be at least 100,000 more acres of fire only treatments than in alternative B, and more than 120,000 more than alternative D. With fire as the primary treatment tool, severity/mortality patterns in areas where fire would be the first entry for thinning would be less predictable.

Where fire was used as a thinning agent, there would likely be more mixed severity fire, potentially leaving some areas with high burn severity. Those areas would not be expected to be large enough to be a concern, but would take longer to support herbaceous surface vegetation and, for a while, would be vulnerable to invasive species. There would be more variability in the patchiness of species diversity and vegetative cover under this alternative. Although it could take at least two entries with fire to achieve the desired structure for woody cover, the changes to canopy cover from the first burn would have an immediate effect on herbaceous surface vegetation. By the time a second burn was implemented, there should already be an herbaceous response, and a thicker, more contiguous fuel bed of light flashy fuels to help consume the residual woody fuels from the first burn.

Ground cover would increase proportionally with the increase in herbaceous surface vegetation. Effects would be much as described above under alternative B, though there would be less ground disturbance from mechanical treatments and, where there was more mixed severity fire, ground cover could take longer to replace itself.

The effects on semi-desert grasslands and desert ecological response units would be identical to those described under alternative B.

Under alternative C, the effects to "other" ecological response units would be expected to be the same as those described under alternative B, but with greater potential for fire, and less potential for mechanical treatments.

Vacant allotments would be closed. This would allow herbaceous surface vegetation to increase in cover and density. Fires could then burn more contiguous areas and with greater intensity, making it more effective at regulating woody species.

Alternative D

Under alternative D, only frequent fire forested ecological response units, would have treatment objectives. Where there were acres with combined treatments, the effects would be the same as those described for alternative B, though there could be over 60,000 more acres of combined treatments than in alternative B.

For frequent fire woodland ecological response units, the effects would be identical to those in alternative A.

Under alternative D, at least 72 percent of all frequent fire forests and woodlands, would have the same effects as alternative A.

Ground cover would increase or decrease proportionally with the change in herbaceous surface vegetation. Where there were treatments, effects would be much as described above under alternative B, though there would more soil disturbance from mechanical treatments. In frequent fire woodland ecological response units, effects would be as described in alternative A.

The effects on semi-desert grasslands and desert ecological response units would be identical to those described under alternative B, except for the effects of invasive species treatments, which would be the same as alternative A.

Under alternative D, the effects to "other" ecological response units would be expected to be the same as those described under alternative B, but with greater potential for mechanical treatments, and less potential for fire treatments.

Summary

In forested frequent fire ecological response units, all action alternatives would move herbaceous cover and ground cover towards desired conditions. Alternative B would move the most acres furthest towards desired conditions, including all frequent fire forest and woodland ecological response units. Alternative C would have potential to treat the most acres, and could move the most acres of herbaceous surface vegetation further if there were sufficient burn windows, but there would be no mechanical treatments in frequent fire woodland ecological response units. Under alternative D, there would be an average of only 6,000 acres of fire only treatments for a 10-year period, severely limiting how effective management could be outside of areas that are accessible for mechanical treatments. All treatments would be in forested frequent fire ecological response units.

In frequent fire woodland ecological response units, effects of alternatives A and D are identical.

Herbaceous surface vegetation, in its roles as providing diversity, cover, and as a light, flashy fuel needed in frequent fire ecological response units, would do best under alternative B. There would be more potential for treatment under alternative C, but it would be difficult to get the needed burn windows for implementing so much first entry fire for thinning in forested areas with moderate to closed canopies.

semi-desert grasslands will continue to move away from desired conditions in all alternatives although, under alternatives B, C, and D, the Tonto National Forest would be gaining knowledge on where and how to restore semi-desert grasslands acres.

Alternatives B, C, and D would benefit desert ecological response units, alternative A would not.

The effects to "other" ecological response units would be minimal, and identical to alternative A, except where there could be incidental treatments associated with work in adjacent ecological response units, or fuels reduction in wildland-urban interface areas, or where needed to protect values at risk.

In regards to grazing management, vegetation and fire would benefit the most from alternatives B and C. Frequent fire systems, in particular, would benefit from some decreases in grazing that could mimic historic levels of grazing by native ungulates. That would allow herbaceous surface fuels to support the kind of fire effects and behavior that these systems have adapted to.

Fire Regime and Patch Size

Restoring fire regimes plays both direct and indirect roles in achieving or maintaining desired conditions for frequent fire ecological response units (mixed conifer-frequent fire, ponderosa pine forest, ponderosa pine-evergreen oak, Madrean encinal woodland, Madrean pinyon-oak, and semi-desert grasslands). There are about 1,250,255 acres of frequent fire ecological response units on the Tonto National Forest (42 percent). The standard definition for 'frequent fire' is when the average fire return interval is less than 35 years. On the Tonto National Forest, that would require an average of about 26,000 acres of frequent fire forests and woodlands to burn annually. However, 35 years is the maximum, and few areas of the frequent fire ecological response units on the Tonto National Forest could be sustained if they only burned once every 35 years. If the frequent fire ecological response units are not highly departed, some areas could probably be managed with a fire return interval of about 20 years; that would require that an average of about 45,000 acres burn annually. Much of the area on the Tonto that is occupied by frequent fire forest or woodland ecological response units is moderately to highly departed. In those areas, treatment frequency would need to be higher for the first, second, and sometimes third entries in order to effectively manage regeneration and sprouting of woody species. If frequent fire forest and woodland ecological response units were managed with a fire return interval of 15 years (still not frequent enough to effectively manage sprouting woody species where fire has been withheld for decades), the Tonto National Forest would need about 60,000 acres of fire a year in these ecological response units.

The fire potential in frequent fire ecological response units can also affect adjacent ecological response units. It may be from a fire moving into a non-frequent fire ecological response unit at a high intensity, or it could be runoff or sedimentation impacting a riparian area from an uncharacteristically large area of high severity upslope.

Semi-Desert Grasslands: In addition to forest and woodland frequent fire ecological response units, there are almost 350,000 acres of semi-desert grasslands on the Tonto National Forest, which is also a frequent fire ecological response unit. However, it is currently not known how much of the semi-desert grasslands is restorable and, therefore, how many of these acres should be counted as a frequent fire ecological response unit. The most easily identified characteristic of departed conditions in grasslands is the encroachment of woody species. Where shrubs or trees become established in grasslands, the increased woody component and the associated decrease in the light flashy surface fuels changes fire behavior and effects. Where there were restoration treatments, herbaceous surface fuels would increase and expand, allowing fire to spread naturally across larger areas, and decreasing woody species encroachment. However, the minimum required treatment acreage under all action alternatives is only

500, less than half the reference patch size, so patch size would continue to deteriorate. High severity would be more contiguous, coarsening the mosaic, and moving the treated areas towards desired conditions. Changes in the flexibility of grazing in desert grasslands, whether it be changes in numbers of livestock, frequency, or seasonality, would allow grazing to be a tool that could help improve grassland conditions, and allow the fire behavior and effects that these grasslands need to be healthy.

Desert ecological response units: Fire is generally not a healthy disturbance in desert ecological response units. Historically, when it did occur, it would have been small and patchy, and not large or frequent enough to have produced obvious adaptations in individual plants or the vegetation type as a whole. Currently, invasive exotic grasses are increasing occupying areas that historically would have had little to no vegetation. This is allowing fire to spread across areas with a frequency and severity that are outside of its historic range of variation. Fire would rarely be used in this vegetative type, though mechanical treatments may be used to facilitate wildland fire in adjacent vegetation types as long as it maintains, or improves the condition of the Mojave-Sonoran Desert Scrub.

Alternative A

Fire regimes would continue to move away from desired conditions for all frequent fire ecological response units, as fire return intervals and fire severity continued to increase.

For the next 10-year period, frequent fire ecological response units would continue to be at high risk of uncharacteristically large and severe fires. Alternative A would have the highest and most contiguous fuel loads (coarse woody debris, litter, and vertical / horizontal canopy fuels). Increasing canopy closure would contribute to increasing surface and canopy fuel loads. Potential fire intensity (flame length) would decrease significantly for at least a few years in those areas that were treated, but would increase in areas not treated. In forested and woodland areas, it is likely there would be large, high severity fires before enough acres could be treated to significantly affect the movement, behavior, or effects of fires burning in conditions that favor large fire growth across large swaths of the forested ecological response units on the Tonto National Forest.

Patches with uncharacteristically high and contiguous fuel loads are vulnerable to high severity fire. At the current rate of treatments, these areas would expand in many ecological response units, increasing patch size for all frequent fire forest and woodland systems. Patch size would expand in frequent fire forests and woodlands, moving away from reference conditions, as a fire frequency lower than reference conditions could not regulate seedlings, sprouting woody shrubs and trees, or affect surface vegetation.

The result would be adverse effects on herbaceous surface vegetation and fuel structure, as well as the greatest potential for uncharacteristically high severity fire effects of all alternatives. These fire effects would increasingly affect larger areas, as patch size increasingly departed from desired conditions. In forested areas, this would sometimes be expected to lead to type conversion, as large areas of tree mortality would leave no seed source. Additionally, in much of the forested and woodland areas, sprouting woody species respond quickly to most fire, often out completing any tree seedlings that may have sprouting following such a fire. In those cases, type conversion could be the outcome (Savage 2005).

Patches in semi-desert grasslands would continue to decrease, moving away from desired conditions as woody encroachment created a fine scale patchiness that is not characteristic of semi-desert grasslands.

In desert ecological response units, invasive exotic grasses that burn easily would continue to establish and expand, resulting in more and larger fires in these desert communities. Cacti and succulents would be negatively affected by fires, generally shifting dominance to the grass component in a positive feedback loop. Type conversion to exotic grasslands resulting from larger more frequent fires would be expected to continue, as increases in the amount and extent of disturbance increased the opportunities for exotics to become established.

Fire regimes for "other" ecological response units have longer fire return intervals with higher severity, and are not as departed as frequent fire ecological response units. Some ecological response units (pinyon-juniper evergreen shrub, interior chaparral, and pinyon-juniper woodland) currently have high fuel loads and maturing vegetation and are very likely to experience high severity fire during the life of this plan. High severity fires for these ecological response units would be within the historic range of variation, depending on the patch size and the mosaic created by the fire. There are no data currently available for wet mixed conifer, however, in 2016 and 2017, there were fires in wet mixed conifer in the Pinals and in the Sierra Anchas, so it is likely that those fire return intervals are within the historic range of variation (refer to wet mixed conifer in the Affected Environment section).

Alternative B

For forested ecological response units, fire regimes would move towards desired conditions for fire return intervals, fire severity, and patch size. Fire return intervals would move towards desired conditions, ranging between 7 and 20 years for all forested frequent fire ecological response units. This increased fire frequency would regulate fuel loads, and begin to decrease patch size and severity. More frequent fires would start decreasing sprouting woody species where they are over-represented, and functioning as ladder fuels. Patch size would decrease as the horizontal continuity of shrub and overstory fuels decreased.

Frequent fire woodland ecological response units, could move towards or away from desired conditions, depending on how many acres were treated. If the minimum number of acres were treated, fire return intervals could increase to about 290 years, and woodland ecological response units would move away from desired conditions. If the maximum number of acres were treated for woodland ecological response units, fire return intervals would decrease to about 30. That is on the high end of the desired fire return interval, but is within the historic range of variation for most woodlands. The actual fire return interval would likely be somewhere in between, which could be outside of the historic range of variation for some of the woodland ecological response units. In that case, there would still be patches of closed canopy that would be vulnerable to high severity fire, and that are larger than reference conditions.

As more areas were treated in frequent fire forest and woodland ecological response units (mechanically and with fire), it would recreate the fuel structure that supports the kind of fire that these systems evolved with (frequent, mostly low intensity / low severity). This fuel structure would include minimal ladder fuels, and mostly moderate to low surface fuel loading and canopy fuel continuity (horizontally and vertically).

Where combined treatments could be used, the primary limitations on reaching desired conditions would be those constraints (appendix B).

For semi-desert grasslands, fire regimes and patch sizes would continue to move away from desired conditions. If the minimum acres were treated, there would be no discernable change to semi-desert grasslands except on the 500 acres that were treated. On those acres of semi-desert grasslands where both mechanical treatments and fire would be implemented, the increased light to surface vegetation, and the decrease in competition for water and nutrients would increase cover and diversity of herbaceous surface vegetation. Any treatments in semi-desert grasslands are likely to improve the cover and diversity of surface vegetation, and ground cover.

In desert ecological response units, where invasive and exotic species are treated, herbaceous surface fuels would be reduced to historical levels, allowing fire to spread naturally where and when it did occur. The occasional fire would cover a much smaller area due to the discontinuous surface fuels and be easier to suppress. With a large historical patch size of 4,200 to 8,000 acres treatments would have minimal effect on patch size.

"Other" ecological response units would be most likely to receive some kind of treatment if adjacent areas are treated, or there is a wildfire. With the possible exception of the potential of undesirable fire effects, the few changes that could happen under alternative B would be expected to be beneficial to fire regime and patch size. Effects to all these ecological response units would be similar to those described for frequent fire ecological response units, meaning that less canopy cover generally increases herbaceous surface vegetation when there is potential for that, and herbaceous surface cover carries fire more easily. Effects as described in alternative A would also apply.

More flexibility in livestock grazing management would allow surface fuels to recover to extents and levels that would support the kind of fire to which frequent fire ecological response units are adapted.

Alternative C

Where acres are treated, the effects would be identical to those described in alternative B. Where they are not treated, effects would be identical to those described in alternative A.

Under alternative C, in forested frequent fire ecological response units, there could be about 78 percent fewer acres of combined treatments, than under alternative B. There would also be between 39,000 and about 100,000 more acres of fire only treatments.

In frequent fire woodland ecological response units, there would be no mechanical treatments. There would be between 110,000 and 210,000 more acres of 'fire only 'treatments.

Under this alternative, if there were sufficient burn windows, fire frequency could move towards desired conditions faster than in any other alternative, decreasing fire return intervals to about 14 to 26 years in woodland ecological response units and 7 to 20 years in forested ecological response units.

Thinning areas with moderate to closed canopies with fire would require more surface fuel loading to achieve the higher fire intensities needed, increasing the difficulty of finding burn windows suitable for initial entries with fire. Two or three entries would be required to address the residual woody biomass where fire was successfully used as a thinning agent, and there would be more mixed and high severity fire during initial entries. In forested and woodland frequent fire ecological response units, it would take 3 to 4 burns (10 to 20 years), before the results would be expected to be close to desired conditions. Where mechanical treatments could be implemented along with prescribed fire, movement towards desired fire regime and patch size would go more quickly.

Where both mechanical treatments and fire treatments could be used, the primary limitations on reaching desired conditions would be those constraints listed under Assumptions and Methods (page 21).

For semi-desert grasslands, and desert ecological response units, the effects for alternatives C would be identical to those described for alternative B.

Under alternative C, the effects to "other" ecological response units would be expected to be the same as those described under alternative B, but with greater potential for fire, and less potential for mechanical treatments.

Significantly decreased livestock grazing would allow more contiguous and dense herbaceous surface fuels, allowing fire to burn more intensely, and more effectively regulate woody species. This alternative would do more than any other to restore frequent fire ecological response units.

Alternative D

For frequent fire forested ecological response units, where there were treatments, effects would be similar to those described under alternative B. Of the acres that were treated, there could be up to almost 70,000 more acres with combined treatments than in other alternatives. Fire return intervals in frequent fire ecological response units would be between 36 and 137 years. Mechanical treatments would be unlikely to be able to keep up with the need as canopies continued to close up and fire treatments were limited.

For frequent fire woodland ecological response units, effects would be the same as those described under alternative A.

With decreased options for fire, some treated areas would need more continuous mechanical treatments to maintain, competing with new acres for treatment resources. Under this option, it would be difficult to maintain treated areas because the acres needing maintenance treatment would continue to increase and, with fire options more limited than in other alternatives, maintaining and moving acres towards the desired distribution would be a challenge.

Where combined treatments could be used, the primary limitations on reaching desired conditions would be those constraints (appendix B).

For semi-desert grasslands and desert ecological response units, the effects for alternative D would be identical to those described for alternative B.

Under alternative D, the effects to “other” ecological response units would be expected to be the same as those described under alternative B, but with greater potential for mechanical treatments, and less potential for fire treatments.

Increased in livestock grazing would further disrupt fire regimes, and narrow burn windows further, moving frequent fire systems away from desired conditions.

Summary

Combined treatments would move acres towards desired conditions for fire regimes faster than other methods.

‘Fire only’ treatments can take more time to reach desired conditions for fire regimes.

‘Fire only’ treatments can move understory conditions towards desired conditions faster than the woody component. Combined treatments can move the woody component towards desired conditions faster than the herbaceous component. Combined treatments can be the most effective at removing the immediate threat of undesirable fire effects and behavior, depending on how residual fuels are treated.

Alternative A would do the least to move frequent fire ecological response units towards desired conditions, with fire expected to treat between 0.5 and 15 percent of frequent fire woodland and forest ecological response units over a 10-year period. There would be not be a focus on treating frequent fire ecological response units. The rate of treatment for frequent fire ecological response units would not be meaningful in the long run. ponderosa pine-evergreen oak, pinyon-juniper grass, and juniper grass would continue to move towards desired conditions, but the rate of change would likely be too slow to avoid negative effects, such as uncharacteristically large, high severity fire, density mortality (when trees die because the forest is too dense), invasive species effects on fire regimes, and other negative consequences relating to the departure of these ecological response units from reference conditions.

For frequent fire forested ecological response units: alternative B would move the most acres towards desired conditions. Over a 10-year period, the minimum treatment objective for both alternatives B and C is 155,000 acres, while the minimum treatment objective for alternative D is 66,000 acres. While there is potential to treat the most acres under alternative C, the majority of these acres would be for “fire only” treatments. When first entry burns are used for thinning, burn windows are harder to come by and, for alternative C, combined treatments would be limited to 22,000 acres over a 10-year period. Alternative D would potentially treat up to 190,000 acres with combined treatments, but fire would be limited to 62,000 acres, potentially leaving some areas partially treated since the emphasis would be on forest products.

For frequent fire woodland ecological response units, alternative B has a broad range of acres with treatment objectives, so the effects could move the ecological response units towards or away from desired conditions, depending on how many acres would be treated. Those acres that would receive combined treatments would move more quickly towards desired conditions, but would be limited to 2,000 acres over a 10-year period. Alternative C would be all “fire only” treatments in frequent fire woodland ecological response units but, with a minimum treatment objective of 230,000 acres, at least 40 percent of frequent fire woodlands could receive at least one treatment over a 10-year period if there were sufficient burn windows.

For frequent fire woodland ecological response units, the effects of alternative D would be the same as the effects of alternative A.

Overall, fire regimes and patch size would make the most progress towards desired conditions under alternatives B and C. For fire frequency, there are no significant differences between alternatives B and C, except that the wider use of mechanical treatments under alternative B could broaden the burn windows for wildland fire for forested and woodland frequent fire ecological response units. Alternative C could move the most acres forward, if burn windows could be found for using fire as a thinning agent, but would also be likely to produce more mixed or high severity effects. Alternative D would be the most restrictive for reintroducing fire, since prescribed fire would mostly be limited to those areas where there would also be mechanical treatments, and there could be over 100,000 acres of mechanical treatment that are not treated with fire.

The effects to semi-desert grasslands would be identical under alternatives B, C, and D.

The effects to desert ecological response units would be the same under alternatives B, C, and D.

The effects to “other” ecological response units would be minimal, and identical to alternative A, except where there could be incidental treatments associated with work in adjacent ecological response units, or fuels reduction in wildland-urban interface areas, or where needed to protect values at risk.

Ecosystem Function

In this context, ecosystem function is a description of how the combined effects of each alternative would be expected to affect the condition of the ecological response unit. For example, seral stage distribution is an important indicator, but may not include the effects of a deficit of ground cover. When the effects of a deficit of ground cover are combined with a deficit in tree cover, it would affect herbaceous cover and the fire regime

Alternative A

Alternative A would move some ecological response units slowly towards some desired conditions but, overall, ecosystem function would decline for all frequent fire ecological response units. The current rate of treatment is making progress in some frequent fire ecological response units for seral stage distribution, but will be unable to address the growing need for maintenance on acres that have been treated.

Over the last five years, on the Tonto National Forest, wildfires have burned three times as many acres as all prescribed fire treatments combined, largely due to a few large fires. There will be more large fires over the next 10-year period. While wildfires are one of the best tools for treating landscapes, they are far more likely to produce the desired fire effects and behavior if the fuel structure is appropriate. Under this alternative, there would be a disproportionate number of acres with closed canopies, and the associated departures in fuel loading, and herbaceous species cover and diversity. These acres have potential to burn with uncharacteristically large and severe fires, and are more likely to do so under this alternative than the others.

Under alternative A, ecosystem function in semi-desert grassland will continue to move away from desired conditions.

In desert ecological response units, the vulnerability to climate change is high. Recovery from fire is slow among desert shrublands and depends on factors such as topography, species composition, the amount of precipitation following fire. Changing precipitation regimes in the Southwest (Seager et al. 2012), along with higher fuel loads, are likely to have negative impacts to the ecological integrity of these systems. Invasive exotic species, mostly grasses, would continue to expand, disrupting the natural disturbance regimes.

Fire regimes for “other” ecological response units have longer fire return intervals with higher severity, so ecosystem function is not as departed as frequent fire ecological response units.

Alternative B

Under alternative B, the combination of mechanical and fire treatments would improve the resilience of frequent fire ecological response units to disturbances, such as fire and drought. Restoring a fuel loading and structure (trees, shrubs, herbaceous surface fuel, litter/duff, and coarse woody debris) which supports the kind/s of fire that these ecological response units evolved with is key to their restoration and maintenance. Under this alternative, when wildfires do occur, there is an increased chance that the effects would be beneficial. The balance of mechanical treatments with wildland fire in this alternative is the most realistic, for the burn windows and resources needed.

The ecological function of semi-desert grassland would continue to depart from desired conditions, though the Forest would gain an improved understanding of where and how to restore the semi-desert grassland.

In desert ecological response units, the reduction of invasive and exotic species would reduce the risk of fire, improve conditions for native grasses and forbs and return fire to its natural role.

Under alternative B, there would be a balance of combined and “fire only” treatments that would improve overall ecosystem function for all ecological response units, but “other” ecological response units would be affected by alternative B primarily if adjacent areas are treated. Wildfire is another agent for treatment, should there be an opportunity. With the possible exception of the potential of undesirable fire effects, the few changes that could happen under alternative B would be expected to be beneficial to ecosystem function.

Alternative C

Alternative C has the potential to treat more acres than any other alternative, though it would not necessarily move the most acres as far towards desired conditions. To get acres to a point where their ecological functions are close to desired conditions (or as close as they could get with a deficit of large and/or old trees), requires more entries in those areas that would be thinned with fire. This alternative could result in a patchier, more ‘natural’ mosaic, because of the natural variability of regeneration and sprouting shrubs and how they interact with fire and burn severity, soil, slope, aspect, and other environmental variables.

Effects to the ecological function of desert ecological response units and semi-desert grassland would be the same as alternative B.

Under alternative C, the effects to “other” ecological response units would be expected to be the same as those described under alternative B, but with greater potential for fire, and less potential for mechanical treatments.

Alternative D

With significantly more mechanical treatment acres possible, this alternative would have potential to move a lot of acres of forested ecological response units towards desired conditions quickly. However, there are no objectives for woodland ecological response units, which means that, for about 591,000 acres of frequent fire ecological response units, the effects of alternative D would be identical to alternative A, with increasing amounts of closed canopy areas that are increasingly vulnerable to high severity fire.

Effects to the ecological function of desert ecological response units and semi-desert grassland would be the same as alternative B, except for invasive species. For invasive species, the effects of alternative D would be the same as described under alternative A.

Under alternative D, the effects to “other” ecological response units would be expected to be the same as those described under alternative B, but with greater potential for mechanical treatments, and less potential for fire treatments.

Summary

Alternative A would improve ecosystem function for only a portion of the frequent fire ecological response units, and at a rate so slow that most of the area/s would remain vulnerable to high-severity fire for much of the next 10 years. Alternative B would be a good balance of mechanical and fire treatments, with the potential to move at least 51 percent of the frequent fire forest and between 3 and 34 percent of frequent fire woodland ecological response units towards desired conditions. While alternative C could move more acres towards desired conditions, the limited mechanical acreage, and the difficulty in finding burn windows to do thinning with first entry burns would be a challenge. Alternative D has less than 15 percent of the acres available for “fire only” treatments than would be available under alternatives B and C so, although it could have more combined treatments, there would be far less fire restored to the frequent fire ecological response units.

The effects to “other” ecological response units would be minimal, and identical to alternative A, except where there could be incidental treatments associated with work in adjacent ecological response units, fuels reduction in wildland-urban interface areas where needed to protect values at risk, or wildfire.

Table 85 contrasts key trends by vegetation focus area for each alternative for ecological response units with plan objectives.

The ecological response units with plan objectives are:

MCD - mixed conifer-frequent fire

PPF - ponderosa pine forest

PPE - ponderosa pine-evergreen oak

MEW - Madrean encinal woodland

JUG - juniper grass

PJG - pinyon-juniper grass

SDG - semi-desert grassland

SDS - Mojave Sonoran desert scrub

MSDS - Sonora-Mojave mixed salt desert scrub

Table 85. Key trends by vegetation focus area for each alternative for ecological response units (ERUs) with plan objectives: mixed conifer-frequent fire (MCD), ponderosa pine forest (PPF), ponderosa pine-evergreen oak (PPE), Madrean encinal woodland (MEW), juniper grass (JUG), pinyon-juniper grass (PJG), semi-desert grassland (SDG)

Alternative	1. Restore frequent fire ecosystems (MCD, PPF, PPE, MEW, JUG, PJG, SDG)	2. Improve grasslands, herbaceous, and ground cover	3. Restore ecological integrity of desert ecosystems: Sonora-Mojave mixed salt desert scrub (MSDS) and Mojave Sonoran desert scrub (SDS)
A	Seral state distribution would improve slowly for PJG, JUG, PPE, and PPF in regards to the distribution of open/closed, and size classes for trees; other ecosystem characteristics would show little improvement, and many would continue to deteriorate. For SDG, MEW, and MCD, seral state distribution would move away from desired conditions. This alternative would have the highest amount of closed-canopy conditions and the highest fuel loads (coarse woody debris, litter, and vertical/horizontal canopy continuity). For “other” ecological response units, seral state distribution would move little, maintaining current low or moderate departures for the next 10-year period. Fire regime: All frequent fire ecological response units would remain highly departed, and moving away from desired conditions for frequency and severity. Closed canopies reduce herbaceous cover that provides most of the biodiversity, and is needed to support low intensity/low severity fire. Patches with uncharacteristically high and contiguous fuel loads are vulnerable to high severity fires. At the current rate of treatments, these areas would expand in many ecological response units, increasing patch size for all frequent fire non-grassland systems. Patches in SDG would continue to decrease, moving away from desired conditions as woody encroachment created fine scale patchiness that is not characteristic of SDG. “Other” ecological response units could remain with slightly	Under alternative A, SDG would continue to move away from desired conditions at all scales. Little to no progress would be made to identify where there are restorable acres of SDG. There would be no expectations of restoration treatments, and the only changes would occur from grazing, wildfire, drought, or occasional treatments deemed necessary by range managers. Canopy closure would be highest for this alternative, leading to decreased cover and diversity of herbaceous surface vegetation. Ground cover would decrease in most ecological response units, or would increase so slowly that soil would be at risk of erosion and other detrimental disturbances for the next 10-year period. Some Invasive species would have potential to increase ground cover in some areas, and would negatively affect fire regimes and species diversity in others. There would be only minimal change to “other” ecological response units, as they would continue to depart from desired conditions with increasing canopies producing lower surface vegetation and ground cover. There would be no change to grazing management, so rangeland condition would continue to decline, and woody encroachment would continue.	There would continue to be a focus on improving habitat for javelina, Gambel’s quail and cottontail rabbits. Wildland fire management direction would continue to be for minimizing damage to desert ecosystems. Type conversion to exotic grasslands resulting from larger more frequent fires would be expected to continue, as increases in the amount and extent of disturbance increased the opportunities for exotics to become established.

Alternative	1. Restore frequent fire ecosystems (MCD, PPF, PPE, MEW, JUG, PJG, SDG)	2. Improve grasslands, herbaceous, and ground cover	3. Restore ecological integrity of desert ecosystems: Sonora-Mojave mixed salt desert scrub (MSDS) and Mojave Sonoran desert scrub (SDS)
	higher fire return intervals than in their historic range of variability, with increasing chances of uncharacteristically severe fire, except for MCW which is probably within its historic range of variability for fire return interval.		
B	Seral state distribution would show significant improvement for frequent fire forested ecological response units. For frequent fire woodland ecological response units, the effectiveness of treatments would depend on how many acres could be treated. Where there were treatments in woodland and forested frequent fire ecological response units, Medium/Large closed would be replace with Medium/Large open, with treatments in at least 30 percent of the frequent fire forest and woodlands over 10 years. Seral state distribution for SDG would continue to move away from desired conditions, as woody species cover increased. Fire Regime: Fire regimes would move towards desired conditions for forested ecological response units If the number of acres treated in woodland ecological response units was on the low end of the range given in treatment objectives, fire regimes in woodland ecological response units would move away from desirable conditions as fire return intervals could increase to well over 250 years. If treated acres were on the high side of the range for treatment objectives, fire regimes would improve in frequent fire woodland ecological response units, (decreased severity, fire return interval, and patch size), but fire return intervals and severity would still be slightly departed for MEW, JUG, and PJG. For forested frequent fire ecological response units, fire return intervals would decrease (improve) to somewhere	There would be a least 500 acres of SDG restoration treatments over the 10-year period covered by this plan. The Tonto National Forest would refine methods for identifying restorable acres, and methods for restoring SDG. Decreased canopy cover would allow more light and precipitation to reach the surface, as well as decrease the rate of production of needle and leaf litter, resulting in increased cover and diversity of herbaceous surface vegetation. Mechanical and fire treatments together would promote healthy understory conditions as fire recycled nutrients locked up in dead biomass, decreased litter layers that often suppress herbaceous surface vegetation, and scarified species adapted to germinate best with heat or smoke from fire. Ground cover would increase where herbaceous surface vegetation increased. Treatments would increase the potential for invasive species, but the treatment of invasive species would be the greatest under this alternative. In “other” ecological response units, where there were treatments, effects would be much as described for frequent fire ecological response units though the establishment of surface vegetation would depend on site potential. PJO has little surface vegetation, and PJC and IC would be more likely to respond with sprouting shrubs.	In desert ecological response units, seral state distribution would maintain a low departure as there would be little change in the proportion of open states. The likelihood of undesirable fire would be reduced using a combination of mechanical, chemical, and fire treatments to eradicate invasive and exotic grasses. Where invasive and exotic species are treated, herbaceous surface fuels would be reduced to historical levels, allowing fire to occur at sizes and intensities with its historic range of variability. The occasional fire would cover a much smaller area due to the discontinuous surface fuels and be easier to suppress. With a large historical patch size of 4,200 to 8,000 acres, treatments would have little effect on patch size.

Alternative	1. Restore frequent fire ecosystems (MCD, PPF, PPE, MEW, JUG, PJG, SDG)	2. Improve grasslands, herbaceous, and ground cover	3. Restore ecological integrity of desert ecosystems: Sonora-Mojave mixed salt desert scrub (MSDS) and Mojave Sonoran desert scrub (SDS)
	between 7 and 20 years, within the historic range of variability for each of the frequent fire forested ecological response units. Treated acres could regain the fuel structure to support the kind of fire (frequent, mostly low intensity / low severity) that these systems evolved so they could be maintained with fire. Where combined treatments were implemented, the primary limitations on reaching desired conditions would be those constraints listed under Assumptions and Methods (page 31), and a deficit of old and/or large trees Fire regimes and patch size in SDG would remain highly departed, moving away from desired conditions. Treatment opportunities would mostly come from opportunities presented by wildfires. There would be no significant changes expected in “other” ecological response units, so fire regimes would remain slightly departed, except for MCW, which is probably within its historic range of variability.	There would be increased in the flexibility of livestock grazing, with grazing in some allotments decreased or no longer permitted. In those allotments, frequent fire ecological response units would move towards desired condition, and fuel structures would begin to support the type of fire that was characteristic to the ecological response unit.	
C	Seral state distribution would improve for all forest and woodland ecological response units, with increases in open states corresponding with decreases in closed states. More acres could be treated with fire, but many would require multiple entries to reach a seral state distribution that would be similar to that that could be obtained with a single mechanical entry. Fire Regime: Where both fire and mechanical treatments are implemented, the effects would be identical to those described in alternative B. Fire regimes for forested and woodland ecological response units would move towards desired conditions with fire return intervals somewhere between 14 and 26 for woodland ecological response units, and 7 and 20 for	The effects on SDG would be identical to those described under alternative B. The effects of canopy closure would be identical to those described for alternative B where there were treatments. There would be about 75 percent fewer acres with mechanical treatments, and up to 40 percent more acres with just fire treatments. Where fire was used as a thinning agent, there would likely be more mixed severity fire. Areas with higher burn severity would take longer to support herbaceous surface vegetation and, for a while, would be vulnerable to invasive species.	In desert ecological response units, seral state distribution would maintain a low departure as there would be little change in the proportion of open states. The likelihood of undesirable fire would be reduced using a combination of mechanical, chemical, and fire treatments to eradicate invasive and exotic grasses. Where invasive and exotic species are treated, herbaceous surface fuels would be reduced to historical levels, allowing fire to occur at sizes and intensities with its historic range of variability. The occasional fire would cover a much smaller area due to the discontinuous surface fuels and be easier to suppress. With a large historical patch size of

Alternative	1. Restore frequent fire ecosystems (MCD, PPF, PPE, MEW, JUG, PJG, SDG)	2. Improve grasslands, herbaceous, and ground cover	3. Restore ecological integrity of desert ecosystems: Sonora-Mojave mixed salt desert scrub (MSDS) and Mojave Sonoran desert scrub (SDS)
	forested frequent fire ecological response units, and severity and patch size decreasing. There could be up to 40 percent more “fire only” treatments than in alternative B, however, finding opportunities for treating so many acres with fire would be a challenge, particularly where the intent was for fire to be used for thinning. There would be about 22 percent of the acres of mechanical treatments that would be a minimum in alternative B. There would be no mechanical (combined) treatments in frequent fire woodlands ecological response units under alternative C. For frequent fire woodlands ecological response units, the effects of alternative D would be identical to alternative A. SDG would remain highly departed, moving away from desired conditions as, with the exception of 500 acres, the only treatment opportunities would those provided by wildfire when there is a natural start, or where range managers are able to treat... There would be no significant changes expected in “other” ecological response units, so fire regimes would remain slightly departed, except for MCW, which is probably within its historic range of variability.	Ground cover would increase where herbaceous surface vegetation increased. Effects would be much as described above under alternative B, though there would be less ground disturbance from mechanical treatments and, where there was more mixed severity fire, ground cover could take longer to replace itself. Effects to invasive species would be similar to alternative B, but with fewer acres treated. Effects to “other” ecological response units would be expected to be the same as described under alternative B, but with more fire and less mechanical. Significant decreases in livestock grazing under this alternative would do more to move frequent fire ecological response units towards desired conditions than any other alternative, as herbaceous surface vegetation recovers from decades of grazing, and can support a more resilient fire regime.	4,200 to 8,000 acres, treatments would have little effect on patch size.
D	Seral stage distribution would improve the distribution of tree sizes/ages, but other ecological characteristics would not improve as much. In the short term, there could be more acres where mechanical and fire treatments both occur under this alternative, moving more acres faster towards desired seral state distribution than other alternatives. In the long term, fewer overall acres would be treated	The effects on SDG would be identical to those described under alternative B. The effects of canopy closure would be identical to those described for alternative B where there were both mechanical and fire treatments. More ground disturbance, potentially increasing occurrence of exotic or invasive species.	In desert ecological response units, seral state distribution would maintain a low departure as there would be little change in the proportion of open states. The likelihood of undesirable fire would be reduced using a combination of mechanical, chemical, and fire treatments to eradicate invasive and exotic grasses. Where invasive and exotic species are

Alternative	1. Restore frequent fire ecosystems (MCD, PPF, PPE, MEW, JUG, PJG, SDG)	2. Improve grasslands, herbaceous, and ground cover	3. Restore ecological integrity of desert ecosystems: Sonora-Mojave mixed salt desert scrub (MSDS) and Mojave Sonoran desert scrub (SDS)
	because “fire only” treatments would be very limited, making it difficult to treat many acres, and to maintain those that are treated. Fire Regime: Where both fire and mechanical treatments are implemented, the effects would be identical to those described in alternative B. For frequent fire woodland ecological response units, and “other” ecological response units, effects would be as described under alternative A. Maintaining treated areas would be more difficult because of limited acres of wildland fire. Fewer acres would be treated because prescribed fire would mostly be limited to acres that had mechanical treatments. Where both mechanical and fire treatments could be used, the primary limitations on reaching desired conditions would be those constraints listed under Assumptions and Methods (page 285), and a deficit of old and/or large trees. SDG would remain highly departed, moving away from desired conditions as, with the exception of 500 acres, the only treatment opportunities would be those provided by wildfire when there is a natural start. There would be no significant changes expected in “other” ecological response units, so fire regimes would remain slightly departed, except for MCW, which is probably within its historic range of variability.	Fewer acres would be treated with fire, slowing down the movement of these ecological response units towards a healthy, diverse understory. Prescribed fire would be mostly limited to areas that also would have mechanical treatments. Ground cover would increase proportionally with the increase in herbaceous surface vegetation, but more so where the canopy is open and there is fire. The lack of fire in areas that are already open would slow down the improvement of the herbaceous surface vegetation, and the ground cover associated with it. The treatment of invasive species would be similar to alternative A, though mechanical treatments can increase the potential for the establishment of invasive species. Effects to “other” ecological response units would be expected to be the same as described under alternative B, but with more mechanical and less fire. Changes to grazing management under would increase the difficulty of restoring fire to frequent fire ecological response units because of increasingly narrow burn windows needed to account for more livestock, and more acres where surface fuels are impacted by grazing.	treated, herbaceous surface fuels would be reduced to historical levels, allowing fire to occur at sizes and intensities with its historic range of variability. The occasional fire would cover a much smaller area due to the discontinuous surface fuels and be easier to suppress. With a large historical patch size of 4,200 to 8,000 acres, treatments would have little effect on patch size.

Maintenance Level 1 and Temporary Roads

As part of managing vegetation with fire or mechanical thinning operations, the opening of maintenance level 1 roads and the construction of temporary roads is often required in order for equipment to access the project area.

A temporary road or trail is defined as a road or trail necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road or trail and that is not included in a forest transportation atlas (36 CFR 212.1). As with permanent roads, temporary roads require soil disturbance, compaction and drainage manipulation.

Maintenance level 1 roads are roads that have been placed in storage between intermittent uses. The period of storage must exceed one year. Basic custodial maintenance is performed to prevent damage to adjacent resources and to perpetuate the road for future resource management needs. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Roads managed at this maintenance level are described as being in basic custodial care.

Mechanical treatments may require more reconstruction (e.g., curve widening, hardened drainage crossings) of roads or the reopening of maintenance level 1 roads to accommodate the design needs of the critical vehicle to perform mechanical treatment than fire treatments or would require. The reconstruction and opening of maintenance level 1 roads temporarily increases the miles of open roads and the amount of soil erosion that occurs during the life of a project. Roads can be significant sediment sources to water bodies (Gucinski et al. 2001) because soil disturbed during construction (e.g., cut and fill) and use is more susceptible to being entrained by water flowing across the ground surface. Where surface water enters a stream channel (e.g., at a cross-drain), the eroded soil is introduced to the hydrologic network. Sediment contributions from roads can be extreme where culverts are plugged and stream flow is either diverted down the road, or the road fill at the stream crossing is eroded and delivered to the channel below.

Mechanical treatments may also require more construction of temporary roads during the treatment period to access the treatment areas than fire treatments. Occasionally, temporary road construction would also remove vegetation along the road corridor, expose mineral soil, and result in soil compaction along the roadbed. Typically, there is a pulse of erosion from roads during the first 2 years following road construction or reopening (MacDonald and Coe 2008; Megahan 1974). New roads or reopening closed roads may also provide an avenue for the invasion and establishment of invasive plant species.

Maintenance level 1 roads and temporary roads that support ecosystem restoration activities, fuels management, or other short-term projects should be closed, decommissioned, or obliterated (restored to more natural vegetative conditions) upon project completion to protect watershed condition, minimize wildlife disturbance, and prevent illegal motorized use.

All alternatives will require the opening of some maintenance level 1 roads and the construction of temporary roads to varying extents.

Management Areas

Management areas have special, exceptional, or unique values that provide a variety of functions, including ecological, economic, social, and educational. These areas often require different management from surrounding areas, and can affect, or be affected by, adjacent areas.

Wilderness

Wilderness areas are designated by the US Congress, and are defined in the Wilderness Act of 1964 as:

> A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain.

Designated wilderness areas have been designated by Congress.

Recommended wilderness areas are areas that could be recommended for wilderness designation. Resource specialists used a standardized process to identify all areas within the Tonto National Forest that are suitable for inclusion in the National Wilderness Preservation System, as defined in the 1964 Wilderness Act. Areas that are designated as recommended wilderness would be managed to retain or improve the wilderness characteristics for which they were designated, if and until they are considered for designation by Congress. The recommendation is a preliminary administrative recommendation that will receive further review and possible modification by the Chief of the Forest Service, the Secretary of Agriculture, and the President of the United States.

Where wilderness areas are bounded by a road, or where a road goes into a wilderness area, the actual boundary of the wilderness area starts 100 feet from either side of the road.

Ideally, fire would function in its natural ecological roles within wilderness areas, however, the following exceptions need to be considered:

- Where fuel structure and composition are departed from reference conditions, it can be difficult, or impossible for fire to produce beneficial effects without active management, such as prescribed fire, management ignitions on wildfires, or fuel manipulation that could include hand thinning or handlines in order to manage a fire for beneficial effects and manageable behavior. This is most often true in frequent fire ecological response units, particularly forest and woodland frequent fire ecological response units, from which fire has been withheld for multiple cycles.
- Where the natural fire regime is for high intensity and high severity fire, “characteristic” fire behavior and effects may produce undesirable effects to adjacent ecological response units (particularly those that are departed), and/or to downslope/downwind areas. For example, a fire burning in interior chaparral would probably be burning intensely with a high rate of spread because, most of the time, chaparral either burns intensely or not all. If it was burning uphill, and would run into an area of ponderosa pine/evergreen oak that is highly departed and has copious ladder fuels, or towards a road that has flammable vegetation on the opposite side that could easily be ignited by wind-driven embers, there could be a need to manipulate fuels to avoid undesirable effects and behavior.

Management activities are more restricted in wilderness areas, and in adjacent areas if an activity could jeopardize the wilderness character of a wilderness area. Forest plan standards and guidelines for wilderness areas include authorizing the use of equipment for emergencies, resource protection, wildland fire, or maintenance of authorized improvements, as long as the action would not permanently degrade the wilderness characteristics of the area. Such activities could include, but are not restricted to, large equipment (such as bulldozers or feller bunchers), active fire management (including helicopters, management ignitions, the creation of temporary firelines if, once rehabilitated, there would be no permanent effects), treatment of invasive species, or helicopters. Authorization would be specific temporally and spatially, and would depend on a number of variables that could include, but are not restricted to, soil erodibility, vegetation type, values threatened (by wildfire, invasive species, or other undesirable conditions), as well as the effects of not taking an action. ‘Resource protection’ could sometimes include strategic mechanical thinning, depending on the duration and intensity of the perceived effects.

There are eight designated wilderness areas on the Tonto National Forest: Four Peaks (60,688 acres), Hellsgate (37,427 acres), Mazatzal (247,995 acres), Pine Mountain (11,498), Salome (18,519 acres), Salt River Canyon (32,096 acres), Sierra Ancha (20,237 acres), and the Superstition Wilderness (160,115 acres). The Pine Mountain Wilderness has shared management with the Prescott National Forest. There would be no changes in the management of these areas between alternatives, except as they may be affected by adjacent recommended wilderness areas. These effects are described in table 87.

The majority of the proposed recommended wilderness areas are either inaccessible or rugged, with limited access, or areas that would fill in "holes" in existing wilderness areas by moving a boundary to a more logical management location, such as a road or a stream. There are no recommended wilderness areas proposed under alternatives A and D. Alternative C proposes 47 recommended wilderness area, about 399,029 acres. Alternative B proposes 7 recommended wilderness areas, a subset of those proposed in alternative C; for a total of about 43,204 acres. In general, the following effects should be expected in all areas identified as recommended wilderness:

- Where there are more contiguous areas of recommended wilderness means there would be expanded management options for wildfires where the natural fire regime includes higher severity, and there would be lower expectations on the part of the public that a wildfire burning in recommended wilderness would be suppressed.
- More restrictions on the treatment of invasive species. Some species, invasive grasses in particular, have already affected the potential fire behavior and effects by changing the structure of the fuels. For example, invasive grasses in the Sonoran Desert now provide a continuous fine surface fuels over hundreds of thousands of acres, changing an ecosystem in which fire was a rare occurrence, to one which supports frequent fires. That said, in recommended wilderness there is the potential for decreased likelihood of new populations of invasive species becoming established because of decreased public use, including motorized recreation which can disperse seeds.
- Decreased potential for human started wildfires (figure 38) because of fewer vehicles, campfires, generators, and other recreation-related equipment and activities that have been documented as ignition sources.
- Decreased options for mechanical treatments outside of road corridors. In most cases, the parts of recommended wilderness areas that would benefit from mechanical treatments are too rugged or remote for mechanical treatments to be an option. Treatments that would leave long-term effects that would not be perceived as "natural," would not be allowed, e.g., stumps in thinning units.
- The management of wildland fires in these areas would continue to depend largely on air resources, but the "box" for managing any given fire would be larger.
- Grazing management would continue to have a significant impact on the effectiveness of wildland fire meeting resource objectives. In many of the recommended wilderness areas, it would not be possible to use fire effectively if there were no changes in grazing management.

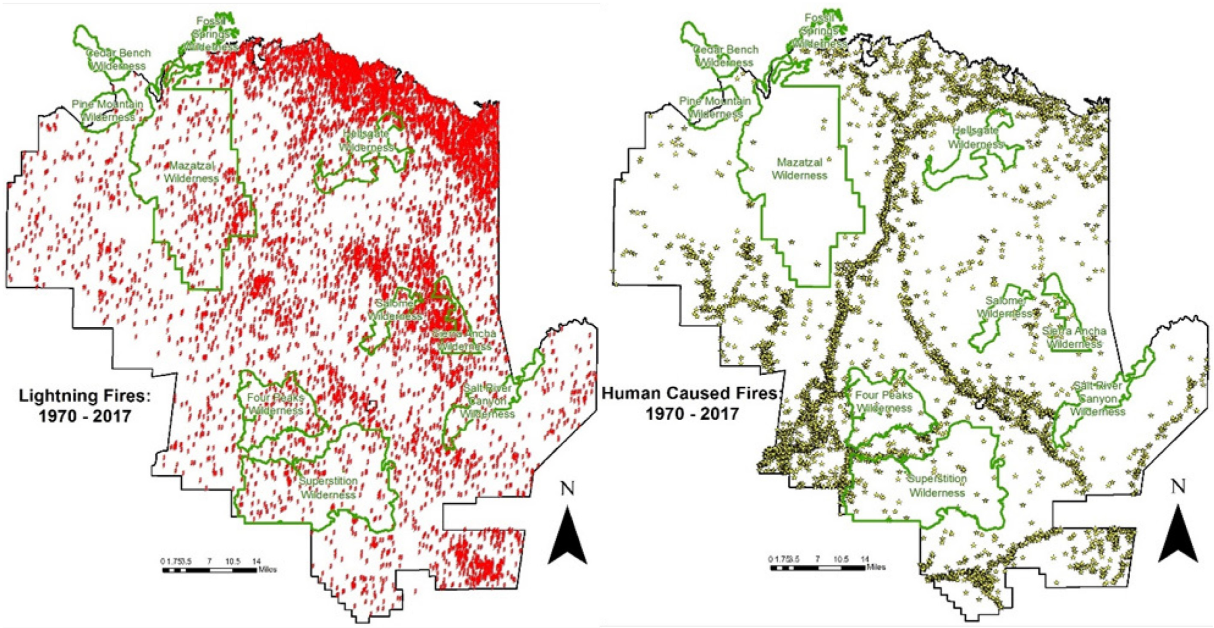

Figure 38. Wildfire starts on the Tonto National Forest between 1970 and 2017 broken out by human starts and lightning starts

Effects that would be specific to a recommended wilderness area are described below (see table 86 and table 87). Ratings were given to each proposed recommended wilderness areas as follows:

1 - Mostly beneficial with no significant concerns

2 - Neutral effects

3 - Beneficial but with some changes needed

4 - Not recommended from a fire and vegetation perspective

The following ecological response unit acronyms are used in the tables:

- DES - Desert Ecosystems
    - SDS - Sonora-Mojave mixed-salt desert scrub;
    - MSDS - Sonoran Mid-Elevation Desert Scrub
- IC - Interior Chaparral
- MCD - Mixed Conifer–Frequent Fire
- MCW - Wet Mixed Conifer/Mixed Conifer with Aspen
- MEW - Madrean Encinal Woodland
- MPO - Madrean Pinyon Oak
- PJC - Pinyon-Juniper Evergreen Shrub
- PJG - Pinyon-Juniper Grass
- JUG - Juniper Grass
- PJO - Pinyon-Juniper Woodland
- PPE - Ponderosa Pine-Evergreen Oak
- PPF - Ponderosa Pine Forest
- PG - Perennial Grass Subclass
- SDG - Semi-Desert Grasslands

Table 86. Effects of recommended wilderness areas to vegetation, fire, and fuels

Recommended Wilderness Area	Rating	Effects to vegetation, fire, and fuels
Alder Point	1	There are no values at risk that would be affected by this designation. In the easternmost corner, this recommended wilderness area is adjacent to a contiguous area of frequent fire ecological response units (JUG, SDG) in the Mazatzal Wilderness, and adding Alder Point would expand that contiguous area by about 1,000 acres. This would increase the flexibility for line officers and fire managers making decisions on the management wildland fire, increasing the chances that wildfire could be used to treat these areas (see the Fire and Vegetation section for specific fire effects in these ecological response units).
Baker Mountain	3	The south side of the northernmost group of polygons that comprise this recommended wilderness area includes PPE and MEW (frequent low severity fire ecological response units), as well as IC and PJC (less frequent, mixed to high severity fire ecological response units). Fire managers have expressed concerns about management options and holding concerns where the IC and MEW are adjacent to the existing Sierra Ancha Wilderness, because of the potential for extreme fire behavior on steep slopes. Such behavior produces high severity fire effects where it burns and, there are steep slopes, could produce flooding and debris flows downslope from the burned areas. As a recommended wilderness area, there would be fewer options for manipulating a fire and fuels in that area. That would narrow burn windows that would allow fire managers to manipulate fire behavior to produce the desired fire effects. Consideration should be given to designating some, but not all, of this proposed recommended wilderness area to allow the maximum opportunities for restoring frequent fire ecological response units to a condition in which they would be resilient to fire and other natural disturbances. Where there are areas with frequent fire ecological response units that are moderately to highly departed and are operable for thinning equipment, it would be beneficial for those areas, and the adjacent ones, to not be designated at this time. Specifically, the area known as Juniper Flats, and some of the more operable areas in PJG and PPE along SR288 would benefit from mechanical treatments to reduce the potential for high severity fire. Recommend removing Object IDs: 355, 351, and 356 from this recommended wilderness area.
Black Cross	2	With only low elevation riparian and desert ecological response units in and adjacent to this recommended wilderness area, the need for fire is low, and the greater There are no values at risk that would be affected by this designation.
Blue Peak	1	This area is a mosaic of fire regimes ranging from frequent fire (SDG, PJG, JUG), to infrequent fire (IC, PJC) to, very rarely burns (MSDS, SDS). Maintaining this mosaic will require fire, but the wrong kind of fire would be devastating to the desert ecological response units, and extremely damaging to frequent fire systems that have highly departed fuel structures. Past management (grazing and fire suppression) have resulted in about 8,000 acres of frequent fire woodlands that are moderately to highly departed. There is a lot of recreation near the southern/lower elevations of this recommended wilderness area, with lots of disturbed ground, user created trails and roads, and lots of invasive grasses that contribute to fire spread in the desert ecological response units. There is just one access road, and it goes up though the middle of this recommended wilderness area. The Tonto National Forest does not have a right of way to access it. If there was access to that road, there would be some good opportunities for beneficial wildland fire in the northern area.
Boulder	4	Half of this recommended wilderness area is contiguous IC, which is an ‘on/off’ fuel, and when it does burn, it burns with high intensity / high severity, and a fast ROS. In this recommended wilderness area, the IC intergrades into PPE, one of

Recommended Wilderness Area	Rating	Effects to vegetation, fire, and fuels
		the most departed and at risk ecological response units on the forest. Where these two ecological response units meet, there is often encroachment in both directions, where pine has encroached into IC, and where IC shrubs have moved into the PPE, in both cases creating a fuel structure that would not produce the desired fire effects or behavior unless closely managed. The recommended wilderness area is in an area that currently has proposed Boulder heavy off-highway vehicle use, particularly in the desert ERUs ecological response units the lower elevations to the east and west. The current road and trail system provides good holding features for wildland fire; many of the roads would be expected to be closed if the area was designated as RW, decreasing options for wildland fire management.
Bull Canyon	1	This proposed recommended wilderness area is rugged, and mechanical treatments would be difficult, even if they were desired. It is bounded by roads on the south and east. There would be little change in management options, though the designation of this area as a recommended wilderness area would increase the options for line officers and fire managers when there is a natural ignition. Cherry Creek is immediately adjacent to the east, and would benefit from having more flexibility for the management of wildland fire in the SDG on its west side because frequent fire would produce less sediment than fewer, higher severity fires in a system that is adapted to frequent fire. There are no values at risk that would be affected by this designation.
Bumblebee	2	There would likely be minimum change in management actions within this area if it was a Wilderness area. This area is a mosaic of fire regimes, of which about 3 percent (almost 900 acres) is a frequent fire ecological response unit (SDG, PPE); about 27 percent (around 8,200 acres) is desert (fire should be rare), and about 55 percent (around 16,800 acres) is an infrequent fire ecological response unit (IC). The remaining 15 percent (about 4,600 acres) is riparian vegetation. In riparian areas there is great variability in fire regimes, and the fire regimes relate to the adjacent ecological response units, so can vary from frequent to infrequent to rare. Maintaining this mosaic will require fire, but the wrong kind of fire would be, and has been, devastating to the desert ecological response units. At higher elevations, the lack of frequent fire has allowed the fuel structures to support the wrong kind of fire, which has been, and would be, extremely damaging to the PPE. There is a lot of recreation near the eastern/lower elevations of this recommended wilderness area along roads, particularly SR188; FS445, FS143, with lots of disturbed ground, user created trails and roads and human-caused ignitions. In wet years, invasive grasses provide a contiguous surface herbaceous fuel load that contribute to fire spread in the desert ecological response units, and a significantly increased threat of fire to values at risk. The increased flexibility of having additional acres of wilderness that are adjacent to other wildernesses would facilitate the ability of the Tonto National Forest to get fire back into the frequent and infrequent fire ecological response units in which the right kind of fire is needed to restore and/or maintain the resilience of those ecological response units.
Childs	2	There would be no significant effects on fire and vegetation management. This proposed area is all JUG, a frequent fire ecological response unit. The adjacency to the Cedar Bench Wilderness (on the Prescott National Forest), and the lack of any values at risk would increase the likelihood that natural ignitions in this area could be managed largely for resource benefits.
Diamond Butte	2	This would expand the Hellsgate Wilderness into adjacent rugged, inaccessible areas. This recommended wilderness area is a mosaic of mostly two fire regimes: PJC (57 percent), which is an ‘on/off’ fuel, burning intensely when it will burn, but only flammable at certain times of the year and moderate to highly departed frequent fire woodland ecological

Recommended Wilderness Area	Rating	Effects to vegetation, fire, and fuels
		response units (41 percent). This combination could support large, high severity fires, in part because the condition of the frequent fire ecological response units would support more high severity, and is more flammable than the surrounding PJC. District fire managers have some holding concerns because of potential limitations on tactics for wildfire management because of the fuels in the area.
Dutchwoman Butte	2	This area is adjacent to the Salome Wilderness to the north. The majority of the area is desert, with some SDG that extends into a larger area of contiguous SDG to the north. There are no values at risk that would be expected to be affected. There is no good access to the Hellsgate Wilderness, and no holding features in this recommended wilderness area, so there would be no significant effects on fire and vegetation management.
Fossil Springs	1	This would fill in an existing ‘hole’ between the existing Mazatzal Wilderness and Fossil Creek. There are no values at risk that would be affected by this designation. There would be no significant effects to fire or vegetation management.
Four Peaks Wilderness Contiguous A	1	There would be no effects on fire and vegetation management. There are no values at risk that would be affected by this designation.
Four Peaks Wilderness Contiguous B	1	There would be no effects on fire and vegetation management. There are no values at risk that would be affected by this designation.
Gun Creek	2	This proposed recommended wilderness area is a mosaic of fire regimes, about 42 percent (~15,000 acres) is frequent fire regimes, large portions of which are highly departed. Effects would be as described for the proposed Diamond Butte recommended wilderness area, in regards to managing a mosaic of fire regimes. There are no values at risk that would be affected by this designation.
Haunted Canyon	1	There would be no significant effects to fire and vegetation management. There is an inholding that would become ‘wilderness locked’ between the proposed recommended wilderness area and the existing Superstition Wilderness. However, there are currently no access roads, so there would be no change for access to the inholding. There is a fair amount of off-highway vehicle usage right now and a trail that goes right up the middle to access the superstition wilderness. That would remain the main holding feature for wildland fire.
Horse Mesa	2	There is no access to this area, so there would be no effect on fire and vegetation management options. The 482 acres of frequent fire ecological response unit (SDG) is on the mesa tops. Fire would only move down into desert areas when there had been sufficient moisture for surface fuels to grow. There are no values at risk that would be affected by this designation.
JK Mountain	1	This areas is a mosaic of frequent ecological response units, IC, and desert. There are no holding features within this area, so the only option for treating it would be wildfire. This would expand a contiguous area of JUG out from the Superstition Wilderness, expanding the options for wildfire management.
Lime Creek	2	There would be no significant effects to fire and vegetation management. On the west side, the recommended wilderness area would surround private land on three sides in one case, and completely in another, but that would not change the strategies or tactics that could or would be used for fire and vegetation management. There are no values at risk that should be affected by this designation.
Picacho	4	There are two inholdings in this proposed recommended wilderness area, both of which are accessible by roads. This area lies within the Highway Tanks, a collaborative project with the San Carlos Apache, and a priority for Region 3. Implementation is expected to begin in 2019. Designating this area would remove about 9,000 acres of potential mechanical treatments from the project, and could complicate the implementation of prescribed fire. This area is a mosaic of fire regimes, for which the most effective management would be a combination of fire and mechanical

Recommended Wilderness Area	Rating	Effects to vegetation, fire, and fuels
		treatments to restore and maintain that mosaic. Larger contiguous areas with few values at risk provide more flexibility for the management of wildland fire.
Pigeon Creek	1	There would be no significant effects on fire and vegetation management. There are inholdings, but there would be no significant changes to strategies and tactics that could or would be used for fire or vegetation management. Over 97 percent of this area is comprised of frequent fire ecological response units, and is adjacent to other frequent fire ecological response units and the Pine Mountain Wilderness. Expanding the contiguous area of frequent fire ecological response units will increase the options for wildland fire.
Rattlesnake	2	There would be no significant effects on fire and vegetation management.
Rock House	2	There are no values at risk that would be affected by this designation. There aren't a lot of holding features in this area, so there is little effect if it is designated as a recommended wilderness area.
Rockinstraw	4	This is a mosaic of fire regimes that would expand the Salt River Canyon Wilderness. Currently, there are some good opportunities for treatments, including mechanical, which would not be available if this area was designated.
Salt River Canyon Wilderness Contiguous A	1	This recommended wilderness area would capture the upper end of a watershed, and would have no significant effect on fire or vegetation management.
Salt River Canyon Wilderness Contiguous B	1	There could be beneficial effects for fire and vegetation management if this area was designated.
Salt River Canyon Wilderness Contiguous C	1	This would fill in an existing 'hole' between the existing Salt River Wilderness and a road. There would be no significant effects on fire or vegetation management.
Sierra Ancha Wilderness Contiguous A	1	This would fill in an existing 'hole' between the existing Sierra Ancha Wilderness and the Cherry Creek Road. There would be no significant effects on fire or vegetation management.
Sierra Ancha Wilderness Contiguous B	1	Effects would be as described for Sierra Ancha Wilderness Contiguous recommended wilderness area A.
Sierra Ancha Wilderness Contiguous C	1	Effects would be as described for Sierra Ancha Wilderness Contiguous recommended wilderness area A.
Sierra Ancha Wilderness Contiguous D	1	Effects would be as described for Sierra Ancha Wilderness Contiguous recommended wilderness area A.
Sierra Ancha Wilderness Contiguous E	1	Effects would be as described for Sierra Ancha Wilderness Contiguous recommended wilderness area A.
Sierra Ancha Wilderness Contiguous F	1	Effects would be as described for Sierra Ancha Wilderness Contiguous recommended wilderness area A.
Sierra Ancha Wilderness Contiguous G	1	Effects would be as described for Sierra Ancha Wilderness Contiguous recommended wilderness area A.
Sierra Ancha Wilderness Contiguous H	1	Effects would be as described for Sierra Ancha Wilderness Contiguous recommended wilderness area A.
Sierra Ancha Wilderness Contiguous I	1	Effects would be as described for Sierra Ancha Wilderness Contiguous recommended wilderness area A.
Sierra Ancha Wilderness Contiguous J	1	Effects would be as described for Sierra Ancha Wilderness Contiguous recommended wilderness area A.

Recommended Wilderness Area	Rating	Effects to vegetation, fire, and fuels
Smokey Hallow	2	See comments for the Diamond Butte recommended wilderness area which is adjacent to this recommended wilderness area. This proposed recommended wilderness area is a mosaic of two fire regimes: PJC (17 percent), which is an “on/off” fuel, burning intensely when it will burn, but only flammable at certain times of the year, and frequent fire woodland ecological response units (83 percent). This would contribute to the contiguous area for the mosaic in the adjacent recommended wilderness area and the Hellsgate Wilderness.
Superstition Wilderness Contiguous A	1	This would extend a small area of the Superstition Wilderness that is a frequent fire ecological response unit (SDG) out to FS172A, which is the obvious holding feature at this location, so there would be no significant changes to fire and vegetation management.
Superstition Wilderness Contiguous B	1	This designation would provide some protection for an area of mostly riparian vegetation that is already surrounded by the Superstition Wilderness. There would be no significant effects for fire or vegetation management.
Superstition Wilderness Contiguous C	1	There would be no significant effects to fire or vegetation management to this area or adjacent areas.
Superstition Wilderness Contiguous E	1	There would be no significant effects to fire management to this area or adjacent areas.
Superstition Wilderness Contiguous F	1	There would be no significant effects to fire or vegetation management to this area or adjacent areas.
Tangle Peak	1	The proposed Tangle Peak Recommended Wilderness was split into four units, 119A, 119B, 119C, and 119X. This designation would bring about six miles of the western boundary of the Mazatzal Wilderness west to a powerline corridor, and most of the rest of the previous boundary would be moved out to roads to the west. This would improve the effectiveness of fire and vegetation management. There are no values at risk that would be affected by this designation.
Tanner Peak	3	This recommended wilderness area is adjacent to Rose Creek, a wildland-urban interface inholding with about 15 private residences. The fuels in this area will need to be actively managed to minimize the risk of high severity fire. Consideration should be given to designating some, but not all, of this area in order to provide a buffer around Rose Creek where there could be more intensive fuels management. Recommend removing Object ID 430, 427, 426, and 430 from the currently proposed designation. Designating these areas would have a negative effect on the forest's ability to move these areas toward desired condition and place values at risk
Tumbleweed	1	There are no values at risk that would be affected by this designation. There are few holding features in this area, so there would be no significant effects on fire or vegetation management.
Wood Canyon	1	This area is on the border of the Tonto National Forest, adjacent to the White Canyon Wilderness, which is managed by the USDI Bureau of Land Management. SDG is mostly up on the mesas, and could only move off the mesas if/when there had been sufficient moisture in the surrounding desert to produce a crop of grass (mostly red brome). There would be no significant effects to fire and vegetation management. There are no values at risk that would be affected by this designation
Zimmerman	1	There is one inholding along Coon Creek, but there would be no significant effects to fire or vegetation management. There aren’t a lot of holding features in this area other than the ridges and drainages. There are no values at risk that would be affected by this designation

Table 87. Acres and percent of ecological response units within each recommended wilderness areas

Recommended Wilderness Area	Acres (percent)	Ecological Response Units
Alder Point	14,844 (3.9)	Desert Willow (214 acres, 1.4 percent) Fremont Cottonwood / Shrub (150 acres, 1.0 percent), Juniper Grass (433 acres, 2.9 percent), Mojave-Sonoran Desert Scrub (13,461 acres, 90.7 percent), Semi-Desert Grassland (533 acres, 3.6 percent), Sycamore - Fremont Cottonwood (53 acres, 0.4 percent)
Baker Mountain	10,565 (2.8)	Arizona Alder–Willow (4 acres, less than 1 percent), Fremont Cottonwood / Shrub (11 acres, less than 1 percent), Interior Chaparral (1,611 acres, 15.2 percent), Madrean Encinal Woodland (486 acres, 4.6 percent), Madrean Pinyon-Oak Woodland (66 acres, less than 1 percent), Mixed Conifer w/ Aspen (201 acres, 1.9 percent), PJ Evergreen Shrub (1,847 acres, 17.5 percent), PJ Grass (184 acres, 1.7 percent), Ponderosa Pine–Evergreen Oak (6,127 acres, 58.0 percent), Sycamore - Fremont Cottonwood (27 acres, less than 1 percent)
Black Cross	2,560 (less than 1)	Fremont Cottonwood / Shrub (7 acres, 0.27 percent), Mojave-Sonoran Desert Scrub (2,553 acres, 99.7 percent)
Blue Peak	23,283 (6.24)	Fremont Cottonwood–Conifer (12 acres, less than 1 percent), Fremont Cottonwood / Shrub (332 acres, 1.4 percent), Interior Chaparral (903 acres, 3.9 percent), Juniper Grass (6,861 acres, 29.5 percent), Mojave-Sonoran Desert Scrub(12,078 acres, 51.9 percent), PJ Evergreen Shrub(589 acres, 2.5 percent), PJ Grass(124 acres, less than 1 percent), Semi-Desert Grassland(1,279 acres, 5.5 percent), Sonora-Mojave Mixed Salt Desert Scrub(908 acres, 3.9 percent), Sycamore - Fremont Cottonwood(196 acres, less than 1 percent)
Boulder	72,508 (19.43)	Desert Willow (124 acres, less than 1 percent), Fremont Cottonwood - Conifer(31 acres, less than 1 percent), Fremont Cottonwood / Shrub(350 acres, less than 1 percent), Interior Chaparral (36,407 acres, 50.2 percent), Juniper Grass (1,040 acres, 1.4 percent), Madrean Encinal Woodland (233 acres, less than 1 percent), Mojave-Sonoran Desert Scrub (20,655 acres, 28.5 percent), PJ Evergreen Shrub (879 acres, 1.2 percent), Ponderosa Pine–Evergreen Oak (1,332 acres, 1.8 percent), Semi-Desert Grassland (9,888 acres, 13.6 percent), Sonora-Mojave Mixed Salt Desert Scrub(1,216 acres, 1.7 percent), Sycamore - Fremont Cottonwood (353 acres, less than 1 percent)
Bull Canyon	7,712 (2.1)	Desert Willow (363 acres, 4.7 percent), Fremont Cottonwood–Conifer (12 acres, less than 1 percent), Fremont Cottonwood / Shrub (154 acres, 2.0 percent), Mojave-Sonoran Desert Scrub (461 acres, 6.0 percent), PJ Evergreen Shrub (2,503 acres, 32.4 percent), PJ Grass (16 acres, less than 1 percent), Semi-Desert Grassland (4,117 acres, 53.4 percent), Sycamore - Fremont Cottonwood (88 acres, 1.1 percent)
Bumblebee	30,512 (7.6)	Desert Willow (64 acres, less than 1 percent), Fremont Cottonwood – Conifer (7 acres, less than 1 percent), Fremont Cottonwood – Oak (17 acres, less than 1 percent), Fremont Cottonwood / Shrub (84 acres, less than 1 percent), Interior Chaparral (16,736 acres, 54.9 percent), Mojave-Sonoran Desert Scrub (8234 acres, 27 percent), Ponderosa Pine – Evergreen Oak (698 acres, 2.3 percent), Semi-Desert Grassland (4,476 acres, 14.7 percent), Sycamore - Fremont Cottonwood (197 acres, less than 1 percent).
Childs	402 (0.1)	Juniper Grass (7,194 acres, 100 percent)
Diamond Butte	15,498 (4.1)	Fremont Cottonwood - Conifer (24, less than 1 percent), Fremont Cottonwood / Shrub (20, less than 1 percent), Juniper Grass (1,233, 8.0 percent), Madrean Encinal Woodland (6,020, 38.8 percent), PJ Evergreen Shrub (6,389, 41.2 percent), PJ Grass (1,606, 10.4 percent), Sycamore - Fremont Cottonwood (207, 1.3 percent)

Recommended Wilderness Area	Acres (percent)	Ecological Response Units
Dutchwoman Butte	3,806 (1.02)	Desert Willow (90, 2.3 percent), Fremont Cottonwood / Shrub (4, less than 1 percent), Mojave-Sonoran Desert Scrub (2,688, 70.6 percent), Semi-Desert Grassland (886, 23.3 percent), Sonora-Mojave Mixed Salt Desert Scrub (140, 3.7 percent)
Fossil Springs	30 (0.01)	Juniper Grass (28, 93.0 percent), Sycamore - Fremont Cottonwood (2, 7.0 percent)
Four Peaks Wilderness Contiguous A	9 (0.00)	Mojave-Sonoran Desert Scrub (9, 100 percent)
Four Peaks Wilderness Contiguous B	8 (0.3)	Fremont Cottonwood / Shrub (8, 99.8 percent), Mojave-Sonoran Desert Scrub (less than 1 percent, less than 1 percent)
Gun Creek	29,657 (7.95)	Arizona Alder - Willow (46, less than 1 percent), Fremont Cottonwood - Conifer (27, less than 1 percent), Fremont Cottonwood - Oak (8, less than 1 percent), Fremont Cottonwood / Shrub (20, less than 1 percent), Juniper Grass (1,249, 4.2 percent), Madrean Encinal Woodland (5,489, 18.5 percent), Madrean Pinyon-Oak Woodland (1,993, 6.7 percent), PJ Evergreen Shrub (14,142, 47.7 percent), PJ Grass (4,907, 16.5 percent), Ponderosa Pine–Evergreen Oak (1,603, 5.4 percent), Sycamore - Fremont Cottonwood (172, less than 1 percent)
Haunted Canyon	11,059 (3.0)	Arizona Alder - Willow (23, less than 1 percent), Fremont Cottonwood - Conifer (1, less than 1 percent), Fremont Cottonwood / Shrub (74, less than 1 percent), Interior Chaparral (7,191, 65.0 percent), Juniper Grass (3,649, 33.0 percent), Semi-Desert Grassland (1, less than 1 percent), Sycamore - Fremont Cottonwood (119, 1.1 percent)
Horse Mesa	6,515 (1.75)	Desert Willow (5, less than 1 percent), Mojave-Sonoran Desert Scrub (5,942, 91.2 percent), Semi-Desert Grassland (482, 7.4 percent), Sycamore - Fremont Cottonwood (86, 1.3 percent)
JK Mountain	5,267 (1.41)	Interior Chaparral (1,063 acres, 20.2 percent), Juniper Grass (4,007 acres, 76.1 percent), Sycamore - Fremont Cottonwood (198 acres, 3.7 percent)
Lime Creek	56,771 (15.21)	Desert Willow (91 acres, less than 1 percent), Fremont Cottonwood - Conifer (265 acres, less than 1 percent), Fremont Cottonwood - Oak (3 acres, less than 1 percent), Fremont Cottonwood / Shrub (122 acres, less than 1 percent), Interior Chaparral (4,953 acres, 8.7 percent), Juniper Grass (15,921 acres, 28.0 percent), Mojave-Sonoran Desert Scrub (20,625 acres, 36.3 percent), Narrowleaf Cottonwood / Shrub (59 acres, less than 1 percent), PJ Evergreen Shrub (6,961 acres, 12.3 percent), Semi-Desert Grassland (7,453 acres, 13.1 percent), Sycamore - Fremont Cottonwood (318 acres, less than 1 percent)
Picacho	15,899 (4.26)	Desert Willow (41 acres, less than 1 percent) Fremont Cottonwood - Conifer (27 acres, less than 1 percent), Fremont Cottonwood / Shrub (171 acres, 1.1 percent), Herbaceous (wetland) (16 acres, less than 1 percent), Juniper Grass (8,086 acres, 50.9 percent), Madrean Encinal Woodland (less than 1 acres, less than 1 percent), Mojave-Sonoran Desert Scrub (485 acres, 3.0 percent), PJ Evergreen Shrub (4,709 acres, 29.6 percent), PJ Grass (932 acres, 5.9 percent), PJ Woodland (466 acres, 2.9 percent), Semi-Desert Grassland (892 acres, 5.6 percent), Sycamore - Fremont Cottonwood (74 acres, less than 1 percent)
Pigeon Creek	5,828 (1.56)	Juniper Grass (5,154 acres, 88.4 percent), PJ Evergreen Shrub (204 acres, 3.5 percent), PJ Grass (0 acres, less than 1 percent), Ponderosa Pine–Evergreen Oak (398 acres, 6.8 percent), Ponderosa Pine Forest (0 acres, less than 1 percent), Semi-Desert Grassland (3 acres, less than 1 percent), Sycamore - Fremont Cottonwood (69 acres, 1.18 percent)

Recommended Wilderness Area	Acres (percent)	Ecological Response Units
Rattlesnake	6,140 (1.65)	Desert Willow (4 acres, less than 17 percent), Fremont Cottonwood / Shrub (76 acres, 1.2 percent), Interior Chaparral (60 acres, less than 1 percent), Mojave-Sonoran Desert Scrub (5,293 acres, 86.2 percent), Semi-Desert Grassland (707 acres, 11.5 percent)
Rock House	5,228 (1.4)	Madrean Encinal Woodland (255 acres, 4.89 percent), PJ Evergreen Shrub (4,811 acres, 92.02 percent), Sycamore - Fremont Cottonwood (162 acres, 3.09 percent)
Rockinstraw	6,312 (1.69)	Fremont Cottonwood - Oak (50 acres, 0.80 percent), Interior Chaparral (2,835 acres, 44.91 percent), Juniper Grass (2,379 acres, 37.68 percent), Mojave-Sonoran Desert Scrub (110 acres, 1.74 percent), PJ Evergreen Shrub (243 acres, 3.85 percent), Semi-Desert Grassland (657 acres, 10.40 percent), Sycamore - Fremont Cottonwood (39 acres, 0.62 percent)
Salt River Canyon Wilderness Contiguous A	613 (1.00)	Juniper Grass (613 acres, 100 percent)
Salt River Canyon Wilderness Contiguous B	94 (0.62)	Interior Chaparral (less than 1 acres, 0 percent), Semi-Desert Grassland (94 acres, 99.8 percent)
Salt River Canyon Wilderness Contiguous C	13 (0.03)	PJ Evergreen Shrub (4 acres, 28 percent), Semi-Desert Grassland (10 acres, 71.9 percent)
Sierra Ancha Wilderness Contiguous A	50 (0.01)	PJ Evergreen Shrub (50 acres, 100 percent)
Sierra Ancha Wilderness Contiguous B	67 (0.02)	PJ Evergreen Shrub (63 acres, 93.09 percent), Semi-Desert Grassland (5 acres, 6.91 percent)
Sierra Ancha Wilderness Contiguous C	20 (0.01)	PJ Evergreen Shrub (14 acres, 71.9 percent), Semi-Desert Grassland (5 acres, 28.1 percent)
Sierra Ancha Wilderness Contiguous D	10 (0.01)	PJ Evergreen Shrub (10 acres, 100 percent)
Sierra Ancha Wilderness Contiguous E	18 (0.00)	PJ Evergreen Shrub (18 acres, 100 percent)
Sierra Ancha Wilderness Contiguous F	24 (0.01)	Madrean Encinal Woodland (24 acres, 100 percent)
Sierra Ancha Wilderness Contiguous G (1)	20 (0.01)	Madrean Encinal Woodland (20 acres, 100 percent)
Sierra Ancha Wilderness Contiguous H (1)	8 (0.00)	Madrean Encinal Woodland (8 acres, 100 percent)
Sierra Ancha Wilderness Contiguous I (1)	5 (0.00)	Madrean Encinal Woodland (5 acres, 100 percent)
Sierra Ancha Wilderness Contiguous J (1)	7 (0.00)	Madrean Encinal Woodland (7 acres, 98.8), Sycamore - Fremont Cottonwood (less than 1 acres, 1.23)

Recommended Wilderness Area	Acres (percent)	Ecological Response Units
Smokey Hallow (2)	1,634 (0.44)	Madrean Encinal Woodland (221 acres, 14 percent), PJ Evergreen Shrub (1,413 acres, 86 percent)
Superstition Wilderness Contiguous A (1)	12 (0.00)	Semi-Desert Grassland (12 acres, 100 percent)
Superstition Wilderness Contiguous B (1	28 (0.01)	Desert Willow (28 acres, 98.2), Fremont Cottonwood / Shrub (0 acres, less than 1 percent), Semi-Desert Grassland (0 acres, less than 1 percent)
Superstition Wilderness Contiguous C (1)	36 (0.01)	Interior Chaparral (30 acres, 81.9 percent), Mojave-Sonoran Desert Scrub (7 acres, 18.1 percent)
Superstition Wilderness Contiguous E (1)	616 (0.16)	Fremont Cottonwood / Shrub (4 acres, less than 1 percent), Mojave-Sonoran Desert Scrub (609 acres, 99.4 percent)
Superstition Wilderness Contiguous F (1)	827 (0.22)	Desert Willow (3 acres, less than 1 percent), Fremont Cottonwood / Shrub (2 acres, less than 1 percent), Mojave-Sonoran Desert Scrub (145 acres, 17.5 percent), Semi-Desert Grassland (676 acres, 81.7 percent), Sycamore - Fremont Cottonwood (2 acres, less than 1 percent)
Tangle Peak Recommended Wilderness Area (1)	21,361 (5.72)	Fremont Cottonwood - Conifer (167 acres, less than 1 percent), Fremont Cottonwood / Shrub (288 acres, 1.3 percent), Juniper Grass (5,743 acres, 26.9 percent), Mojave-Sonoran Desert Scrub (10,947 acres, 51.2 percent), Semi-Desert Grassland (3,766 acres, 17.6 percent), Sonora-Mojave Mixed Salt Desert Scrub (343 acres, 1.6 percent), Sycamore - Fremont Cottonwood (107 acres, less than 1 percent)
Tanner Peak Recommended Wilderness Area (3)	21,842 (5.85)	Desert Willow (90 acres, 0.4 percent), Fremont Cottonwood - Conifer (10 acres, less than 1 percent), Fremont Cottonwood / Shrub (710 acres, 3.2 percent), Interior Chaparral (3,396 acres, 15.5 percent), Mixed Conifer w/ Aspen (787 acres, 3.6 percent), Mojave-Sonoran Desert Scrub (6,048 acres, 27.7 percent), PJ Grass (877 acres, 4.0 percent), Ponderosa Pine–Evergreen Oak (4,555 acres, 20.8 percent), Semi-Desert Grassland (5,044 acres, 23.1 percent), Sonora-Mojave Mixed Salt Desert Scrub (263 acres, 1.2 percent), Sycamore - Fremont Cottonwood (62 acres, less than 1 percent)
Tumbleweed Recommended Wilderness Area	4,722 (1.27)	Fremont Cottonwood - Conifer (2 acres, less than 1 percent), Interior Chaparral (231 acres, 4.90 percent), Juniper Grass (3,913 acres, 82.87 percent), Mojave-Sonoran Desert Scrub (340 acres, 7.19 percent), PJ Woodland (224 acres, 4.74 percent), Sycamore - Fremont Cottonwood (12 acres, less than 1 percent)
Wood Canyon Recommended Wilderness Area	11,985 (3.21)	Fremont Cottonwood / Shrub (27 acres, 0.2 percent), Juniper Grass (1 acres, less than 1 percent), Mojave-Sonoran Desert Scrub (10,708 acres, 89.3 percent), Semi-Desert Grassland (1,249 acres, 10.4 percent)
Zimmerman Recommended Wilderness Area	9,217 (less than 1)	Desert Willow (8 acres, less than 1 percent), Fremont Cottonwood - Conifer (15 acres, less than 1 percent), Fremont Cottonwood / Shrub (6 acres, less than 1 percent), Interior Chaparral (439 acres, 4.77 percent), Juniper Grass (3,790 acres, 41.12 percent), Madrean Pinyon-Oak Woodland (172 acres, 1.86 percent), Mixed Conifer w/ Aspen (350 acres, 3.80 percent), Mojave-Sonoran Desert Scrub (774 acres, 8.40 percent), PJ Evergreen Shrub (534 acres, 5.79 percent), Ponderosa Pine–Evergreen Oak (172 acres, 1.86 percent), Semi-Desert Grassland (2,890 acres, 31.35 percent), Sycamore - Fremont Cottonwood (67 acres, less than 1 percent)

Alternative A

There are no proposed recommended wilderness areas under alternative A. In those areas proposed for recommended wilderness areas under alternatives B and C, wilderness characteristics could increasingly be impacted by recreational uses, including invasive species and increases in human caused wildfires.

Existing access would not change, and there would be no new constraints on treatment options.

Alternative B

Of the 43,204 acres proposed for recommended wilderness areas under alternative B, there are about 17,000 acres of frequent fire ecological response units. Those areas would have more constraints on mechanical treatments and prescribed fire, but potentially greater flexibility for wildfire management.

Effects to those areas that would be designated under alternative B would be as described under alternative A.

Alternative C

Of the 399,029 acres proposed for recommended wilderness areas under alternative C, there are about 143,000 acres of frequent fire ecological response units. Those areas would have more constraints on mechanical treatments and prescribed fire than non-wilderness areas, but greater flexibility for wildfire management.

Alternative C proposes the most recommended wilderness areas. Increased logistical complexity (access and resource availability) and constraints on management tools (chainsaws, engines, bulldozers, and aviation resources) could make fire management more complicated. Alternative C could reduce mechanical treatment opportunities which, in turn, could limit fire in places where fuel conditions are not conducive to beneficial fire effects or behavior.

Alternatives D

The effects of alternative D would be identical to those described under alternative A, but with more options for fire and mechanical treatments.

Comparison of Alternatives

Overall, there is greater protection for wilderness areas under alternatives B and C, with the greatest protections under alternative C. Wildfire is a critical tool for the management of public land, and alternative C would provide the greatest flexibility for the management of wildfires, but more limitations than alternative B on where mechanical treatments could be implemented. Overall, alternatives B and C would be the most beneficial for wilderness areas.

Wild and Scenic Rivers

Wild and scenic rivers are designated by the U.S. Congress to preserve the beauty and free-flowing nature of a stream. To be designated, rivers or sections of rivers must be free-flowing and possess at least one outstanding remarkable value, and must be managed for those wild and/or scenic characteristics for which they were deemed eligible. The Tonto National Forest has two designated wild and scenic rivers; Fossil Creek (16.8 miles) and the Verde River (40.5 miles). There would be no changes to the management of those areas.

All rivers on the Tonto National Forest were evaluated to determine their eligibility, resulting in 19 possible river segments with outstandingly remarkable values. All 19 segments are included in all four alternatives.

Vegetation and fire management activities affecting these areas would not change, as the segments are, and would remain, designated as 'eligible wild and scenic river' segments. Treatment of invasive species, mechanical treatments, wildland fire management, (as described in earlier sections) are mainly impacted by best management practices, mitigation measures, and design features required or recommended when implementation is within the stream corridor (0.25 miles on each side of the stream). The same are considered when treatments are in an area nearby, or adjacent, where treatments could affect the stream corridor, though they would not be expected to differ significantly from the same measures used in non-designated segments (FSH 1909.12_80).

Research Natural Areas and Botanical Areas

These areas are managed to maintain or enhance the characteristics for which they were designated or recommended. Research natural areas are part of a national network of ecological areas designated in perpetuity for research and education and/or to maintain biological diversity on National Forest System lands. Research natural areas are principally for non-manipulative research, observation, and study. A botanical area is an area that contains plant specimens, plant groups, or plant communities that are significant because of their form, color occurrence, habitat, location, life history, arrangement, ecology, rarity, or other features.

Currently, there are no designated botanical areas on the Tonto National Forest. There are three designated research natural areas: Buckhorn Mountain, Bush Highway, and Haufer Wash. There are four Recommended Research Natural Areas: Dutchwoman Butte, Picket Post Mountain, Three Bar, and Upper Forks Parker Creek. There are four recommended botanical areas: Mesquite Wash, Horseshoe, Fossil Springs, and Little Green Valley Fen.

Changes to designated areas would only occur if there were changes to areas adjacent to, or nearby/upslope/upstream from the proposed designated or recommended areas. Expected effects are described below in table 88.

Table 88. Recommended research natural areas and botanical areas and the effects expected by alternative

Area Name	Classification	Acres	Ranger District	Alternative A	Alternatives B and C	Alternative D
Buckhorn Mountain	Designated Research Natural Areas	2,801	Tonto Basin	No change	No significant changes expected.	No change.
Bush Highway	Designated Research Natural Areas	516	Mesa	No change	No change	No change
Dutchwoman Butte (new)	Recommended Research Natural Areas	86	Tonto Basin	No change	This area would be a good reference for disturbance effects (particularly fire and grazing) on the upper elevational range of SDG. That data could provide useful information for predicting the response of ecological response units (vegetation and fire regimes) to climate change.	No change
Fossil Springs (new)	Recommended Botanical Areas	9	Payson	No change	Parts of the upper watershed, some of the area immediately surrounding the proposed botanical area currently support unnaturally high fuel loads that could produce unnaturally severe fire effects. The actual effects depend on conditions before, during, and after a fire. Should fire occur under adverse conditions, the effects could destroy or severely damage many of the characteristics for which this botanical area is proposed. Designation of this area as a recommended botanical area could increase the priority of fuels treatments in the adjacent area and upper watershed, as well as what treatments and activities are deemed appropriate.	No change
Haufer Wash	Designated Research Natural Areas	751	Tonto Basin	No change	No change	No change
Horseshoe (new)	Recommended Botanical Areas	3,590	Cave Creek	There would be no change in management actions. However, visitation continues to increase on the Tonto National Forest, particularly in areas related to water-based recreation.	Designation of this area for special management would reduce the potential for uncharacteristic disturbances to rare, endemic, sensitive, and at-risk plant species	Same as alternative A

Area Name	Classification	Acres	Ranger District	Alternative A	Alternatives B and C	Alternative D
				With no additional protections, it should be expected that those characteristics for which this area is being proposed would be at increasing risk of damage from human impacts. Such impacts could include destruction or damage to populations of rare, endemic, sensitive, and at-risk plant species, and/or destruction/damage to limestone features.	found within the area. Thus far, there have been no significant disturbance from recreational area nearby, but that could change in the near future with increasing human populations nearby and increasing popularity of water-based recreation.	
Little Green Valley Fen (new)	Recommended Botanical Areas	21	Payson	There have been no conflicts in this area but, without active management actions, the headcut could continue to grow. This could have significant adverse impacts on the vegetation and processes within fens, particularly if the moisture regime and/or chemistry are altered. If the fen dried out, it would be part of the fuel load in the area and, if it burned, it would be destroyed.	Fens occur under fairly narrow moisture regimes and chemistry. Livestock and elk grazing would be managed to minimize/remove adverse impacts on the existing headcut. This would stabilize the vegetative communities associated with the fen so that, outside of climate change, the fen would survive. Designation as a Recommended Botanical Area would provide additional protections to be considered when management actions are to be implemented on adjacent lands.	Same as alternative A
Mesquite Wash (new)	Recommended Botanical Areas	10	Mesa	Increasing recreational activities at this site have the potential to damage plants and soil, and contaminate soil and water from lead bullets. Recreational shooting also has the potential to start fires. Under this alternative, there would be little change in management, leaving this area at increasing risk of damage and degradation, mostly from human impacts.	There would be increased protections for the unique plant communities, soils, and a natural spring. Management actions associated with this designation would provide protections that would prioritize botanical values by direct and indirect effects, such as limiting recreational shooting, off-highway vehicle usage, or livestock grazing. All of these affect the condition of the vegetation, including invasive species. Grazing affects the surface herbaceous vegetation/fuel, and shooting can result in wildfires.	Same as alternative A
Picket Post Mountain	Recommended Research Natural Areas	1,261	Globe	No change	Management actions that protect the botanical resources in this area would be prioritized, particularly the	Under alternative D, existing protections would be removed, potentially

Area Name	Classification	Acres	Ranger District	Alternative A	Alternatives B and C	Alternative D
					Cottonwood Willow riparian community.	increasing the likelihood of plant communities being damaged or destroyed, particularly by off-highway vehicle use and/or grazing. Grazing affects surface fuel loading, changing the potential fire effects and behavior.
Three Bar (new)	Recommended Research Natural Areas	22,920	Tonto Basin	No change	Alternatives B and C would change the focus in this area from primarily wildlife, to a broader, ecological focus, particularly research. There is a broad range of flora and fauna within the area, ranging from desert riparian zones to PPE. This area is adjacent to the Four Peaks Wilderness, and would allow almost the entire elevational gradient from Lake Roosevelt to the aspen on top of the Four Peaks Wilderness to have special management protections. The primary human disturbance in this area for decades has been fire suppression, so this area provides valuable data for assessing how plant associations move up or down in elevation in response to climate change.	No change
Upper Forks Parker Creek	Recommended Research Natural Areas	1,441	Pleasant Valley	No change	Existing protections uld continue, affecting multiple ecological response units and the ecotones between them by managing dispersed recreation at low intensities, restrictions on off-highway vehicle use, and no livestock grazing. These will allow the existing ecological response units to respond to natural disturbances, such as fire and drought, as well as climate change. There has been extensive and long-term research in this area for decades.	Under alternative D, existing protections would be removed, potentially increasing the likelihood of plant communities being damaged or destroyed, particularly by off-highway vehicle use and/or grazing, and potentially ending decades of research.

Comparison of Alternatives

Alternatives B and C would provide the most beneficial options for moving ecological response units towards desired ecological conditions by providing management direction affecting recreational shooting (causes fires), grazing (affects surface fuels), off-highway vehicles (weeds and fuels), and the contiguousness of fuels or burn units across the landscapes affected.

National Trails

There are four national trails on the Tonto National Forest. Between the alternatives, the differences in effects would mostly relate to the ratio of fire to mechanical treatments. Trails are sometimes used as firelines, though in the case of the National Trails System, any use of these trails would be likely to use Minimum Impact Suppression Tactics, or as agreed upon with other affected resources. Though rare, trails may occasionally be temporarily closed to ensure public safety and facilitate the implementation of prescribed fire or mechanical treatments. Where trails run through forest, woodland, and shrubland ecological response units, there is potential for severe fire effects to severely damage trails, or otherwise render them unsafe (such as snag fields created by high severity fires), which may require them to be closed for weeks while the damage is repaired, or changed conditions mitigated (such as cutting snags adjacent to trails).

Much of the Highline National Recreation Trail is about halfway up the steep escarpment face of the Mogollon Rim, and other parts are close to infrastructure and communities in the Payson Ranger District. Thinning and wildland fire are needed across much of these areas to move the ecological response units towards desired conditions. There is significant potential for uncharacteristically high-severity fire on some segments of this trail.

In 2017, the Pinal Fire burned though most of the Six Shooter Canyon National Recreation Trail, so the need for fire or mechanical treatments in the vicinity of the trail should be low for several years.

The Great Western Millennium Trail does not go through much forested land on the Tonto National Forest, so there is less chance of impacts from vegetation treatments.

Most of the highest areas of the Arizona National Scenic Trail on the Tonto National Forest are in designated wilderness areas, and would not be directly affected by management activities. Those areas, mostly north of the Mazatzal Wilderness area would have potential for the same types of effects described above for the Highline National Recreation Trail.

Comparison of Alternatives

Under alternative A, there would be no change to current management. In shrubland, woodland, and forested ecological response units, restoration and fuels treatments would continue at the current rate, with occasional impacts on hikers. The potential for trails to be impacted by high severity fire would vary, depending on the fuel type and the conditions under which a fire would burn.

Under alternative B, there would be fuels treatments (mechanical and fire) that would occur, particularly in or near areas of forested vegetation. The long-term effects on trail conditions would be beneficial, increasing the stability of the areas adjacent to and upslope from the trails as unnaturally high accumulations of surface fuel were replaced with herbaceous surface vegetation and/or fresh, less dense litter. Short term effects could include smoke, temporary increases in sediment and erosion in trail corridors, and occasional closures. There would be a decrease in the potential for adverse effects from wildland fire where treatments are adjacent to, or near, the trail.

The effects under alternative C would be similar to those described under alternative B, but the effects from fire would be more frequent and extensive, and the effects from mechanical would be less than in alternative B.

The effects under alternative D would be similar to those described under alternative B, but the effects from mechanical treatments would be more frequent and extensive, and the effects from fire would be lower. There would be a decrease in the potential for high severity fire adversely impacting trails, though less than alternatives B and C.

Significant Caves

Caves can be affected by management actions, which will differ between alternatives. However, there are specific mitigations, design features, and best management practices for protecting caves that would be followed for all alternatives. These include (but are not limited to) managing fire effects carefully in the vicinity of caves, restrictions on where equipment can be operated, and specific design features, such as directional felling, when appropriate near caves.

Inventoried Roadless Areas

Inventoried roadless areas are a USDA administrative designation. They are relatively undisturbed areas and serve as reference areas to measure the effects of development on other parts of the landscape. Management activities are limited within these areas to sustain the social and ecological roadless characteristics of each area. These areas are managed to preserve roadless character. The Tonto National Forest manages thirteen inventoried roadless areas, totaling about 264,876 acres. This includes about 21,000 acres of frequent fire ecological response units, which are near, or adjacent to, wilderness areas.

Under alternative A, there would be no change to current management, resulting less specific management direction for individual inventoried roadless areas than in the other alternatives. This could result in missed opportunities to identify and manage for unique or rare features, including implementation of wildland fire, the treatment of invasive species, or mechanical treatments that would otherwise move ecological response units towards desired conditions.

Under alternatives B, C, and D, there would be more site-specific direction. That would allow more active vegetation and fire management within the inventoried roadless areas. Management could be designed to enhance the emphasis areas for each inventoried roadless area.

Apache Leap Special Management Area

This area is entirely within the semi-desert grassland ecological response unit, and adjacent to interior chaparral on the east. There would be no changes to current management under any alternative, and no difference in the effects between alternatives.

Lakes and Rivers Management Area

Effects Common to Alternatives A and C

Under these alternatives, there would be no change from current management in these areas. There would be less management of recreation, which is more likely to result in human caused fires along roadways, camping areas, and in areas where there is recreational shooting. Under-regulated recreation and no additional restrictions on livestock management would increase the spread of invasive species. This would be particularly problematic in desert areas where invasive grasses allow fire to spread into desert areas that are not adapted to fire.

Effects Common to Alternatives B and D

Under these alternatives, there would be direction that includes restrictions on recreational shooting, off-highway vehicle use, and livestock grazing. Recreational shooting sometimes ignites fires. Livestock grazing affects fire effects and behavior, so improved management of these activities would contribute to maintaining current conditions, or moving areas towards ecological desired conditions where possible.

Salt River Horse Management Area

The Salt River Horse Management Area is common to all action alternatives (alternative B, C, and D). The plan components for this management area allow a deviation in the management of ecological response units from forestwide management. This deviation has the potential to impact the resiliency of the area as the disturbance from the Salt River Horses but not including it will continue the negative impacts of the horses. Some of the negative impacts are vegetative ground cover and soil function.

Cumulative Effects

This cumulative effects analysis does not attempt to quantify the effects of past actions by adding up all prior actions on an action-by-action basis. In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current conditions (as detailed in the description of alternative A) as a proxy for the impacts of past and present actions. This is because existing conditions reflect the aggregate impact of all prior actions and natural events.

This analysis focuses on the cumulative impact of those reasonably foreseeable actions that are relevant in assessing the impacts of revising the forest plan.

Space and Time Boundary for Analysis

The area used for the analysis of cumulative effects is comprised of the ecoregion subsections (Cleland et al. 2007) which intersect the Tonto National Forest administrative boundary, with two exceptions: the Gila Bend Desert Shrubland subsection boundary is the Gila River to the south and at the Agua Fria River to the west. The White Mountains Coniferous Forest subsection boundary is the New Mexico state line to the east (as defined in the assessment report, USDA Forest Service 2017). The timeframe for past actions is 20 years and 10 years for future and foreseeable projects. These timeframes were chosen because harvested sites have normally grown back to pre-treatment conditions within 20 years, and planning beyond 10 years is speculative.

Past vegetation growth, trends, previous management and disturbance patterns, and annual weather patterns have contributed to the current vegetative composition, structure, patterns, densities, and conditions present today. Past vegetation management actions (including the lack of action) which are still contributing to effects today include the lack of thinning in the sapling, small, and medium diameter classes for many decades, giving rise to a surplus of trees that would likely continue to dominate untreated acres for several more decades. During the first 10 years of the 1985 plan, much of the vegetation management direction was driven by the production of forest products, and was managed largely by using even-aged silvicultural methods, such as shelterwood and seed tree cuts. The legacy of this approach is reduced structural diversity and a general deficit of large and old trees.

Direction for fire management in the 1985 plan focused on reintroducing fire where it was needed, but there were numerous constraints from other resources, as well as a steep learning curve at all levels of the Forest Service on how to get fire back on the ground. There was no focus on the frequent fire systems that were the most departed; rather, there was an emphasis on using fire as a tool.

Ongoing and Reasonably Foreseeable Actions

In terms of reasonably foreseeable future actions, this analysis has attempted to include, specific to vegetation and fire resources, projects for which upcoming actions are known and can be meaningfully analyzed. What will not be analyzed are projects that are inevitable and known, but which have not yet developed proposed actions.

Cumulative effects are the consequences of foreseeable activities on other Federal and non-federal lands that, in conjunction with management activities likely to occur on the Forest, may intensify, negate, improve or otherwise affect the vegetation types, habitats, and species of the Forest. Cumulative effects in terms of vegetation would include timber sales, precommercial thinning, mastication, prescribed burning and other vegetation improvement projects. Below are considerations of consequences of activities that would likely occur on adjacent or nearby ownerships to the Forest.

Other Federal Lands

Several national forests in the immediate vicinity of the Tonto National Forest (Kaibab, Prescott, Apache-Sitgreaves, and Coconino National Forests) have revised or are in the process of revising their forest plans. All have placed an emphasis on the restoration of plant communities (ecological response units). Activities associated with the new plans are expected to maintain or make progress toward desired conditions that are similar across the Southwestern Region; these activities include uneven-aged silvicultural treatments that ensure that all ages and sizes of trees are present throughout the landscape and fire treatments that reduce the potential for undesirable fire behavior and effects. Cumulatively, they would also promote a structure, composition, and pattern that is similar to historic conditions and also promote resilience to disturbances like insect outbreaks, wildfires, and a changing climate. These management activities will positively influence both the rate and scale of restoration efforts across the ecoregion subsections under all Tonto National Forest alternatives.

The Four-Forest Restoration Initiative (4FRI) is a planning effort designed to restore ponderosa pine forest structure, composition, pattern, and function across four national forests in Arizona: the Coconino, Kaibab, Apache-Sitgreaves, and Tonto National Forests. The 4FRI project area has been divided into multiple environmental analyses. The first large National Environmental Policy Act analysis covered over 980,000 acres on the Coconino and Kaibab National Forests. The National Environmental Policy Act decision cleared about 230,000 acres of the Kaibab National Forest and 355,000 acres of the Coconino National Forest for fire and mechanical treatments. The second large analysis is currently underway, and is analyzing about one million acres for the restoration of ponderosa pine forest and other integrated ecological response units that span the southern portion of the Coconino National Forest and portions of the Apache-Sitgreaves and the Tonto National Forests. The restoration treatments that are being analyzed would augment and improve treatments from other National Environmental Policy Act efforts on the Tonto National Forest by increasing the scale of restoration treatments that reduce vegetation and fire regime departure across a larger landscape.

The Bureau of Land Management Phoenix District manages lands adjacent to the western and southern borders of the Tonto National Forest through two field offices, The Lower Sonoran Field Office and the Hassayampa Field Office.

The Bureau of Land Management Hassayampa Field Office guidance for the management comes from two Resource Management Plans, the Bradshaw-Harquahala Resource Management Plan (USDI Bureau of Land Management 2010a) and Agua Fria National Monument Resource Management Plan (USDI Bureau of Land Management 2010b). These resource management plans have direction to maintain, restore, or enhance the diversity, distribution, and viability of populations of native plants, and maintain, restore, or enhance overall ecosystem health. They also contain direction to contain the distribution and abundance of invasive plants through active management and reduce the impact of invasive species on native ecosystems from current levels. These actions would positively complement the management activities authorized under all alternatives of the revised Tonto forest plan.

The Bureau of Land Management Lower Sonoran Field Office guidance for the management comes from Lower Sonoran Resource Management Plan (USDI Bureau of Land Management 2012). The Lower Sonoran Resource Management Plan places an emphasis on the maintenance or restoration of vegetative communities to achieve desired future conditions as identified in the Natural Resources Conservation Service ecological site descriptions. Together with direction to control invasive species using an integrated weed-management approach, including prevention, restoration, mechanical, chemical, biological control methods, and prescribed fire, where appropriate. USDI Bureau of Land Management efforts on these lands would decrease the dispersion of seeds and the establishment of new populations of invasive species on National Forest System lands. These actions would support and improve the outcomes of treatments on the Tonto National Forest by increasing the scale of restoration across a larger landscape under all alternatives of the revised forest plan.

The White Mountain and San Carlos Apache Tribes to the east of the Tonto National Forest continue to manage their lands for multiple resource purposes. Management within these lands has been focused on using fire as a tool for reducing hazardous fuels. Management alternatives under the revised Tonto National Forest Land Management Plan with have a positive effect on Tribal lands by reducing vegetation and fire regime departure of lands along their borders. Conversely, the reduction of hazardous fuels on Tribal lands will contribute to fuels reduction and fire reintroduction efforts on the Forest.

State Lands

The Arizona Governor’s Forest Health Council created a Statewide Strategy for Restoring Arizona’s Forests (City of Phoenix 2007) which focuses attention on the current condition of Arizona forests and the steps required to restore their health and vigor. It describes approaches for achieving long-term ecosystem restoration, fire risk reduction around communities, natural fire management in wildlands, and the development of appropriate restoration-related economic opportunities. Based on sound ecological and social science, the statewide strategy incorporates valuable insights and techniques from the successful and innovative efforts already underway in Arizona. The primary purpose of the statewide strategy is to foster the implementation of a comprehensive, systematic effort to restore the ecological integrity of Arizona’s forests and woodlands, while at the same time describing how rural communities can benefit from their aesthetic, ecological, and economic resources without compromising forest health and public safety.

Arizona State Land is interspersed throughout and adjacent to the Tonto National Forest. Those areas managed by the Arizona State Forestry Division are done so under their mission to manage and reduce wildfire risk to Arizona’s people, communities, and wildland areas and provide forest resource stewardship through strategic implementation of forest health policies. The Forestry Division is expected to continue implementing mechanical and fire treatments that reduce tree density, restore the local vegetation structure and pattern, and reduce the risk of uncharacteristic fires (especially in the wildland-urban interface). These actions would complement the proposed management activities authorized under all alternatives of the revised Tonto forest plan, favoring alternatives B and D which provide more opportunities for economic development.

Arizona Game and Fish Department and the Arizona Department of Transportation both have plans that emphasize limiting the spread of invasive species including invasive species. It is expected that as a result of these various activities, there would be overall improvements in the departure of affected ecological response units both on and off the Tonto National Forest.

Local Government Lands

The Tonto National Forest resides in four counties: Maricopa, Yavapai, Pinal and Gila Counties. County or city comprehensive plans can be used as a source of information on the history of land use within the region, the patterns of development, desired conditions, and current county land use policies. County governments hold no legal authority over independent jurisdictions such as Federal and State lands, incorporated cities and towns, or Native American Tribal reservations.

The Yavapai County Comprehensive Plan (Yavapai County 2012) guiding vision is to provide a flexible and adaptable approach to managing growth while protecting a permanently sustainable natural environment. The “Environmental Element” of the plan addresses environmentally sensitive lands (primarily wetlands and riparian areas), wildlife habitat, invasive species, forest ecosystem health, and air quality. The comprehensive plan recognizes that the Forest Service manages approximately 38 percent of the land in Yavapai County and recommends that the county coordinate with public land agencies to improve forest health and “to create standards to protect Wildland/Urban Interface.” No conflicts between the Yavapai County goals and objectives and Tonto National Forest proposed plan components have been identified.

The Maricopa County Vision 2030 Comprehensive Plan (Maricopa County 2016) provides guidance on managing growth to provide a high quality of life by protecting public health and safety, promoting stable economic growth, maintaining a healthy environment, providing adequate community services, and ensuring that tax money is spent efficiently. The comprehensive plan recognizes that the Forest Service manages approximately 53 percent of the land in Maricopa County and recommends the coordination of county planning efforts with Federal and State agencies, and participation in State and Federal planning activities to help ensure consistent and efficient development patterns. The Environment element identifies Maricopa County’s foremost concerns with respect to its environmental issues, and potential strategies for lessening the impact that development has on its environment. Particular attention focuses on air quality, water quality, wildlife protection, natural and cultural resources, and natural and human-caused hazards. No conflicts between the Maricopa County goals and objectives and Tonto National Forest proposed plan components have been identified.

The Pinal County Comprehensive Plan (Pinal County 2019) is the guiding document to manage growth, preserve the quality of life, and promote sustainability within Pinal County. It is a long-term vision that promotes effective economic vitality while ensuring environmental stewardship. The plan acknowledges that the Tonto National Forest manages 127,466 acres within Pinal County. The plan encourages compatible development in environmentally-sensitive areas that minimize impacts to the native desert, grasslands and riparian areas and supports efficient urban design aimed at conserving, protecting, and enhancing natural and environmental resources. No conflicts between the Pinal County goals and objectives and Tonto National Forest proposed plan components have been identified.

The Gila County Comprehensive Master Plan (Gila County 2018) is a planning document intended to serve as a guide to address future growth and development within the unincorporated portions of Gila County. The plan acknowledges that the Tonto National Forest manages 1,683,603 acres (55 percent) of the land base in Gila County. The Gila County Comprehensive Master Plan supports heavy engagement with the Tonto National Forest, and promotes the establishment of an active and positive dialogue. The plan supports restoration and protection activities on public and private lands, such as thinning of overgrown forests, revegetation of riparian areas and reclamation of disturbed areas. The plan encourages coordination in the timing of prescribed forest burning activities to minimize air quality impacts. Gila County also contracts with the United States Forest Service through an intergovernmental agreement to maintain several roadways within the national forest. These actions all support and improve treatments on the Tonto National Forest and are consistent with proposed plan components.

Community wildfire protection plans have been developed for Yavapai County (2011) and for Gila County (2016) and cities included within these counties. They emphasize treatments across multiple jurisdictions including Federal, State, county, and private lands that are within the wildland-urban interface; as a consequence, the risk of uncharacteristic wildfires to communities would be reduced.

Based on the revisions (or expected revisions) to the forest plans of neighboring national forests and the anticipated activities throughout adjoining lands under other jurisdictions, there are no anticipated negative cumulative effects to vegetation and fire return interval. Rather, it is expected that the cumulative environmental consequences, in the context of the surrounding area, would improve the identified trends of vegetation and fire return interval departure for all alternatives. The cumulative environmental consequences of proposed management efforts in the context of the larger ecoregion would contribute to the movement of vegetation toward desired conditions over larger areas. These efforts could greatly contribute to landscape restoration, with a focus on reestablishing the composition, structure, patterns, and processes necessary to facilitate healthy, resilient, sustainable ecosystems. These management efforts will also help to control invasive species, improve wildlife habitat, and reduce the instances of uncharacteristic, extreme wildfire. Increasing health and ecosystem function through management will also serve to increase the ability of ecosystems within the context area to adapt to climate change. Ultimately, ecosystems exhibiting desired conditions better provide for multiple uses, and better contribute to sustainable social and economic systems.

Riparian Areas

Riparian areas on the Tonto National Forest are a focal point for humans, wildlife, livestock activities, and groundwater-dependent species. These areas represent some of the most diverse ecosystems that support an abundance of plants and animals, including rare and at-risk species. There are 84,776 acres of mapped riparian areas on the forest including deciduous forests and woodlands, montane riparian areas, Sonoran riparian scrublands (xero-riparian), and some minor inclusions of herbaceous wetlands.

Affected Environment

A riparian area is the interface between the terrestrial and aquatic ecosystem. As ecotones, they encompass sharp gradients of environmental factors, ecological processes, and plant communities (Gregory et al. 1991). Riparian areas are plant communities contiguous to, and affected by, surface and subsurface hydrologic features of perennial or intermittent lotic and lentic water bodies (rivers, streams, lakes, or drainage ways). Riparian ecosystems are defined as transition areas between the aquatic ecosystem and the adjacent terrestrial ecosystem; they are identified by soil characteristics or distinctive vegetation communities that require free or unbound water (Gage and Cooper 2013). Although riparian areas make up a small percent of the context landscape (table 89), they support some of the greatest plant and animal diversity and are essential habitat for much of the native flora and fauna and migratory avian species.

The affected environment describes current conditions for riparian areas and riparian ecological response units using available stream and riparian condition assessments for the forest. The Tonto Stream Assessment Method was developed on the Tonto National Forest in 1996 and revised in 1998 and 2001. Riparian condition assessment is based on stream channel stability[103]. Parameters used to assess stability include depositional pattern, stream bank vegetative cover (Thompson et al. 1998), stream channel width to depth ratio, channel stability rating, and bank erosion hazard index (Rosgen 1996).

Stream conditions are rated and classified as either stable, impaired (slightly or severely), or unstable. All impaired ratings (slightly impaired and severely impaired) were combined for this planning effort. Stream conditions were also assessed for major riparian ecological response units (ecological units) on the Tonto National Forest[104]. These ecological units are mapped riparian areas that describe the potential of riparian plant communities (table 89).

Stream reaches in stable condition contribute the best conditions of ecological diversity and provide the best riparian area and riverine habitat for those plant and animal species that rely on them for their survival. Stream reaches in impaired condition provide fairly diverse ecological conditions but have the capability of providing improved plant composition and diversity and quality riverine habitat. Stream reaches that are unstable have the lowest level of plant diversity and contribute the least towards ecological sustainability, and may contribute to poor water quality and reduced quantity, compared to stable and impaired reaches.

[103] Stream channel stability is defined as the ability of a stream to carry the water and sediment of its watershed while maintaining its dimension, pattern, and profile, without aggrading or degrading over time, and in the present climate (Rosgen 1996).

[104] Stream assessment data only covers lands within the Tonto National Forest boundary. Assuming an average of 0.5 miles for each reach, just under one percent of the stream miles on the Forest (perennial and intermittent) have been assessed.

Table 89. Riparian ecological units on the Tonto National Forest

Ecological Unit	Acres on the Forest	Description
Desert Willow	8,951	The desert willow riparian ecological response unit is often found in dry washes, intermittent streams, and often along ephemeral and drier reaches of interrupted alluvial channels. Desert willow (*Chilopsis linearis*) makes up the dominant stratum of this ecological response unit. Other commonly associated tree species include netleaf hackberry (*Celtis reticulata*) and velvet mesquite (*Prosopis velutina*). Shrubs such as burrobush (Ambrosia spp.) and desert broom (*Baccharis sarothroides*) are also commonly associated with this ecological response unit.
Cottonwood group	57,063	The cottonwood group includes narrowleaf cottonwood/shrub, sycamore-Fremont cottonwood, Fremont cottonwood/shrub, and Fremont cottonwood/oak riparian ecological response units. Riparian species commonly found in the cottonwood group ecological response unit group are Fremont cottonwood (*Populus fremontii*), narrowleaf cottonwood (*P. angustifolia*) and lanceleaf cottonwood (*P. acuminata*), boxelder (*Acer negundo*), willow species (*Salix spp.*), Arizona alder (*Alnus oblongifolia*), Arizona Sycamore (*Platanus wrightii*), velvet ash (*Fraxinus velutina*), Arizona walnut (*Juglans major*) and desert willow (*Chilopsis linearis*).
Fremont Cottonwood–conifer	12,699	The Freemont cottonwood-conifer ecological response unit is typically found at elevations ranging from 2,100 to 8,800 feet. Fremont cottonwood (*Populus fremontii*) and conifers, such as Utah juniper (*Juniperus osteosperma*), share the dominant stratum of this ecological response unit. Other plant species include net leaf hackberry (*Celtis reticulata*) and velvet mesquite (*Prosopis velutina*).
Ponderosa Pine/Willow	6,063	Ponderosa pine/willow is typically found at elevations ranging from 4,500 to 9,700 feet and is characterized by an overstory of ponderosa pine with an understory of shrub-form willow species. As a result of the pine overstory, this map unit is particularly hard to distinguish from pine-oak systems of similar physiognomy and is believed to be under-represented in the mapping. Other riparian species commonly found in this ecological response unit include oneseed juniper (*Juniperus monosperma*) and Arizona white oak (*Quercus arizonica*), Arizona walnut (*Juglans major*), box elder (*Acer negundo*), and velvet ash (*Fraxinus velutina*).

Data gathered using the Tonto Stream Assessment Method indicate about 19 percent of stream reaches assessed are in stable condition, 49 percent are impaired, and 32 percent are unstable. The cottonwood group ecological units have the highest percentage impaired conditions and lowest percentage of stable streams compared to all other riparian ecological units (table 90).

Table 90. Riparian conditions for riparian ecological response units and for all assessed streams

Ecological Response Unit	Stable (percent)	Impaired (percent)	Unstable (percent)	Ecological Status[1]
Desert Willow	22 percent	19 percent	59 percent	Insufficient data
Cottonwood group	17 percent	50 percent	33 percent	Moderate
Fremont Cottonwood–Conifer	20 percent	56 percent	24 percent	Low
Ponderosa Pine/Willow	23 percent	57 percent	20 percent	Moderate
Total assessed streams	19 percent	49 percent	32 percent	Low-Moderate

1 - Ecological status is an assessment of how similar (low, moderate, or high similarity) current conditions are to the potential natural community based on species composition plot data. For desert willow there is insufficient plot data to accurately assess ecological status.

Not all activities and stressors equally impact riparian areas on the forest. Riparian areas near urban areas and areas which are highly accessible to users tend to have a greater concentration of negative impacts. Other riparian areas are especially sensitive to the compounded effects of drying conditions (climate change and drought), increasing pressure of water demands (surface and subsurface flows), livestock grazing, and the effects of wildfires (e.g., excessive erosion and sediment deposition in riparian areas).

Cottonwood willow ecosystems (cottonwood group and Fremont cottonwood-conifer ecological units) are limited in the southwestern United States and on the forest and represent some of the most important riparian ecosystems. They have been dramatically reduced over the past century and are at very high risk of degradation on and off the Tonto National Forest from recreational use, livestock grazing, water control measures (irrigation diversions, dams, groundwater pumping), climate change, and drought.

Altered flows (timing, magnitude, frequency) continue to have strong and lasting regional impacts on these ecosystems. A number of riparian key species are groundwater dependent – some requiring permanent shallow groundwater sources, such as willows (*Salix* spp.) and cottonwoods (*Populus* spp.). Additionally, these riparian species depend on the timing between seed dispersal and the floods that create seedbeds or opportunities for species to establish. Many riparian areas have become altered because flows do not coincide with the phenology (for example, seed dispersal) of the species. Without periodic flooding, structural diversity (fewer age groups) is lowered and further reduces ecological integrity.

Recreational pressure is an increasing risk to all riparian ecological response units on the forest, especially riparian areas that experience heavy use, such as areas along the forest near the Phoenix metropolitan area. At the watershed level, the high densities of roads have also influenced impaired stream conditions forest-wide. Roads directly affect the natural sediment and hydrological regimes by altering stream flow, sediment loading, sediment transport and deposition, channel morphology, channel stability, substrate composition, stream temperatures, water quality, and riparian conditions in the watershed. Also, the high density of user-created trails, trampling, off-highway vehicle use, and herbivory at sites are resulting in impaired riparian conditions. At some areas, fences and enclosures have become damaged (fire, recreation, and fallen trees) where livestock are impacting riparian areas (compacted soils and reduced streambank vegetation).

Livestock grazing occurs throughout many perennial streams, riparian areas, and some wetlands. Overgrazing has been observed to reduce effective vegetative ground cover and riparian vegetation, which contributes to accelerated erosion and soil compaction (Tellman and Yarde 1997), as well as increase sedimentation into connected perennial waters. Due to ample soil moisture, riparian and wetland areas have the capacity to produce very large amounts of forage. Riparian area conditions of high moisture content of forage, cool temperatures, and available water causes concentration of herbivore use in riparian areas and can lead to the overuse of vegetation necessary to protect streambanks from the effects of high flows.

Most riparian ecological response units have low similarity to the potential reference plant community. The height and density of herbaceous vegetation in riparian areas is important for maintaining streambank stability needed for proper riparian condition and function. Areas of high concern are those areas with actively eroding stream banks or high erosion potential. Restoring native species in riparian areas is key to long-term riparian condition. A number of species have become naturalized in these systems (such as mullein and sweetclovers) where they have effectively filled in the spaces and are now part of the potential plant community.

Other sites are experiencing increases in exotic and invasive species. Tamarisk (*Tamarix chinesnsis*) is present in mostly cottonwood habitats at low levels, mostly scattered populations primarily along the Verde River and some stretches of the Lower Salt River and recent accounts along Reynolds Creek in the Sierra Ancha Mountains. When site conditions are not favorable for native riparian species (such as willows and cottonwood), tamarisk can rapidly increase and dominate reaches. This tends to occur in rivers with large departures in flow regimes. There is considerable debate on the efficacy of tamarisk removal and riparian restoration efforts. The potential for successful revegetation can be highly variable and depends on a careful examination of the current site conditions, desired conditions, and site potential of the area (Shafroth et al. 2005).

Some mid- to high-elevation riparian areas (Fremont cottonwood-conifer, cottonwood group and ponderosa pine/willow) are at risk from the effects of high severity wildfire at the watershed scale (secondary effects). The role of fire in riparian plant community dynamics is closely related to geology and hydrology. Fire alters erosion processes, and the magnitude and scale of the effects directly relates to the size and severity of the fire, the topographical components of the stream system, and the size of stream, in conjunction with the amount, intensity, and timing of postfire precipitation. Streamside soils are usually highly erodible when the majority of vegetation and duff has been removed by fire. Large amounts of precipitation and other hydrologic events that occur soon after fire may result in drastic channel alteration. However, newly deposited alluvium and changes in channel morphology usually increase habitat complexity. In general, fire-induced channel alterations occur most readily during the first ten postfire years (Simonin 2001).

The most immediate risk of uncharacteristic fire in riparian areas results from past fire exclusion, particularly in adjacent forested areas uphill from riparian stretches. As forest conditions become denser and more prone to high severity fire, there is an increasing likelihood of high burn severity. Adverse second order fire effects that then become more likely include accelerated erosion and excessive sedimentation to connected stream courses and into closed wetland areas; excessive or increased water flow, and uncharacteristic flooding, which can result in scouring of stream channels and the removal of vegetation and coarse woody debris that helps regulate hydrological dynamics in riparian areas. Fire suppression in adjacent uplands areas is responsible for the increased risk of undesirable fire effects in most of the riparian and wetland areas within woodlands and forests on the Tonto National Forest. In some places, log jams have accumulated with greater frequency and/or with greater volume than would have occurred historically. If these accumulations burn all at once, they can produce high burn severity in the immediate vicinity of a stream, creating conditions that would result in collapsed banks and excessive erosion and sedimentation.

See the volume 1 of the assessment (USDA Forest Service 2017a) for a detailed analysis on current conditions for riparian areas.

Environmental Effects[105]

Effects Common to all Alternatives

Riparian Plan Components

Stream channel and riparian and wetland restoration objectives include a suite of possible activities and actions (passive and active) that all should have the beneficial effect of rehabilitated geomorphic and biological processes, which would help to restore stream and riparian and wetland ecosystem services. Properly functioning streams and riparian areas provide clean water, regulated water temperature, water storage, sediment storage, nutrient cycling and good habitat (Gregory et al. 1991). Invasive species objectives specifically in riparian areas include both mechanical and chemical treatments. Removing invasive species capable of altering stream channel conditions and function, improves stream channel and

[105] All assumptions and methods used for this analysis can be found in volume 4 of the environmental impact statement, appendix B.

riparian conditions. Using chemical applications can adversely affect water quality when sediment or chemicals are delivered to a water body through the riparian area. Longer than predicted residence times of herbicide in soils are not uncommon, and as the herbicide remains in the soil it can inhibit the recovery of native vegetation. Herbicides can alter soil pH, microbial activity, and reduce the growth and function of mycorrhizal fungi which can affect the ability of plants to absorb and acquire nutrients from soils (Vieira et al. 2007).

Upland Conditions

Mechanical harvest/thinning and restoration treatments in the uplands may impact riparian areas through the displacement of soil, rutting, compaction, puddling, and removal of vegetation and groundcover. Rutted soil is likely to channelize water, making it more susceptible to erosion and entrainment (Elliot 2010). Depending on the area and intensity of treatment, increased erosion and sedimentation could degrade surface water quality from water that flows from treatment areas. However, these effects are largely mitigated through the use of best management practices, outlined in Forest Service Handbook direction (FSH 2509.22 R3), aimed to minimize ground disturbance and adverse impacts to soils and surface water quality. These mitigations and best management practices would be followed under all alternatives.

Prescribed fire and wildfire in the uplands may result in negative impacts, such as increased transport of sediment and ash from storm water runoff into riparian areas. However, these effects are short term and generally last between 1 and 3 years. Factors affecting fire-return intervals in riparian zones include soil and plant moisture, fire exclusion, livestock grazing, logging, damming and other water-flow regulation, and presence of invasive species that alter fuel characteristics. The most immediate risk of uncharacteristic fire in riparian areas results from past fire exclusion, particularly in adjacent forested areas uphill from riparian stretches. These conditions can increase the severity and incidence of adverse second order fire effects including accelerated erosion and excessive sedimentation to connected stream courses and into closed wetland areas; excessive or increased water flow, and uncharacteristic flooding, which can result in scouring of stream channels and the removal of vegetation and coarse woody debris that helps regulate hydrological dynamics in riparian areas. Fire suppression in adjacent uplands areas is responsible for the increased risk of undesirable fire effects in many riparian and wetland areas on the forest. In some places, log jams have accumulated with greater frequency and/or with greater volume than would have occurred historically. If these accumulations burn all at once, they can produce high burn severity in the immediate vicinity of a stream, creating conditions that would result in collapsed banks and excessive erosion and sedimentation.

Riparian areas that are vulnerable to uncharacteristic high-severity fire (due to unnaturally high fuel levels, tree densities, and seasonal dry conditions) may benefit from upland fuel reduction treatments to promote resilience to wildfire across the landscape. Furthermore, treatments that reduce tree density and allow more light to reach the forest floor can have positive effects on understory plant diversity and aquatic productivity in some riparian areas. Other beneficial effects of treating adjacent upland areas include increased spring discharge due to the removal of dense vegetation at areas above spring heads, and thinning woody species encroaching within the riparian management zone.

Road decommissioning is a common restoration practice which involves using heavy equipment to treat the road prism to reduce erosion and hydrologic impact. Levels of treatment range widely, but generally requires de-compacting the road and may involve removing the road prism and reshaping the area to match natural hillslope contours. Road decommissioning should benefit surface water resources and riparian management zones through restored hillslope drainage patterns, increased infiltration, water storage and retention, restored hydrographs, decreased channel aggradation, and improved water quality.

In addition, the smaller road system may limit motorized use impacts in the riparian management zone including the spread of invasive plants and increases in erosion. Ultimately, these should result in a water supply that is less expensive to clean to standard, increased baseflows during the dry periods of the year, and improved fisheries. Decommissioning of nonmotorized trails have minimal negative effects to riparian areas largely because these trails do not impact the land (size, scale, and extent) the same way motorized trails do. Additionally, trails are decommissioned based on user demand and need and is not always near the riparian management zone. See the Watershed Section for effects of road decommissioning to watersheds, streams, and riparian areas.

Recreation

Common recreation activities within riparian areas include hiking, camping, fishing, swimming, biking, and motorized vehicle use. Not all recreational uses have the same effects to riparian conditions – the intensity of recreation and the sensitivity of the riparian area are large factors on riparian conditions. Dispersed recreation, such as camping, can cause ground disturbance, impair soil and vegetation conditions. Off-highway vehicle use within or in close proximity to riparian areas can impair soil conditions, increase erosion into streams, and impair vegetation conditions. Developed recreation sites are maintained to standards that minimize negative impacts to riparian areas (e.g., hardened surfaces that reduce soil erosion). However, they can increase visitor use and dispersion within the vicinity of the developed site, which can increase negative impacts similar to dispersed recreation. Effects from dispersed and developed recreation are greater among sensitive stream types and riparian areas where stream bank vegetation is essential to maintain stability and ecological integrity (e.g., Rosgen C-type streams).

All of these activities can impact riparian condition by affecting vegetation and soils through soil compaction and displacement and destruction or damage to riparian vegetation. Off-highway vehicle use is limited in riparian areas to occasional crossing on approved roads and trails in all alternatives. Best management practices and forest plan standards and guidelines require developed recreation sites to mitigate or avoid adverse impacts to stream conditions and riparian areas. Best management practices and forest plan direction would be followed under all alternatives to minimize adverse impacts to riparian areas.

Special Uses

Water developments and road access are common special uses that affect riparian areas. Special uses for water developments, such as wells and stock tanks, can reduce base flows in stream channels and springs depending on the location and amount/intensity of water withdraws. Spring ecosystems are especially sensitive to changes in subsurface or groundwater withdraws – some springs can become completely dewatered once groundwater levels are reduced. Road access within riparian management zones can increase sedimentation to riparian areas, impair soil and vegetation conditions – however special uses include provisions to minimize or mitigate impacts to riparian areas. These effects are greater among sensitive riparian areas where vegetation is essential for stream function and riparian ecological integrity (e.g., Rosgen C-type streams). Under all alternatives, site-specific mitigations, best management practices, and maintenance requirements will be written into each permit along with periodic monitoring to protect riparian areas.

Livestock grazing

Livestock grazing occurs throughout many perennial streams, riparian areas, and some wetlands. Overgrazing has been observed to reduce effective vegetative ground cover and riparian vegetation, which contributes to accelerated erosion and soil compaction (Swanson et al. 1987, Platts and Nelson

1989, Tellman and Yarde 1997), as well as sedimentation into connected perennial waters. The greater amount and higher quality of forage and shade of riparian areas attract livestock, especially during the hot dry months in arid climates. In some areas, riparian areas can also make up a large proportion of useable forage compared to the surrounding uplands. For these reasons, riparian areas can receive a disproportionate amount of use in comparison to their size (Gillen et al. 1985, Marlow and Pogacnik 1986). Grazing does not occur in all riparian areas with equal extent and magnitude – that is, some riparian areas have different proportions of area in active allotments. Thus, the plan components that affect grazing would disproportionately affect the riparian areas that are subject to the most grazing.

The number of livestock, length of grazing period, and the length of time the riparian area is allowed to rest between grazing periods are significant factors on how long a riparian area can sustain grazing without deteriorating (Briggs 1996). Negative impacts to riparian conditions generally occur when areas are grazed repeatedly without adequate rest periods. Some riparian areas are more sensitive to grazing pressure (e.g., land characterized by steep slopes, shallow soils, and low vegetation densities) and can experience significant declines from being severely overgrazed just once.

Effective grazing management can succeed if it enables control of and variation in duration and timing, periods of grazing and recovery, livestock distribution, and intensity of use (Swanson et al. 2015). Several overgrazed riparian areas on the Tonto National Forest have been dramatically recovered by working with grazing permittees to reduce grazing intensities and establish designated areas for grazing (Alford 1993). Riparian exclosures are one of grazing management tools that have been used to improve riparian conditions (e.g., Tonto Creek exclosure) at sensitive riparian areas on the forest. Riparian exclosures can result in increased woody and herbaceous vegetation growth, greater bank stability, narrower and deeper stream channels, and improved fish habitat (McDowell and Magilligan 1997).

Standards, guidelines, and allotment management plans (under all alternatives) would direct the use of best management practices and adaptive management to not impair riparian conditions.

Designated and Eligible Wild and Scenic Rivers

All designated and eligible wild and scenic rivers are included in all alternatives, and the boundaries do not change by alternatives. Rivers are classified as wild, scenic, and recreational and a river can have more than one stream classification along the same corridor. The Forest has two wild and scenic rivers – Fossil Creek (includes wild and recreational segments) and the Verde River (includes wild and scenic segments). There are 19 eligible river segments[106]. Regardless of classification, each river is managed with the goal of protecting and enhancing outstandingly remarkable values. Projects and activities in eligible rivers or the surrounding river corridor[107] would be managed to preserve the free-flowing[108] condition of the river, protect the outstandingly remarkable values that provide the basis of the river's eligibility for inclusion in the system, and would not affect the classification of the river segment. In some cases, free-flow may be positively affected when instream structures promote more natural levels of river processes (e.g., bank erosion, channel shifting, groundwater infiltration, floodplain development) and bed load or debris movement. In the case that a proposed project may negatively impact the free-flow characteristics, a suitability study would analyze the effects of designation to other resource values, identify issues, and explore alternatives for protecting river values.

[106] See the Wild and Scenic River study for more information on the eligibility analysis.
[107] The geographic area generally encompassed within one-quarter mile on either side of a river studied for eligibility or suitability that contains the river and its outstandingly remarkable values.
[108] Flowing in a natural condition without impoundment, diversion, straightening, riprapping, or other modification of the waterway.

Designated Wilderness Areas

All designated wilderness areas are included in all alternatives and there would be no changes to boundaries or management direction. Similar to recommended wilderness areas, there could be positive effects that come from restrictions on motorized use and negative effects that come from the limited ability (e.g., limited access via roads and use of intensive mechanical thinning) to treat high risk areas adjacent to riparian areas to reduce associated wildfire effects such as increased flooding and sedimentation. These effects are anticipated to be more or less consistent across alternatives.

Alternative A

Resource Indicator 1: Riparian Plan Components

Alternative A continues forest management under the 1985 forest plan (hereinafter referred to as "existing plan"). Management prioritizes wildlife and riparian dependent resources over recreation and grazing. In general, objectives lack clarity on where to prioritize riparian restoration, primarily focused on improving riparian vegetation structure with overstory cover targets[109]:

- Fifty percent of cottonwood-willow and mix broadleaf acreage will be in structural Type I in fifty years with the objective that 25 percent will be in structural Type IV in ten years and 50 percent in structural Type IV in 20 years.
- Coordinate with range to achieve at least 50 percent of the cottonwood-willow and mixed broadleaf acres in structural Type I by 2030.

Objectives for alternative A narrowly focuses on restoring vegetation structure and habitat and less on restoring the ecological integrity of riparian areas (e.g., where stream channel conditions, soils, and vegetation are impaired). The existing plan does include management direction to rehabilitate and maintain riparian conditions, specifically through the following standards and guidelines:

- Reestablish riparian vegetation in severely degraded but potentially productive riparian areas. Natural regeneration is anticipated to achieve this goal, but artificial regeneration may be necessary in some areas.
- Any surface or vegetation disturbing projects in riparian areas will be coordinated and will specify protection or rehabilitation of riparian dependent resources.
- Rehabilitate and maintain, through improved management practices, mixed broadleaf riparian to achieve 80 percent of the potential overstory crown coverage. Natural regeneration is anticipated to achieve most of this goal. Artificial regeneration may be necessary in some areas.
- If it is determined through allotment monitoring that objectives are not being achieved, necessary changes in permitted numbers and/or management will then be made. In extreme cases, exclusion of livestock by fencing may be necessary.

Plan components under this alternative lack clear direction for restoration and improving riparian conditions and ultimately provide fewer benefits than the action alternatives. There would be less beneficial effects of restoring geomorphic and biological processes that would help to restore stream and riparian ecosystem services compared to the action alternatives. Properly functioning streams and riparian areas provide clean water, regulated water temperatures, water storage, sediment storage, nutrient cycling, and good habitat. All action alternatives (alternatives B, C, and D) include better language and

[109] Structure typing (described in Ohmart et al. 1988) is based on the relative importance of understory, mid-story, and canopy cover – used to describe six successional stages (e.g., type I is a mature community whereas type VI is the beginning community of regenerated vegetation).

management direction for maintaining riparian conditions, ensuring that activities and uses don't result in long-term degradation of riparian areas, setting appropriate limits for plant recovery following livestock use, and ensuring projects and activities are designed to promote a diversity of age classes and natural succession of riparian and wetland species. Therefore, the action alternatives would provide increased beneficial effects of improving riparian conditions with increased management emphasis on improving species diversity compared to alternative A.

Resource Indicator 2: Upland Conditions

Fire regimes would continue to move away from desired conditions for most ecological response units under alternative A. The most immediate risk of uncharacteristic fire in riparian areas results from past fire exclusion, particularly in adjacent forested areas uphill from riparian stretches. The insufficient rate of treatments under alternative A would likely lead to forest conditions becoming denser and more prone to high severity fire, increasing likelihood of high burn severity compared to all action alternatives. Adverse second order fire effects that then become more likely include accelerated erosion and excessive sedimentation to connected stream courses and into closed wetland areas; excessive or increased water flow, and uncharacteristic flooding, which can result in scouring of stream channels and the removal of vegetation and coarse woody debris that helps regulate hydrological dynamics in riparian areas. Fire suppression in adjacent uplands areas is responsible for the increased risk of undesirable fire effects in many riparian and wetland areas on the forest. In some places, log jams have accumulated with greater frequency and/or with greater volume than would have occurred historically. If these accumulations burn all at once, they can produce high burn severity in the immediate vicinity of a stream, creating conditions that would result in collapsed banks and excessive erosion and sedimentation. No specific road decommissioning objectives for motorized trails in this alternative would mean less beneficial effects that come from road decommissioning compared alternatives B and C. Alternative D only includes trail decommissioning for nonmotorized, therefore effects of road decommissioning under alternative D is the same as alternative A. Road decommissioning improves surface water resources and riparian management zones through restored hillslope drainage patterns, increased infiltration, water storage and retention, restored hydrographs, decreased channel aggradation, and improved water quality. In addition, the smaller road system may limit motorized use impacts in riparian management zones including the spread of invasive plants and increases in erosion.

Resource Indicator 3: Management Areas, Recommended Research Natural Areas, and Recommended Botanical Areas with Special Riparian Management Emphasis

A number of rare and unique riparian areas on the forest have special management emphasis and direction – either through management areas referred to as natural areas[110] in the existing plan, or recommended research natural areas.

Management areas with special riparian management emphasis include the Blue Point Cottonwood Natural Area, Fossil Springs Natural Area, and the Sycamore Creek Natural Area. The management emphasis for these areas is to provide protection to the natural features and vegetative communities, maintain as nearly as possible existing conditions and natural processes for public enjoyment and research, maintain water flows and quantity, and to place special consideration to the visual resource of the area. Increased resource protection is established through standards and guidelines for natural areas. In general, they include managing dispersed recreation at low intensity, posting boundaries, limiting off-

[110] These areas were identified through the Arizona State Parks board Natural Area program which are referred to as "natural areas" but are in fact management areas in the existing plan. Natural areas are intended for demonstration and study purposes in a natural undisturbed setting. The natural areas described in the existing plan were proposed by the Arizona Parks Board, but never officially designated.

highway vehicle use, and limiting livestock grazing. The proposed Sycamore and Blue Point Cottonwood Natural Areas have not been formally managed as natural areas on the ground. The Sycamore Creek Natural Area is located in heavily used areas along Sycamore Creek just downstream of National Forest System Road 402. This area receives intense recreational pressure from off-highway vehicles, target shooting, and camping. The proposed Blue Point Cottonwood Natural Area is located along the Lower Salt River where the area is being managed as a recreation area. For these reasons, maintain existing conditions and natural processes for the Sycamore Natural Area and Blue Point Natural Area would be difficult to achieve under this alternative. Riparian conditions would likely be maintained or improved for the Fossil Springs Natural Area under this alternative.

The recommended research natural areas with special riparian management emphasis include the recommended Picket Post Mountain Research Natural Area and the recommended Upper Forks Parker Creek Research Natural Area. Research natural areas represent high quality representative areas that have scientific interest and importance that, in combination, form a national network of ecological areas for research, education, and maintenance of biological diversity. Increased resource protection is established through standards and guidelines for these recommended research natural areas. In general, they include managing dispersed recreation at low intensity, posting boundaries, and excluding the areas from livestock grazing. These recommended research natural areas represent important riparian areas that are rare or limited on the forest and in the Southwest – Sonoran desert deciduous riparian areas (Arnett Creek within the Picket Post Mountain recommended research natural areas) and canyon bottom mixed broadleaf riparian forests (Upper Forks Parker Creek recommended research natural area). While Arnett Creek within the Picket Post Mountain Research Natural Area has become an increasingly popular destination for recreationists, efforts to redirect uses from the riparian area are underway (e.g., trails are being relocated out of the riparian area and exclosures have been installed to exclude livestock) to maintain and improve riparian conditions. Riparian conditions in the recommended Picket Post Mountain and Upper Forks Parker Creek research natural areas would likely be maintained or improved under this alternative.

Management for these areas not only protects the rarity and uniqueness of riparian and wetland ecosystems but has the effect of contributing to the regional biodiversity and a network of areas that are managed in perpetuity. These areas have increased resource protection in the form of additional standards and guidelines which would also have the effect of maintaining and improving conditions potentially more so than without research natural area distinction. Alternative A does include management for rare and unique riparian areas; however, some areas would likely be less effectively managed due to changed conditions and manageability (Blue Point Cottonwood and Sycamore Creek natural areas). Alternatives B and C would include the most areas and greater diversity of wetland and riparian ecosystems (including rare Sonoran desert riparian areas and wetlands, canyon bottom riparian forests, a rare spring ecosystem, and a rare wetland meadow) which would have the effect of contributing the most to the regional biodiversity of rare and unique riparian areas and wetlands and maintaining riparian conditions compared to alternatives A and D.

Alternative A does not include the Salt River Horse management area. The current plan does not account for the presence of the Salt River Horses on the landscape and does not allow a deviation in the management of riparian ecological response units from forestwide management. This will perpetuate many of the negative impacts to the health and resiliency of the riparian areas where the Salt River Horses occur. More information can be found in the Management Areas section of volume 2.

Alternative B

Resource Indicator 1: Riparian Plan Components

Alternative B places a greater emphasis on restoring riparian areas and setting management priorities than alternative A by setting realistic objectives aimed to address riparian areas that are most impaired (nonfunctional and functional-at-risk riparian areas), specifically by incorporating following objective:

- Complete active and passive restoration projects on at least 125 miles of streams every 10 years to improve the ecological integrity of perennial and intermittent riparian ecosystems rated as nonfunctional and functional-at-risk.

The terms “nonfunctional” and “functional-at-risk” are based off the Proper Functioning Condition riparian assessment protocol[111] developed by the Bureau of Land Management. This qualitative assessment is intended to provide a snapshot in time condition of the riparian area and describes how well physical processes are functioning. Other qualitative metrics could be used to meet this objective, based on the best available science. The following describes the riparian PFC condition ratings:

- **Proper Functioning Condition (PFC):** a riparian area is considered to be in proper functioning condition when adequate vegetation, landform, or woody material is present to dissipate stream energy, capture sediment, improve floodwater retention and ground water recharge, develop root masses that stabilize streambanks against erosion, and maintain channel characteristics.
- **Functional-at-risk (FAR):** these riparian areas are in limited functioning conditions and existing hydrologic, vegetative, or geomorphic attributes make them susceptible to impairment.
- **Nonfunctional (NF):** There riparian areas clearly lack are not providing adequate vegetation, landform, or woody material to dissipate stream energy associated with moderately high flows, and thus are not reducing erosion, improving water quality, etc.

Plan objectives under this alternative provide clear direction on where to prioritize and accomplish restoration efforts by directing efforts at nonfunctional and functional-at-risk areas. Additionally, there is an increased focus on restoring spring ecosystems, aquatic habitat restoration, and treating invasive species in riparian areas:

- Complete at least 4 aquatic habitat restoration projects (such as increase pool quantity, provide stream cover, or bank stabilization,) every 10 years
- Improve[112] 10 to 15 individual springs during each 10-year period.
- Treat and or control invasive species on 2 to 10 stream reaches[113] every five years. Maintain follow-up treatments to prevent regrowth, establishment, or spread of treated and other invasive species.

Standards and guidelines would provide the necessary plan direction to ensure that projects are designed in such a way to achieve desired conditions. Specifically, the following guideline for all riparian management zones would ensure that riparian conditions are maintained or restored across the forest:

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[111] There are 17 different criteria specific to hydrology, vegetation, and geomorphology that are evaluated during a PFC assessment. For specifics on each criteria and the evaluation process, see Dickard et al. 2015.

[112] Spring improvement or maintenance refers to work that improves or maintains the ecological integrity of a spring. See the 2020 Forest Service General Technical Report “Rangeland Water Developments at Springs: Best Practices for Design, Rehabilitation, and Restoration.”

[113] A stream reach generally represents a 0.25 to 0.5 mile stream segment.

- In riparian areas, project and management activities should be designed and implemented to maintain or restore natural streambank stability, native vegetation, floodplain, and soil function.
- Livestock use in and around riparian areas will be evaluated on an allotment specific basis. Design elements (e.g., deferment, herding, and fencing) will be implemented as needed.

This alternative would also include additional guidelines to maintain riparian species diversity. Specifically, through the following riparian vegetation (riparian ecological response units) guidelines:

- Vegetation management (e.g., timber harvest, invasive species, and prescribed fire) should not result in long-term degradation to riparian ecological response units.
- Livestock management practices should allow riparian vegetation to recover. Plant development or recovery sufficient to sustain healthy riparian areas should occur following each livestock use period.
- Projects and activities should be designed and implemented to promote a diversity of age classes and natural succession of native riparian and obligate species (e.g., cottonwood, willow, sycamore, ash, and alder).

These standards and guidelines would incorporate better management than alternative A; specifically by ensuring that activities and uses don’t result in long-term degradation of riparian areas, setting appropriate limits for plant recovery following livestock use, and ensuring projects and activities are designed to promote a diversity of age classes and natural succession of riparian and wetland species.

Alternative B also provides better management direction pertaining to livestock use in and around sensitive riparian areas by requiring allotment management plans and grazing decisions to consider design elements where needed such as livestock deferment, herding, or fencing/excluding areas. The existing forest plan (alternative A) direction is vague and simply states that “in extreme cases the exclusion of livestock by fencing may be necessary” but does not describe the conditions in which this would be implemented. For these reasons, alternative B would provide better direction to mitigate adverse impacts of livestock grazing at sensitive riparian areas.

There is also a greater likelihood that spring conditions and aquatic habitat conditions would improve under alternative B more than they would under alternatives A and D (these alternatives have no objectives specific for aquatic habitat and spring restoration). The plan objective to treat invasive species in riparian areas under alterative B (and alternative C) would lead to less negative impacts from invasive species compared to alternatives A and D. These potential negative effects include impaired stream conditions, loss of native vegetation, and lowered biodiversity.

Overall, this alternative would provide better management direction with the effect of improving riparian and wetland conditions (including springs) and improving species diversity compared to alternative A and D, and similar effect to alternative C. For these reasons, these proposed plan components for alternative B would lead to the most beneficial effects of restoring geomorphic and biological processes compared to alternatives A and D and more or less similar to alternative C. These effects include improving stream and riparian conditions which would improve floodwater retention and ground water recharge, support vegetation capable of developing root masses that stabilize streambanks against erosion, and maintain channel characteristics.

Resource Indicator 2: Upland Conditions

Fire regimes would move towards desired conditions for fire return intervals, fire severity, and patch size more so than other alternatives (see Vegetation and Fire section). The combination of mechanical and fire treatments would improve the resilience of frequent fire ecological response units to disturbances, such as fire and drought. Restoring a fuel loading and structure (trees, shrubs, herbaceous surface fuel, litter/duff, and coarse woody debris) which supports the kind/s of fire that these ecological response units evolved with is key to their restoration and maintenance. Under this alternative, when wildfires do occur, there is an increased chance that the effects would be beneficial. The balance of mechanical treatments with wildland fire in this alternative is the most realistic for the burn windows and resources needed. The increase rate of treatment under alternative B would lead to less adverse second order fire effects to riparian areas compared to other alternatives. These adverse second order fire effects include accelerated erosion and excessive sedimentation to connected stream courses and into closed wetland areas; excessive or increased water flow, and uncharacteristic flooding, which can result in scouring of stream channels and the removal of vegetation and coarse woody debris important for maintaining hydrological dynamics in riparian areas. Alternative B includes the plan objective of decommissioning 10 miles of unneeded motorized and/or nonmotorized trails every 5 years. This alternative would have increased beneficial effects to riparian areas compared to alternative A and D. Decommissioning of motorized and nonmotorized routes can meet this objective under alternative B, therefore depending on the proportion of motorized routes decommissioned, alternative C (objective is specific to only decommissioning motorized routes) may have a greater beneficial effect to riparian areas from road decommissioning compared to alternative B. Beneficial effects include improved surface water resources and riparian management zones through restored hillslope drainage patterns, increased infiltration, water storage and retention, restored hydrographs, decreased channel aggradation, and improved water quality. In addition, the smaller road system may limit motorized use impacts in riparian management zones including the spread of invasive plants and increases in erosion.

Resource Indicator 3: Management Areas, Recommended Research Natural Areas, and Recommended Botanical Areas Managed for Unique Riparian Ecosystems

Alternative B would not carry forward any of the natural areas in the existing plan: the Sycamore Creek Natural Area, Blue Point Cottonwood Natural Area, and Fossil Springs Natural Area.

Alternative B would include all recommended research natural areas in the existing plan, including those described in alternative A. Plan direction in alternative B would more or less provide the same resource protections as alternative A (see plan direction listed below). Effects of including these recommended research natural areas in alternative B are the same as described in alternative A.

Alternative B would include three new recommended botanical areas that represent unique or rare riparian ecosystems: Fossil Springs, Mesquite Wash, and Little Green Valley Fen. Like research natural areas, botanical areas are recommendations in the forest plan until a separate National Environmental Policy Act process is completed for formal designation. A botanical area is an area that contains plant specimens, plant groups, or plant communities that are significant because of their form, color, occurrence, habitat, location, life history, arrangement, ecology, rarity, or other features.

The Fossil Springs Botanical Area includes a portion of the existing Fossil Springs Natural Area (alternative A) and is adjacent to the recommended Fossil Springs Botanical Area on the Coconino National Forest boundary (on the northern side of the Fossil Creek)[114]. The Fossil Springs Botanical Area contains a highly diverse riparian deciduous forest associated with a large and complex spring system and travertine geology.

[114] The area is within the Fossil Creek Wild and Scenic River corridor. Management for this area would be consistent with the management described for the Fossil Creek Wild and Scenic River compressive river management plan (CRMP). The Coconino National Forest is currently developing the CRMP.

The recommended Mesquite Wash Botanical Area is located along Sycamore Creek in the Mesa Ranger District. Mesquite Wash is a unique desert riparian ecosystem within Sycamore Creek, rare on the Forest and in the region. Arizona Walnut and willows are abundant along the channel with mesquite occupying the terraces and upper banks. The more or less permanent water source and spring at Mesquite Wash produce a striking level of plant diversity and a stark difference to the surrounding vegetation outside the riparian zone.

The recommended Little Green Valley Fen Botanical Area is located in the Payson Ranger District. Little Green Valley Fen serves as a benchmark example of a rare and sensitive wetland meadow with peat soils that are extremely rare in Arizona.

Under alternative B, these recommended research natural areas and botanical areas would receive increased resource protection specifically through the following standards and guidelines:

- Sales or extraction of common variety minerals shall not be authorized in designated or recommended research natural areas and botanical areas.
- Logging or fuelwood gathering activities are not permitted in designated or recommended research natural areas and botanical areas, unless required for restoration of an area to natural conditions.
- In designated or recommended botanical areas overnight camping, recreation campfires, and recreational shooting are prohibited.
- Livestock grazing will not be authorized in recommended or designated research natural areas or recommended or designated botanical areas.
- In designated or recommended research natural areas and botanical areas, fire management activities should be designed and implemented to mimic the natural fire regime, and/or move the burned area towards desired conditions, and should be compatible with ongoing research. Multiple entry burns and strategic planning may be required to establish a more natural fire regime.
- New roads or trails (motorized or nonmotorized) should not be in designated or recommended research natural areas and botanical areas, except as needed for resource protection.
- Wildland fire should be managed to protect the resources for which research natural areas and botanical areas are designated or recommended.
- Special use authorizations should be designed and implemented to retain the values for which the research natural areas and botanical areas are designated or recommended.

Management for these areas not only protects the rarity and uniqueness of riparian and wetland ecosystems but has the effect of contributing to the regional biodiversity and a network of areas that are managed in perpetuity. These areas have increased resource protection in the form of additional standards and guidelines which would also have the effect at maintaining and improving conditions potentially more so than without research natural or botanical area distinction. Alternative B (and alternative C) would include the most areas and greater diversity of wetland and riparian ecosystems (including rare Sonoran desert riparian areas and wetlands, canyon bottom riparian forests, a rare spring ecosystem, and a rare wetland meadow) which would have the greatest effect of contributing to the regional biodiversity of rare and unique riparian areas and wetlands and maintaining riparian conditions compared to alternatives A and D.

The Salt River Horse Management Area is common to all action alternatives (alternative B, C, and D). The plan components for this management area allow a deviation in the management of riparian ecological response units from forestwide management. This deviation has the potential to impact the health and resiliency of the riparian areas within the Salt River Horse Management Area. Some of these impacts could be damage to vegetative ground cover and stream bank vegetation as a result of greater numbers of horses than the resources can support. However, the Salt River Horse Management Area does provide additional plan components to restrict other uses in the area that also have the potential for negative resource impacts (such as livestock grazing and recreational target shooting (SRHMA-S-03, SRHMA-S-04). These restrictions along with the desired conditions for the Salt River Horse Management Area provide additional management to help mitigate negative impacts from the Salt River Horses on riparian areas. More information can be found in the Management Areas section of volume 2.

Alternative C

Resource Indicator 1: Riparian Plan Components

Plan components and effects are the same as alternative B, with additional plan components and effects described below.

Alternative C would include the following standard:

- If a riparian area is non-functional, as identified in the Proper Functioning Condition Assessment framework or similar protocol, all permitted and allowed uses and activities will be removed until riparian recovery is achieved.

This standard would exclude all uses and activities in riparian areas that are non-functional. This standard would only apply to riparian areas that have the ability to reach their potential extent and where major stressors are within forest service jurisdiction. Monitoring would establish when riparian recovery is achieved and establish the appropriate use levels. Potential management options might include (but are not limited to) fencing riparian areas, relocating or removing camp sites, and removing water diversions (on National Forest System lands). The following are examples of conditions where this standard would not apply:

- Human altered intermittent stream channel with hardened banks. The stream has been permanently channelized with hardened banks to protect a road. This riparian area is not expected to be further modified or rerouted in the near future and therefore unlikely to reach its potential extent.
- Flow regulated river. The riparian area has been altered from a perennial to an ephemeral stream from regulated flows. The area no longer has the potential to support riparian vegetation and removal of a dam is outside Forest Service jurisdiction.

An important first step in identifying recovery potential is to examine the local site conditions and site potential of an area. Causes of impairment or decline should be considered in the context of the watershed that requires an examination of reaches upstream and downstream from the degraded riparian area, tributaries of the drainageway that passes through the degraded riparian area, and the uplands adjacent to the riparian corridor (Briggs 1996).

The dynamic nature of riparian areas means they are generally resilient and have a high capacity to recover where the natural flow regime is still present. It should be noted that some of these systems may take a long time to recover (e.g., some systems may “reset” or recover after a 500-year flood event). Where the natural flow regime is no longer present, conditions are less likely to recover simply through passive means. These systems would require active management (revegetation and bank stabilization) to improve riparian conditions and make meaningful progress within the planning cycle.

Most of the beneficial effects to riparian areas would come from the other proposed plan components that are already included in this alternative and in alternative B, and it is uncertain that this additional standard would provide any measurable beneficial effects for the reasons listed above. Additionally, where the potential exists for passive recovery (i.e., those systems that have a natural flow regime), we may not see a measurable improvement in riparian conditions and make meaningful progress towards desired conditions within the planning cycle. Therefore, alternative C would lead to more or less the same beneficial effects as alternative B. These beneficial effects include improving stream and riparian conditions which would improve floodwater retention and ground water recharge, support vegetation capable of developing root masses that stabilize streambanks against erosion, and maintain channel characteristics. By removing any and all uses in nonfunctional riparian areas, this additional standard in alternative C could increase management conflicts and negative effects to other resource areas and uses[115].

Resource Indicator 2: Upland Conditions

Alternative C focuses on treatments primarily using wildfire (22 percent is anticipated to be treated with prescribed fire). This alternative has the potential to treat more acres than any other alternative, though it would not necessarily move the most acres as far towards desired fire regime as alternative B primarily due to environmental and logistical constraints (e.g., sufficient burn windows). To get acres to a point where their ecological functions are close to desired conditions (or as close as they could get with a deficit of large and/or old trees), requires more entries in those areas that would be thinned with fire. For these reasons upland conditions are anticipated to still remain moderately departed and could increase the incidence of adverse second order fire effects to riparian areas. Therefore, there is a potential for more adverse second order fire effects to riparian areas under alternative C compared to alternative B. However, alternative C would likely have less negative effect compared to alternative A simply due to more acres treated compared to alternative A. These adverse second order fire effects include accelerated erosion and excessive sedimentation to connected stream courses and into closed wetland areas; excessive or increased water flow, and uncharacteristic flooding, which can result in scouring of stream channels and the removal of vegetation and coarse woody debris important for maintaining hydrological dynamics in riparian areas. Alternative C includes the plan objective of decommissioning 10 miles of unneeded motorized trails every 5 years. This alternative would have the greatest potential of increasing beneficial effects that come from motorized road and trail decommissioning compared to other alternatives. Beneficial effects include improved surface water resources and riparian management zones through restored hillslope drainage patterns, increased infiltration, water storage and retention, restored hydrographs, decreased channel aggradation, and improved water quality. In addition, the smaller road system may limit motorized use impacts in riparian management zones including the spread of invasive plants and increases in erosion.

Resource Indicator 3: Management Areas, Recommended Research Natural Areas, and Recommended Botanical Areas managed for Unique Riparian Ecosystems

Effects are the same as alternative B.

[115] See the recreation, range, and mining and minerals sections for effects from implementing this standard.

Alternative D

Resource Indicator 1: Riparian Plan Components

While this alternative places more emphasis on other program areas (e.g., increasing developed recreation opportunities and maximizing forest products), riparian areas would still be managed to achieve desired conditions.

Only plan riparian plan objectives are different for alternative D, standards and guidelines and effects of those plan components on riparian conditions are the same as alternative B.

There are no specific objectives for restoring stream channel and riparian conditions, spring ecosystems, and aquatic habitat restoration (as described and included in alternatives B and C). Only the invasive species treatment objective of treating or controlling invasive species on 2 to 10 stream reaches every 5 years in riparian areas is included in this alternative. While it is not possible to quantify the number of riparian restoration projects that might occur under this alternative, not having objectives specific for riparian areas (including seeps, springs, and wetlands) would mean a lower potential for accomplishing riparian restoration and fewer beneficial effects compared to other alternatives - specifically where impairment is the result of other factors besides invasive species impacts. There would be fewer beneficial effects of improving stream and riparian conditions which improve floodwater retention and ground water recharge, support vegetation capable of developing root masses that stabilize streambanks against erosion, and maintain channel characteristics compared to other alternatives.

Resource Indicator 2: Upland Conditions

Alternative D focuses on using mechanical thinning as the primary restoration tool with increased emphasis on providing forest products. Mechanical treatments would be unlikely to keep up with the need to treat areas as canopies continued to close up and limited fire treatments. With decreased options for fire, some treated areas would need more continuous mechanical treatments to maintain, competing with new acres for treatment resources. Under this option, it would be difficult to maintain treated areas because the acres needing maintenance treatment would continue to increase and, with fire options more limited than in other alternatives, maintaining and moving acres towards the desired distribution would be a challenge. Areas untreated would be subject to uncharacteristic fire in the uplands and would increase second order negative fire effects to riparian areas. These adverse second order fire effects include accelerated erosion and excessive sedimentation to connected stream courses and into closed wetland areas; excessive or increased water flow, and uncharacteristic flooding, which can result in scouring of stream channels and the removal of vegetation and coarse woody debris important for maintaining hydrological dynamics in riparian areas. These negative effects would likely be highest in alternatives A and D (many areas would still remain in a high departure state), and less so in alternative C (still moderate departure but the high treatment objective target would mean a potential for more acres treated). Alternative B would likely have the least negative effects as more areas have the potential to be treated (using both mechanical and fire) and would reduce adverse second order fire effects to riparian areas. While largely mitigated at the project level through best management practices, this alternative would have the greatest potential for negative impacts from mechanical thinning operations on water resources and riparian areas. These negative effects include compaction and rutting of soil which is likely to channelize water, making it more susceptible to erosion and entrainment and compacted soils have reduced infiltration, resist revegetation, and have increased erosion. The increase in erosion from channelized runoff and compacted surfaces can degrade riparian hydrologic function and increase sedimentation into streams.

Resource Indicator 3: Management Areas, Recommended Research Natural Areas, and Recommended Botanical Areas Managed for Unique Riparian Ecosystems

There would be less management emphasis of rare or unique riparian ecosystems under this alternative. No recommended research natural areas or recommended botanical areas would be included. This alternative was developed in response to public comment supporting less restriction on user access and permitted uses.

While these rare ecosystems would still afford some level of resource protection through forest-wide management direction (riparian management zone), there is a potential that conditions may not be maintained as well as they could with the afforded resource protections (through additional standards and guidelines) and management emphasis that these areas would provide. Therefore, under alternative D there would be the least beneficial effects of contributing to the regional biodiversity of rare and unique riparian areas and wetlands and maintaining riparian conditions compared to other alternatives.

Effects Summary by Alternative

Alternative A

Under alternative A there would be a low likelihood of making meaningful progress towards desired conditions with conditions remaining static to slightly improved within the next planning cycle. There would be less beneficial effects of restoring geomorphic and biological processes that would help to restore stream and riparian ecosystem services compared to the action alternatives. Proper functioning streams and riparian areas provide clean water, regulated water temperatures, water storage, sediment storage, nutrient cycling, and good habitat. All action alternatives (alternatives B, C, and D) include better language and management direction for maintaining riparian conditions, ensuring that activities and uses don’t result in long-term degradation of riparian areas, setting appropriate limits for plant recovery following livestock use, and ensuring projects and activities are designed to promote a diversity of age classes and natural succession of riparian and wetland species. Therefore, the action alternatives would provide increased beneficial effects of improving riparian conditions with increased management emphasis on improving species diversity compared to alternative A.

The insufficient rate of treatments under alternative A will likely lead to forest conditions becoming denser and more prone to high severity fire, increasing likelihood of high burn severity compared to all action alternatives. Adverse second order fire effects that then become more likely include accelerated erosion and excessive sedimentation to connected stream courses and into closed wetland areas; excessive or increased water flow, and uncharacteristic flooding, which can scour stream channels and remove vegetation and coarse woody debris that helps regulate hydrological dynamics in riparian areas.

There are no road decommissioning objectives for motorized trails in this alternative and therefore there would be less beneficial effects that come from road decommissioning compared alternatives B and C. Alternative D only includes trail decommissioning for nonmotorized, therefore effects of road decommissioning under alternative D is the same as alternative A. Road decommissioning improves surface water resources and riparian management zones through restored hillslope drainage patterns, increased infiltration, water storage and retention, restored hydrographs, decreased channel aggradation, and improved water quality. In addition, the smaller road system may limit motorized use impacts in riparian management zones including the spread of invasive plants and increases in erosion.

Recommended research natural areas and management areas would afford some additional management emphasis and resource protection for rare and sensitive riparian areas, but for some of these areas, management would be less effective at maintaining or enhancing riparian conditions (Blue Point

Cottonwood and Sycamore Creek Natural Areas) because of changed conditions (loss of obligate wetland vegetation) and manageability (high recreation use and enforcement). Special management for these areas not only protects the rarity and uniqueness of riparian and wetland ecosystems but has the effect of contributing to the regional biodiversity and a network of areas that are managed in perpetuity. Alternatives B and C would include the most areas and greater diversity of wetland and riparian ecosystems (including rare Sonoran Desert riparian areas and wetlands, canyon bottom riparian forests, a rare spring ecosystem, and a rare wetland meadow) which would have the effect of contributing the most to the regional biodiversity of rare and unique riparian areas and wetlands and maintaining riparian conditions compared to alternatives A and D.

Alternative B

Alternative B would likely result in improved riparian conditions and a positive trend towards desired conditions over the planning cycle more than alternative A because plan direction clearly articulates where management is needed to achieve the desired conditions and plan objectives focus restoration efforts where riparian and stream channel conditions are most impaired (e.g., functional-at-risk and non-functional). Alternative B would also provide improved management direction compared to alternative A; specifically by ensuring that activities and uses don't result in long-term degradation of riparian areas, setting appropriate limits for plant recovery following livestock use, and ensuring projects and activities are designed to promote a diversity of age classes and natural succession of riparian and wetland species. Alternative B also provides better management direction pertaining to livestock use in and around sensitive riparian areas by requiring allotment management plans and grazing decisions consider mitigation measures such as livestock deferment, herding, or fencing/excluding areas where needed. The existing forest plan (alternative A) direction is vague and simply states that "in extreme cases the exclusion of livestock by fencing may be necessary" but does not describe the conditions in which this would be implemented. For these reasons, alternative B would provide better direction to mitigate adverse impacts of livestock grazing at sensitive riparian areas. Therefore, alternative B would provide better management direction aimed at improving riparian conditions and improving species diversity compared to alternative A. Alternative B would likely lead to more acres restored compared to alternative A due to better management direction and the greater amount of treatment objectives compared to alternative A.

There is a greater likelihood that spring conditions and aquatic habitat conditions would improve under alternative B more than they would under alternatives A and D (these alternatives have no objectives specific for aquatic habitat and spring restoration). The plan objective to treat invasive species in riparian areas under alterative B (and alternative C) would lead to less negative impacts from invasive species compared to alternatives A and D. These potential negative effects include impaired stream conditions, loss of native vegetation, and lowered biodiversity.

Overall, this alternative would provide better management direction with the effect of improving riparian and wetland conditions (including springs) and improving species diversity compared to alternative A and D, and similar effect to alternative C. For these reasons, these proposed plan components for alternative B would lead to the most beneficial effects of restoring geomorphic and biological processes compared to alternatives A and D and more or less similar to alternative C. These effects include improving stream and riparian conditions which would improve floodwater retention and ground water recharge, support vegetation capable of developing root masses that stabilize streambanks against erosion, and maintain channel characteristics.

The increase rate of treatment under alternative B would lead to less adverse second order fire effects to riparian areas compared to other alternatives. These adverse second order fire effects include accelerated erosion and excessive sedimentation to connected stream courses and into closed wetland areas; excessive or increased water flow, and uncharacteristic flooding, which can result in scouring of stream channels and the removal of vegetation and coarse woody debris important for maintaining hydrological dynamics in riparian areas.

Alternative B includes the plan objective of decommissioning 10 miles of unneeded motorized and/or nonmotorized trails every 5 years. This alternative would have increased beneficial effects to riparian areas compared to alternative A and D. Decommissioning motorized and nonmotorized routes can meet this objective under alternative B, therefore depending on the proportion of motorized routes decommissioned, alternative C (objective is specific to only decommissioning motorized routes) may have a greater beneficial effect to riparian areas from road decommissioning compared to alternative B. Beneficial effects include improved surface water resources and riparian management zones through restored hillslope drainage patterns, increased infiltration, water storage and retention, restored hydrographs, decreased channel aggradation, and improved water quality. In addition, the smaller road system may limit motorized use impacts in riparian management zones including the spread of invasive plants and increases in erosion.

Special management for these areas not only protects the rarity and uniqueness of riparian and wetland ecosystems but has the effect of contributing to the regional biodiversity and a network of areas that are managed in perpetuity. This alternative would also increase the diversity (includes Sonoran desert riparian, rare spring ecosystem, rare wetland meadow, and canyon bottom mixed broadleaf riparian) of areas managed for their unique or rare status by incorporating three additional recommended botanical areas that contain rare and unique riparian ecosystems. While natural areas are not included in this alternative, other areas (Arnett Creek within the recommended Picket Post Mountain Research Natural Area, recommended Mesquite Wash Botanical Area) would be better managed to maintain and protect rare Sonoran desert riparian areas. Alternative B (and alternative C) would include the most areas and greater diversity of wetland and riparian ecosystems (including rare Sonoran desert riparian areas and wetlands, canyon bottom riparian forests, a rare spring ecosystem, and a rare wetland meadow) which would have the greatest effect of contributing to the regional biodiversity of rare and unique riparian areas and wetlands and maintaining riparian conditions compared to alternatives A and D.

Alternative C

Alternative C includes a standard that would exclude all uses and activities in riparian areas that are non-functional. This standard would only apply to riparian areas that have the ability to reach their potential extent and where major stressors are within forest service jurisdiction. Monitoring would establish when riparian recovery is achieved and establish the appropriate use levels. Potential management options might include (but not limited to) fencing riparian areas, relocating or removing camp sites, and removing water diversions (on lands managed by the USDA Forest Service). Most of the beneficial effects to riparian areas would come from the other proposed plan components that are already included in this alternative and in alternative B, and it is uncertain that this additional standard would provide any measurable beneficial effects. Additionally, where the potential exists for passive recovery (i.e., those systems that have a natural flow regime), we may not see a measurable improvement in riparian conditions and make meaningful progress towards desired conditions within the planning cycle. Therefore, alternative C would lead to more or less the same beneficial effects as alternative B. These beneficial effects include improving stream and riparian conditions which would improve floodwater retention and ground water recharge, support vegetation capable of developing root masses that stabilize streambanks against erosion, and maintain channel characteristics. By removing any and all uses in nonfunctional riparian areas, this additional standard in alternative C could increase management conflicts and negative effects to other resource areas and uses.

Alternative C focuses on treatments in the uplands primarily using wildfire (22 percent is anticipated to be treated with prescribed fire). This alternative has the potential to treat more acres than any other alternative, though it would not necessarily move the most acres as far towards desired fire regime as alternative B primarily due to environmental and logistical constraints (e.g., sufficient burn windows). Therefore, there is a potential for more adverse second order fire effects to riparian areas under alternative C compared to alternative B. However, alternative C would likely have less negative effect compared to alternative A simply due to more acres treated compared to alternative A. These adverse second order fire effects include accelerated erosion and excessive sedimentation to connected stream courses and into closed wetland areas; excessive or increased water flow, and uncharacteristic flooding, which can result in scouring of stream channels and the removal of vegetation and coarse woody debris important for maintaining hydrological dynamics in riparian areas.

Alternative B has the same effect for management areas, recommended research natural areas, and recommended botanical areas that contain unique riparian ecosystems and associated beneficial effects.

Alternative D

While this alternative places more emphasis on other program areas (e.g., increasing developed recreation opportunities and maximizing forest products), riparian areas would still be managed to achieve desired conditions. Only riparian plan objectives are different for alternative D, standards and guidelines and effects of those plan components on riparian conditions are the same as alternative B. There are no specific objectives for restoring stream channel and riparian conditions, spring ecosystems, and aquatic habitat restoration (as described and included in alternatives B and C). Only the invasive species treatment objective of treating or controlling invasive species on 2 to 10 stream reaches every 5 years in riparian areas is included in this alternative. While it is not possible to quantify the number of riparian restoration projects that might occur under this alternative, not having objectives specific for riparian areas (including seeps, springs, and wetlands) would mean a lower potential for accomplishing riparian restoration and fewer beneficial effects compared to other alternatives - specifically where impairment is the result of other factors besides invasive species impacts. There would be fewer beneficial effects of improving stream and riparian conditions which improve floodwater retention and ground water recharge, support vegetation capable of developing root masses that stabilize streambanks against erosion, and maintain channel characteristics compared to other alternatives.

Alternative D focuses on using mechanical thinning as the primary restoration tool with increased emphasis on providing forest products. Under this option, it would be difficult to maintain treated areas because the acres needing maintenance treatment would continue to increase and, with fire options more limited than in other alternatives, maintaining and moving acres towards the desired distribution would be a challenge. Areas untreated would be subject to uncharacteristic fire in the uplands and would increase second order negative fire effects to riparian areas. These adverse second order fire effects include accelerated erosion and excessive sedimentation to connected stream courses and into closed wetland areas; excessive or increased water flow, and uncharacteristic flooding, which can result in scouring of stream channels and the removal of vegetation and coarse woody debris important for maintaining hydrological dynamics in riparian areas. These negative effects would likely be highest in alternatives A and D (many areas would still remain in a high departure state), and less so in alternatives C (still moderate departure but the high treatment objective target would mean a potential for more acres treated). Alternative B would likely have the least negative effects as more areas have the potential to be treated (using both mechanical and fire) and would reduce adverse second order fire effects to riparian areas. While largely mitigated at the project level through best management practices, this alternative would have the greatest potential for negative impacts from mechanical thinning operations on water resources and riparian areas. These negative effects include compaction and rutting of soil which is likely to channelize water, making it more susceptible to erosion and entrainment and compacted soils have reduced infiltration, resist revegetation, and have increased erosion. The increase in erosion from channelized runoff and compacted surfaces can degrade riparian hydrologic function and increase sedimentation into streams.

There would be less management emphasis of rare or unique riparian ecosystems under this alternative. No recommended research natural areas or recommended botanical areas would be included. This alternative was developed in response to public comment supporting less restrictions on user access and permitted uses. While these rare and unique ecosystems would still afford some level of resource protection through forest-wide management direction (riparian management zone), there is a potential that conditions may not be maintained as well as they could with the afforded resource protections (through additional standards and guidelines) and management emphasis that these areas would provide. Therefore, under alternative D there would be the least beneficial effects of contributing to the regional biodiversity of rare and unique riparian areas and wetlands and maintaining riparian conditions compared to other alternatives.

Table 91 displays the summary and magnitude of effects by alternative, and the overall progress towards meeting desired conditions for riparian areas.

Cumulative Effects

The cumulative effects to riparian areas are the same as the cumulative effects to watersheds. See the Watersheds and Water Resources section. Watershed conditions impact connected streams, riparian areas, and wetlands. The cumulative effects to watersheds is an appropriate measure for the cumulative effects to riparian areas because the spatial and temporal scale of impacts and effects are broad and span across multiple watersheds that intersect the forest.

Table 91. Summary and magnitude of effects (lowest, low, moderate, high, highest) by alternative

Key Effects (beneficial and negative)	Alternative A	Alternative B	Alternative C	Alternative D
Adverse second order fire effects; accelerated erosion and excessive sedimentation to connected stream courses and in connected wetland areas.	**Highest**; insufficient rate of treatment; ecological response units will continue to trend away from desired conditions resulting in increased adverse second order fire effects	**Lowest**; increased rate of treatment – more areas treated, reducing adverse second order fire effects	**Moderate**; high treatment objective primarily using fire – environmental and logistical constrains mean less potential to treat as many areas as alternative B	**High;** mostly using mechanical treatments – not enough fire to maintain conditions and improve upland conditions
Compaction and rutting of soil from mechanical thinning operations; increased erosion and sedimentation in riparian areas.	**Low;** less mechanical thinning operations compared to other alternatives	**Moderate**; increased mechanical thinning operations, but not as much as other alternatives	**Lowest;** the least mechanical thinning operations, most acres are treated using fire	**Highest;** the most mechanical thinning operations and potential for negative effects
Impaired stream conditions from invasive species impacts.	**High;** there are no objectives to treat invasive species in riparian areas	**Low;** there are objectives to treat invasive species in riparian areas	**Low;** Same as alternative B	**Low;** Same as alternative B
Improved riparian and stream channel conditions; floodwater retention, groundwater recharge, and adequate vegetation capable of developing root masses that stabilize streambanks.	**Low;** upland conditions will remain highly impaired, insufficient plan direction and objectives	**High;** upland condition will improve, improved riparian plan direction and objectives	**Moderate;** upland condition may improve but likely less so than alternative B, improved riparian plan direction and objectives	**Low;** upland conditions may not improve compared to other alternatives, no objectives for riparian areas means greater potential for less areas restored
Areas managed for their unique and rare riparian or wetland characteristics; contribute to a regional network of important ecosystems, provide an important visual component of the landscape, and increase user experience and satisfaction (opportunities for watchable wildlife, botany fieldtrips, and increased emphasis for natural history studies)	**Moderate;** does not include the same diversity of unique areas as other alternatives, but would include some areas.	**High;** includes a greater diversity of riparian and wetland ecosystems compared to alternatives A and D.	**High;** same as alternative B.	**Lowest;** has the least areas and beneficial effects due to no research natural areas or botanical areas.
Overall progress toward meeting desired conditions	Towards desired conditions but with limited improvement compared to other alternatives. Insufficient plan direction and objectives, and minimal improvement in upland conditions.	Towards desired conditions with the greatest potential to improve conditions compared to other alternatives. Sufficient plan direction and objectives, and greatest potential to improve upland conditions.	Towards desired conditions and the second greatest potential to improve riparian conditions. Conditions may not improve as well as alternative B because upland conditions are likely to remain moderately departed, increasing negative impacts to riparian areas.	Towards desired conditions but with limited improvement and only slightly better than alternative A. No riparian plan objectives, and upland conditions are projected to remain moderately departed increasing negative impacts to riparian areas.

Watersheds and Water Resources

The Tonto National Forest was originally established for watershed protection purposes. In the late 1800s and early 1900s farmers in the Salt River Valley became interested in constructing a reservoir to provide more reliable water supplies for irrigation. The Reclamation Service who would construct the reservoir was concerned with preventing erosion and siltation which could profoundly impact reservoir projects. Both the Reclamation Service and the Salt River Valley farmers were in favor of creating a forest reserve above the proposed reservoir to manage the timber cutting and grazing that were blamed for denuding the watershed (Marcus 1983). Acting in response to these concerns President Theodore Roosevelt created the Tonto Forest Reserve in 1905, setting aside 1,115,000 acres above 4,000 feet elevation and mostly below the Mogollon Rim as the original forest reserve. The size of the reserve was more than doubled in 1908 to include the western slopes of the Mazatzal Mountains, the Queen Creek Watershed (where a second reservoir was proposed), and the Superstition Mountains (Marcus 1983). The Pinal Mountains south of Globe were also added to the reserve. Lands from the Prescott National Forest were transferred to the Tonto and lands on the Tonto above the Mogollon Rim were transferred to the Coconino National Forest in 1923. Watershed protection and advanced planning for reclamation dams on the Verde River were factors supporting the administrative move that placed much of the Salt and Verde watershed in one national forest. In 1934, the Bloody Basin area of the Prescott National Forest was transferred to the Tonto as well. Addition of these 151,000 acres placed the entire lower Verde watershed within the boundaries of the Tonto National Forest.

Affected Environment

Watersheds

Watersheds on the Tonto National Forest are defined using a uniform hierarchical system developed by the U.S. Geological Survey. The United States is divided and subdivided into successively smaller hydrologic units. The hydrologic units are nested within each other and range from the largest (regions) to the smallest (subwatersheds). Each hydrologic unit is identified by a unique hydrologic unit code consisting of two to 12 digits that are based on six levels of classification in the hydrologic unit system.

The Tonto National Forest lies entirely within Region 15 (Lower Colorado River Region) of the USGS watershed classification system. The Lower Colorado River region is subdivided into subregions, basins, subbasins, watersheds, and subwatersheds. The Tonto lies within portions of four subregions, (Upper Gila, Middle Gila, Salt, and Lower Gila), within parts of five basins (Upper Gila, Middle Gila, Salt, Verde, and Lower Gila-Agua Fria) seven subbasins, 35 watersheds, and within portions of 197 subwatersheds (see figure 39). Planning and analysis generally occur at the subwatershed level, which is also referred to as the 6th code watershed.

Watershed condition is the state of the physical and biological characteristics and processes within a watershed that affect the hydrologic and soil functions supporting aquatic ecosystems (Potyondy and Geier 2011). Watershed conditions are either properly functioning (in a natural pristine state, commonly called healthy watersheds), functioning at risk, or degraded (in a severely altered state or impaired). Watersheds that are properly functioning have terrestrial, riparian, and aquatic ecosystems that capture, store, and release water, sediment, wood, and nutrients within the range of natural variability for these processes. In this condition, they create and sustain terrestrial, riparian, aquatic, and wetland habitats that are capable of supporting diverse populations of native aquatic- and riparian-dependent species. In general, the greater the departure from the natural pristine state, the more impaired the watershed condition.

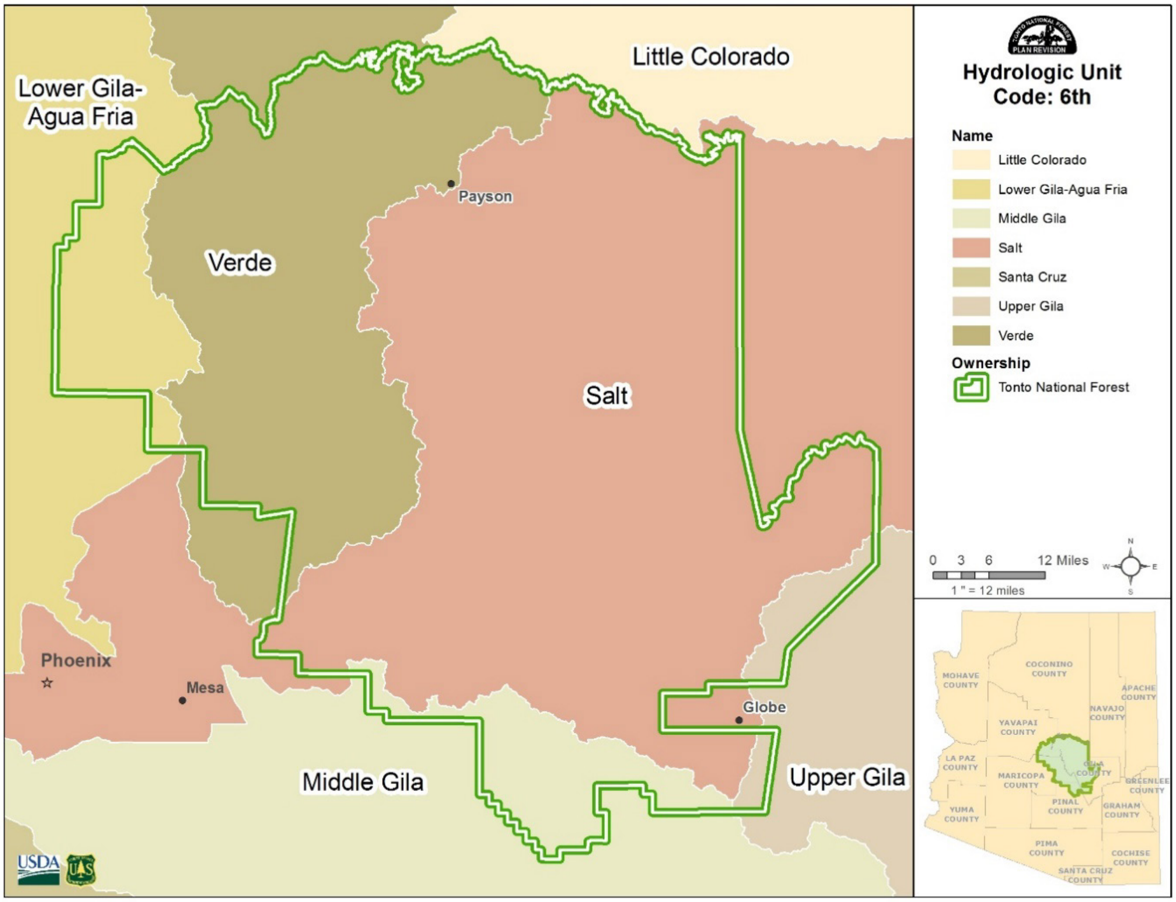

Figure 39. Watersheds (hydrologic unit code 6th) in the Tonto National Forest

Watershed condition classification is the process of describing watershed condition in terms of discrete categories (or classes) that reflect the level of watershed health or integrity. In this analysis, watershed health and integrity are considered to be conceptually the same. Watersheds with high integrity are properly functioning and support ecosystems that show little or no influence from human actions.

Forest Service Manual 2521.1 uses three classes to describe watershed condition:

- Class 1 (properly functioning) - These watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition and are functioning properly.
- Class 2 (functional-at-risk) - These watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition and are functioning at risk.
- Class 3 (impaired) - These watersheds exhibit low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition and are impaired function.

The Forest Service conducted a national effort to assess the condition of all subwatersheds on National Forest System lands in 2010 and 2011 (USDA Forest Service 2011a and b). Although 197 subwatersheds lie partly or entirely within the boundaries of the Tonto National Forest, only 181 were assessed by the Tonto in the national effort because the remaining 16 watersheds contained less than 5 percent of Tonto National Forest System land. The other watersheds contain less than five percent National Forest System lands or were primarily within the boundaries of another national forest.

Watershed condition on the Tonto National Forest was assessed using the Watershed Condition Classification Technical Guide (Potyondy and Geier 2011) developed for the national assessment effort. The guide classifies watershed condition on the basis of a core set of 12 indicators, each containing 1 to 4 attributes that represent the underlying ecological functions and processes that affect soil and hydrologic function (Potyondy and Geier 2011). The attributes are scored, summed, and averaged to produce indicator scores, which are averaged within four process categories. The overall watershed condition score is then computed as a weighted average of the process category scores. The final score for each subwatershed results in an overall rating of functioning properly, functioning at risk, or impaired function.

A properly functioning watershed is one that is functioning in a manner similar to natural wildland conditions (Karr and Chu 1998, Lackey 2001 in Potyondy and Geier 2011). A properly functioning watershed has minimal undesirable human impact on its natural, physical, or biological processes and is resilient and able to recover to the desired condition when disturbed by large natural disturbances or land management activities (Yount and Neimi 1990 in Potyondy and Geier 2011). A watershed has impaired function where some physical, hydrological, or biological threshold has been exceeded. Substantial changes to the factors that caused the degraded state are commonly needed to return the watershed to a properly functioning condition). A watershed that is functioning at risk lies somewhere in between; it is a watershed with moderate geomorphic, hydrologic, and biotic integrity relative to natural potential condition (Potyondy and Geier 2011).

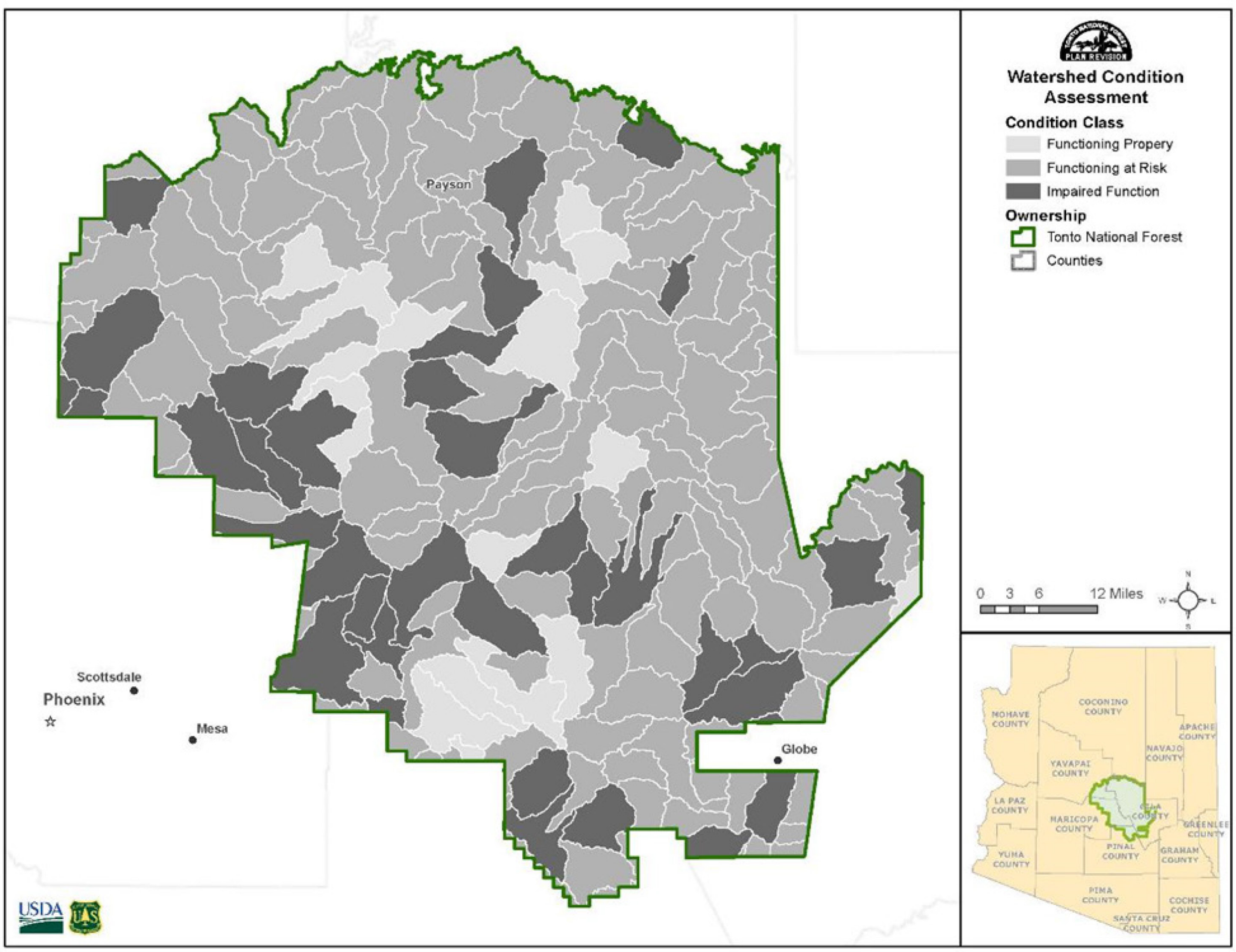

Figure 40. Condition assessment of subwatersheds on the Tonto National Forest

The results of the Tonto National Forest assessment process are displayed by location and condition class in figure 40. Nineteen (11 percent) subwatersheds are rated as functioning properly, 122 (68 percent) as functioning at risk, and 37 (21 percent) as impaired function. Many of the impaired watersheds are found in areas of heavy recreation use where road density is high, areas of current or historic mining, watersheds where dams have disrupted natural flow regimes, and areas with impaired water quality ratings. Many of the properly functioning watersheds lie within wilderness areas where human disturbances are minimal. Assessing watersheds allows the Forest to determine where to focus projects that taken together will improve or maintain watershed condition. These watersheds where work is focused become “priority watersheds” and work completed within them is outline in watershed restoration action plans. (Potyondy and Geier 2011).

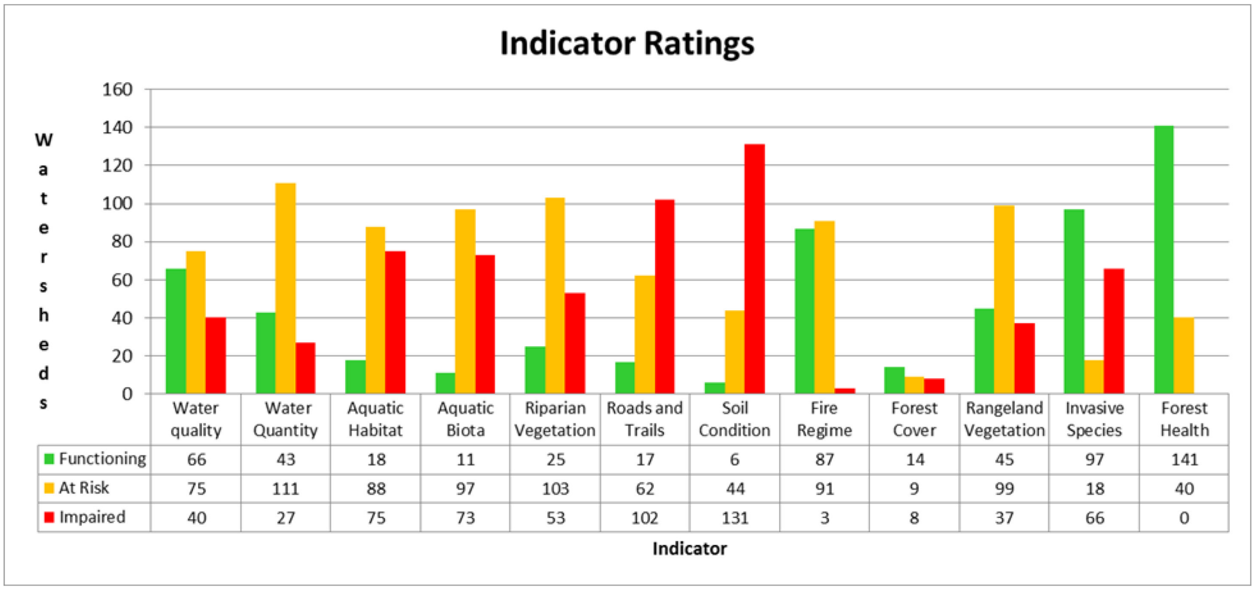

Figure 41. Subwatershed ratings for each watershed condition indicator

Figure 41 displays the number of subwatersheds in each assessment category for the 12 indicators used in the watershed condition assessment. Indicators that contributed substantially to functioning at risk and impaired function ratings for many watersheds and the attributes assessed for these indicators are:

- Water quantity - accounts for changes to the magnitude, duration, or timing of the natural streamflow hydrograph. Watersheds with dams, diversions, major impoundments, or significant retention structures; groundwater pumping that affects stream base flows; effluent discharge; poor range conditions; recent fires; or urbanized areas affected this rating.
- Aquatic habitat - accounts for habitat fragmentation, large woody debris, and channel shape and function. This rating was affected by road crossings that serve as fish barriers, the condition of riparian vegetation along stream channels that controls recruitment of large woody debris, and the condition of stream channels[116].
- Aquatic biota - accounts for distribution, structure, and density of native and introduced aquatic fauna. Most of the perennial streams on the Tonto support populations of nonnative fish and invertebrate species (including crayfish and bullfrogs).

[116] Data for approximately 650 stream channel reaches on the Tonto National Forest exist to assess channel conditions

- Riparian and wetland vegetation - accounts for function and condition of riparian vegetation along streams, waterbodies, and wetlands. Photo points, riparian surveys, and channel condition surveys were used to assess riparian conditions on the National Forest System lands.
- Roads and trails - accounts for density, location, distribution and maintenance of the road and trail network. This indicator was influenced by low frequency of maintenance on level 2 roads (high-clearance, native-surface roads), location of roads close to stream channels, and to a lesser extent, by road density.
- Soil condition - accounts for soil productivity, erosion, and chemical contamination. The Region 3 Soil Condition Class Rating Guide (USDA Forest Service 1999) that rates soils as satisfactory, impaired or unsatisfactory was used for this indicator.

Other indicators, such as fire regime, rangeland vegetation, and invasive species also have a large number of watersheds rated as functioning at risk or impaired function but have only a small effect on the overall watershed condition rating due to the low weight assigned to these indicators in the assessment process. The large number of watersheds rated as impaired function for invasive species is due to the presence of red brome, an annual nonnative grass species, in the desert portions of the Tonto National Forest.

Periods of drought result in reduced streamflow and can result in reduced vegetative groundcover that exposes soils to increased erosion and sediment delivery to stream channels during storm events. Drought can also increase the risk of catastrophic wildfire due to the low moisture content of drought-stressed vegetation. Depending on the fire regime within the ecological response unit, wildfires can have either a negative or beneficial impact on watershed condition. See the Vegetation, Ecological Response Units, Fire, and Fuels section for more description of fire impacts on watersheds.

Water Quality

Water quality has been assessed in major perennial stream reaches and lakes on the forest (ADEQ 2017). Water quality is assessed by comparing existing conditions with water quality standards established for designated uses identified by the State under the authority of the Clean Water Act. The Arizona Department of Environmental Quality (Quality Department) is the regulating authority for water quality in Arizona. The Quality Department identifies designated uses for individual stream reaches and waterbodies across the state that water quality standards are intended to protect. Designated uses include (Arizona Department of Environmental Quality 2017):

- Aquatic wildlife (coldwater, warmwater, effluent-dependent, or ephemeral)
- Body contact (full or partial)
- Domestic water source
- Fish consumption
- Agricultural irrigation
- Agricultural livestock watering

Individual waterbodies are categorized based on how well they attain the water quality standards for the designated uses identified for the waterbody. The most recent assessment completed by Quality Department was issued in 2017 and includes data collected from 2010 to 2015. Assessed waterbodies are placed in specific water quality categories:

- Category 1: Attaining All Uses — There is sufficient data to determine all designated uses are supported.

- Category 2: Attaining Some Uses — At least one designated use assessed as "attaining," and no designated uses were not attaining or impaired.
- Category 3: Inconclusive or Not Assessed — Insufficient samples or core parameters to assess any designated uses.
- Category 4: Not attaining — One or more designated use is not attaining but a total maximum daily load[1] (TMDL) analysis is not required.
- Category 5: Impaired — One or more designated uses is not attaining, and a total maximum daily load (total load)[117] needs to be developed or revised.

Some surface waters have special water quality standards that must be met (Arizona Department of Environmental Quality 2017). Examples applicable to the Tonto National Forest include:

- Fossil Creek, which forms the boundary between the Tonto and Coconino National Forests is the only Outstanding Arizona Water managed by the Tonto National Forest.
- Waters classified as effluent dependent waters (surface waters that would be ephemeral if not for the discharge of treated wastewater. Effluent dependent waters on the Tonto include:
    - Queen Creek from the outfall of the Town of Superior Wastewater Treatment Plant to the confluence with Potts Canyon; and
    - American Gulch from the outfall of the Northern Gila County Wastewater Treatment Plant (Payson) to the confluence with the East Verde River.
- Waters with nutrient standards on the Tonto National Forest include:
    - Verde River and its perennial tributaries from the Verde headwaters to Bartlett Lake;
    - Tonto Creek and perennial tributaries; and
    - Salt River below Stewart Mountain Dam to its confluence with the Verde River.

Site specific standards can also be developed for impaired waters where natural conditions alone would cause the standards to be exceeded. Quality Department is currently developing such standards for Pinto Creek within the Tonto National Forest.

The 2016 water quality assessment report for the Tonto National Forest assessed 559 miles of streams (approximately 30 percent of the perennial and intermittent streams in the forest) entirely or partly within the Tonto National Forest and 24,400 acres of lakes (all the lakes within the forest except Horseshoe Lake) within the forest. The assessment found that 75 miles of the assessed stream miles attained all designated uses (Category 1 and 1N), 179 miles attained some designated uses and no uses were impaired (Category 2), 124 miles had insufficient or no data to determine if any designated use is impaired (Category 3), 27 miles were impaired for one or more designated uses however total loads have been completed and the pollutants are covered under those total loads (Category 4A), and 118 miles are impaired for one or more designated uses by a pollutant and total load analyses need to be completed (Category 5). Table 92 displays the percent of assessed stream miles in each assessment category identified in each of the three most recently completed assessments.

[117] A total maximum daily load analysis determines the maximum amount of a pollutant that a surface water can assimilate (the "load") and still meet water quality standards during all conditions. It defines the loading capacity of the surface water relative to discharges from point and nonpoint sources in the watershed, natural background levels, seasonal variation, and with an incremental margin of safety.

Streams assessed and stream mileage assessed vary to some extent in each of Arizona Department of Environmental Quality assessment reports. In 2010, 513 miles were assessed on the Tonto National Forest; the 2012/14 assessment looked at 651 miles, and the 2016 assessment looked at 558 miles. Primary causes of impairment of water bodies within the Tonto National Forest in the 2016 assessment are copper, primarily in areas of historic mining in the Queen Creek and Pinto Creek watersheds, Mercury in fish tissue in Tonto Creek, Roosevelt Lake, and Bartlett Lake, E. coli bacteria in Christopher and Tonto Creeks below the Mogollon Rim and the Salt River above Roosevelt Lake, and Selenium in Queen and Pinto Creeks and the Upper Salt River.

Table 92. Percentage of stream and river miles by assessment category in 2010, 2012/2014 and 2016

Assessment Category	Percent of stream miles 2010	Percent of stream miles 2012/2014	Percent of stream miles 2016
Attaining all Uses (Cat 1)	4	10	13
Attaining Some Uses (Cat 2)	28	26	32
Inconclusive (Cat 3)	36	30	22
Not Attaining (Cat 4)	5	--	0
Not Attaining but completed TMDL (Cat 4A)	--	5	5
Not Attaining/Impaired[a] (Cat 4A/5)	6	6	6
Impaired (Cat 5)	21	25	21

a - These streams have a total maximum daily load completed for one constituent but are impaired for other constituents.

Good water quality is found in a number of streams draining the Mogollon Rim and Sierra Ancha Mountains, reaches of the Verde River, and in the heavily used Salt River from Stewart Mountain Dam to the confluence with the Verde River.

All of the reservoirs within the Tonto National Forest were assessed in the 2010 assessment and all but Horseshoe Reservoir were assessed in the 2012/2014, and 2016 assessments. Table 93 displays the water quality status of reservoirs within the forest.

The most significant change in water quality rating for the reservoirs on the forest from the 2010 assessment to the 2016 assessment has been the change in Bartlett Lake which has gone from Category 2 (attaining some uses) to Category 5 (Impaired) with the detection of mercury at unsafe concentrations in fish tissue. The Arizona Department of Environmental Quality is researching the source of mercury in Tonto Creek and the reservoirs (Roosevelt Lake and Bartlett Lake) that have been assessed as impaired.

Primary sources of pollution from National Forest System lands are nonpoint source pollutants. Activities generating nonpoint source pollutants on the Tonto National Forest include past and present mining activities, livestock grazing, roads, timber and fuelwood harvesting, impoundments, recreational uses, and ground disturbance created by off-highway-vehicle use. Natural and unknown sources of pollutants also contribute to nonpoint source pollution on the Tonto.

Activities that reduce stream shading can also cause violations of water quality standards for stream temperature (particularly in cold-water, high-elevation streams) and dissolved oxygen.

Table 93. Water quality status of reservoirs within the Tonto National Forest

Reservoir Name	Reservoir Size (acres)	Water Quality Rating 2010	Water Quality Rating 2012/2014	Water Quality Rating 2016	Cause of impairment
Roosevelt Lake	18,345	Impaired	Impaired	Impaired	Mercury in fish tissue
Apache Lake	2,192	Impaired	Impaired	Impaired	Low Dissolved Oxygen
Canyon Lake	448	Impaired	Impaired	Impaired	Low Dissolved Oxygen
Saguaro Lake	1,022	Attaining some uses	Attaining some uses	Inconclusive	N/A
Horseshoe Lake	1,982	Inconclusive	Not assessed	Not Assessed	N/A
Bartlett lake	2,376	Attaining some uses	Inconclusive	Impaired	Mercury in fish tissue

Point sources of potential water contaminants on the Tonto include, but are not limited to, wastewater facilities associated with campgrounds, administrative sites, and other sites authorized by special use permits (e.g., fish hatcheries, marinas), and current and historic mines. Point sources are also required to use best management practices including permitting, inspection, state certification, and mitigation of temporary point source pollution through the Clean Water Act, National Pollution Discharge Elimination System program, and Comprehensive Environmental Response, Compensation, and Liability Act program (Superfund).

Water Quantity-Surface Water

There are approximately 700 miles of perennial streams, 1,100 miles of intermittent streams, and 11,000 miles of ephemeral streams within the Tonto National Forest. While perennial streams are often the primary focus of management, a 2008 EPA study reported that 81% of streams in the southwest (AZ, NM, CO, UT, NV, and CA) are either intermittent or ephemeral and Arizona has the greatest percentage of any other state with 94%. The forest occupies just under 50 percent of the 35 watersheds (HUC 10 code) that intersect the forest boundaries yet supports more than 60 percent of the perennial streams within those watersheds. Two of the state's major rivers (the Salt and Verde Rivers) flow through the forest. Six large reservoirs; Roosevelt, Apache, Canyon, and Saguaro Lakes on the Salt River and Horseshoe and Bartlett Lakes on the Verde River with a combined surface area of 31,900 acres and storage capacity of 2,312,201-acre feet occur on the Tonto (Arizona Department of Water Resources 2008). These reservoirs impact the flow regime in downstream reaches of the rivers impacted by the dams. The flow regime in the Salt River below the dams is more greatly altered than that in the Verde due to the greater storage capacity of the reservoirs on the Salt River and the use of these reservoirs to generate power during the summer to support the heavy demand for air conditioning during the hot times of the year.

Figure 42 displays average monthly discharge at two sites on the Salt River[118]. The first site[119] is upstream of the reservoirs on the Salt River and displays a natural stream flow hydrograph for the period from 1913

[118] Source USGS 2014
[119] USGS gage is located at the Salt River near Roosevelt.

to 2014. The second site[120] is below the four reservoirs on the Salt River and displays mean monthly stream flows resulting from controlled releases from these reservoirs for the period 1940 to 2014. Under natural flow conditions, the highest flows occur in the winter and spring and the lowest flows occur in the summer and fall. The controlled releases from the Salt River reservoirs result in high flows in the spring and summer and low flows in the fall and winter. The difference in flow characteristics between the sites reduces the ecological sustainability value of stream flows in the lower reach.

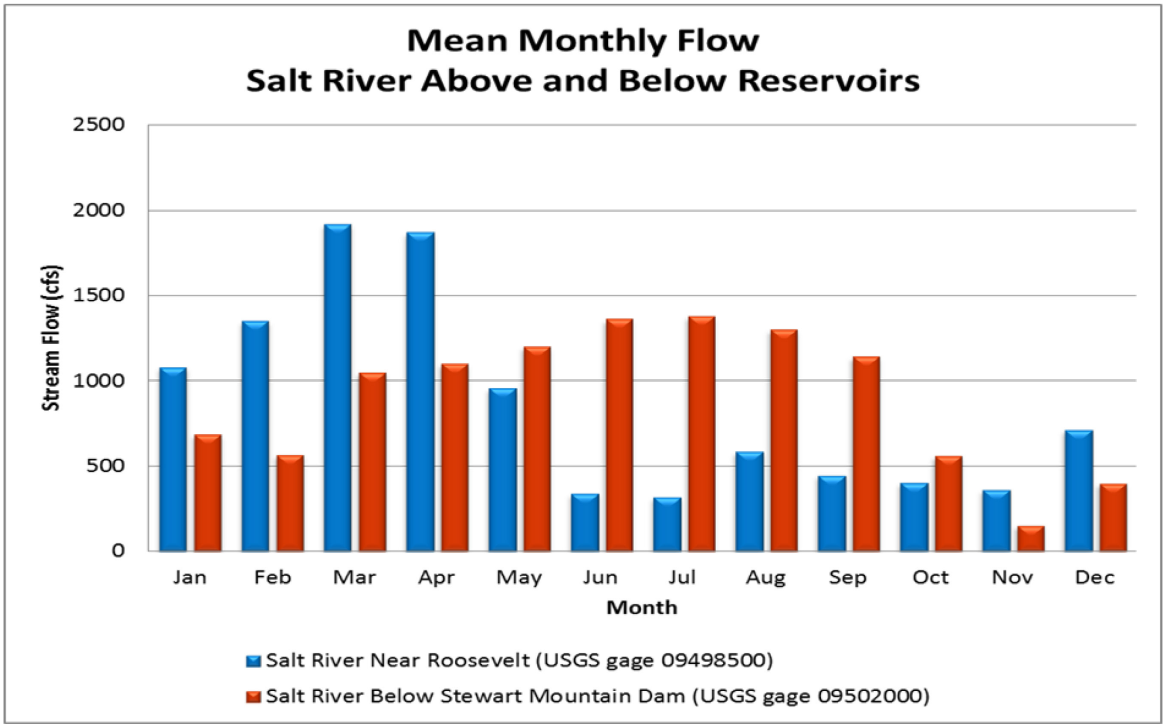

Figure 42. Salt River mean monthly flow

In addition to the effect of reservoirs on the annual distribution of stream flows they also affect the movement of nutrients and sediment through the river system. Stream bottom materials typically coarsen over time below reservoirs due to interruption of the natural sediment transport processes in the river. Sediments transported by the river deposit in the reservoir and are eroded below the reservoir. Reservoirs can also have water quality impacts, particularly on water quality constituents such as nutrients, temperature, and dissolved oxygen (Postel and Richter 2003; Graf 2006; Hadley and Emmett 1998).

The East Verde River is augmented by imports from CC Cragin Reservoir on East Clear Creek in the Coconino National Forest. These imports were intended to repay senior water right holders in the Salt River Basin (primarily Salt River Project) for water diverted out of the basin from the Black River to mines near Morenci. Imports occurred primarily during the spring, summer, and fall and increase base flows in the East Verde River substantially. Since passage of the Arizona Water Settlements Act in 2004, imports to the East Verde River are used to satisfy obligations to the Gila River Indian Community and supplement Salt River Project shareholder water supplies. The Act authorized 3,500 acre-feet annually for northern Gila County communities, and the city of Payson is currently constructing a pipeline from the outlet of the C.C. Cragin pipeline to the city. Imports to the river will be reduced once Payson begins diverting water down the pipeline. Figure 43 displays mean monthly stream flows measured in the East

[120] USGS gage is located at the Salt River below Stewart Mountain Dam.

Verde River near the confluence with the Verde River[121] from 1961 to 2014 and the mean monthly flow imported into the East Verde River headwaters from C.C. Cragin Reservoir[122] from 1965 to 2014[123]. The chart clearly displays the impact of the imports on base flows in the East Verde River particularly during the summer and fall.

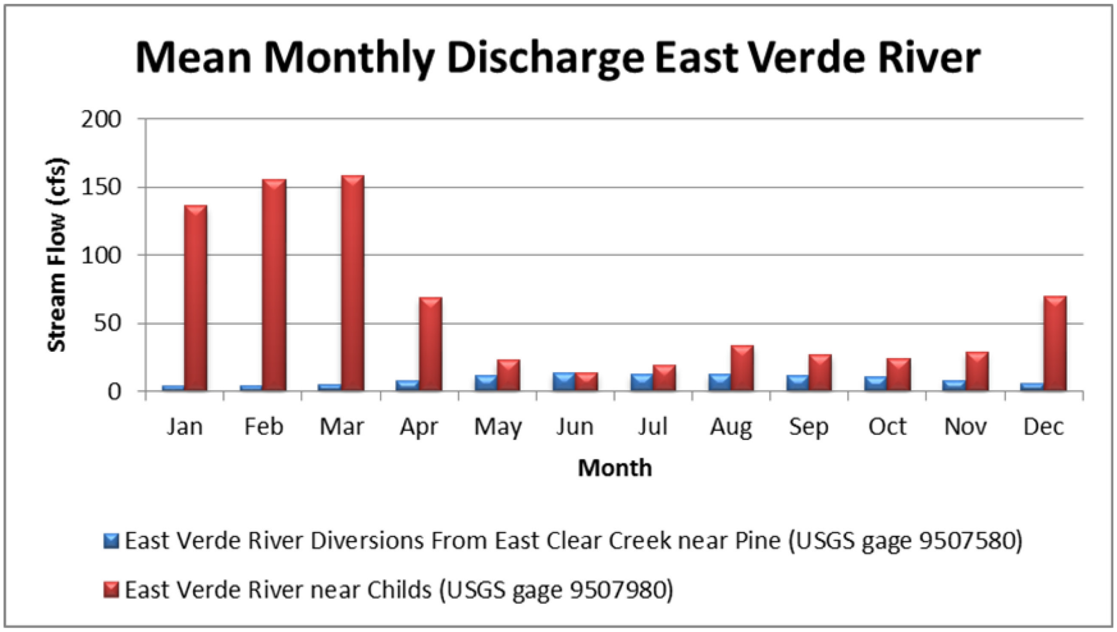

Figure 43. East Verde River mean monthly discharge

Most of the stream flow in Fossil Creek was diverted from the creek for run-of-the-river hydroelectric power generation beginning in the early 1900s until 2005 when the full flow was restored. Water for power generation was provided by a series of springs that discharged an average of about 43 cubic feet per second year-round. The water discharging from these springs is supersaturated with carbon dioxide (CO_2) that created travertine features from calcium carbonate precipitation as CO_2 outgassed from the spring water. These travertine features were damaged by floods during the period of power generation and have been rebuilding since full flows were restored to the creek.

Small-scale diversions occur from many of the perennial streams, or springs feeding these streams, that originate below the Mogollon Rim to provide water to private lands located along these streams. Groundwater pumping on private lands also occurs in proximity to many streams and may also impact stream flows. Diversions for fish hatcheries affect short reaches of Tonto and Canyon Creek. A well field authorized on the Tonto for widening and realigning Highway 260 from Payson to Heber affects nearby springs and a stream. Mitigation measures for the well field include a diversion from Tonto Creek that allows withdrawals from the creek during the winter and spring if specific flow conditions are met in the creek. Water from the creek is used to artificially recharge the aquifer affected by pumping (Northern Arizona University 2005).

[121] USGS Gage is located at the East Verde River near Childs.
[122] USGS Gage is located at the East Verde River Diversions from East Clear Creek near Pine.
[123] Source USGS 2014

Stream diversions from Cherry Creek on the east side of the Tonto National Forest, Tonto Creek above Gisela, Deer Creek near Rye, and Pine Creek above Pine reduce base flows or dewater reaches of these creeks below the diversions.

Large mines exist in the Globe-Miami and Superior areas. Groundwater pumping by these mines may affect stream flows in Pinal and Pinto Creeks. Impacts to streamflow from groundwater pumping by the Carlota Copper Mine were documented in a perennial tributary to Pinto Creek (USDA Forest Service 1997). In addition to the pumping impacts, mines can also affect groundwater flow paths through development of pits in open pit mines and by tunnels, shafts, adits, etc. in underground mines. Both types of mines are found as either abandoned or currently operating mines on the Tonto National Forest. An additional large mine (Resolution Copper Mine) is proposed on the Tonto in the near future. The Resolution Copper Mine is proposed as an underground mine but would be expected to have subsidence effects at the surface.

In addition to human related impacts the recent drought in the Southwest has reduced flows in some streams. Stream flow in Tonto Creek for example has declined from an average annual flow of more than 300 cubic feet per second in the late 1970s to less than 100 cubic feet per second in the last 5 years. Figure 44 displays a running 10-year average precipitation versus long-term average precipitation for Climate Division 4 (Gila County) in Arizona[124]. Data used for the figure begins in 1895 and ends in 2013. The figure displays the extreme drought that occurred at the turn of the 19th century from about 1891 to 1904 (Webb et al. 2007). It also displays a drought period in the 1950s and the severity of the most recent drought that began in the middle 1990s. The figure also displays wet periods in the 1910s to 1920s and from the late 1970s to early 1990s.

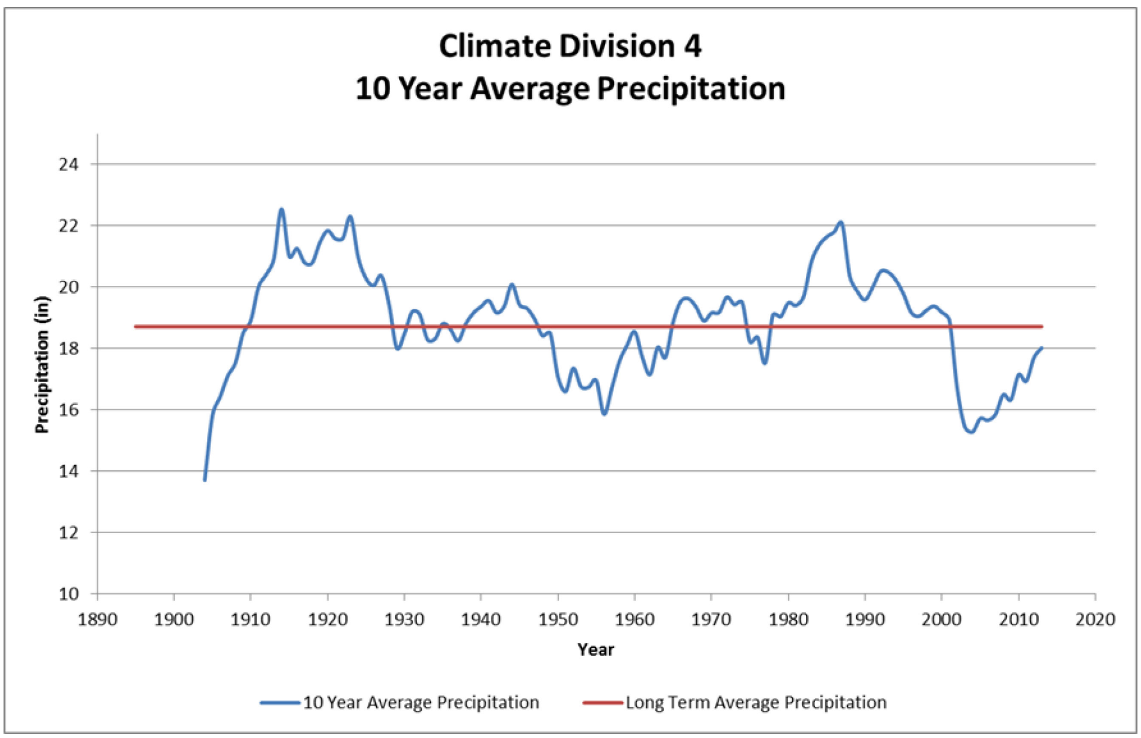

Figure 44. Ten-year average precipitation, climate division 4

[124] Source: WRCC 2015

Springs are a valuable but limited resource on the Tonto National Forest particularly in the more arid portions. Water discharged from springs supports riparian habitat and provides important water sources for wildlife, livestock, and human needs. Springs can also be an important source of base flows in perennial streams and can maintain stream flows during the hot summer months. The Tonto National Forest water rights database identifies approximately 1,860 springs and seeps within the forest boundary for which the Forest has submitted water right applications. Applications for water rights for springs are typically intended to provide water for livestock and wildlife and sometimes include domestic and recreational uses. Developments that divert water from the spring source can affect ecological values supported by the springs. Springs which discharge to form Fossil Creek are the largest springs in the state outside of the Grand Canyon. These springs lie within both the Coconino and Tonto National Forests and sustain a relatively constant discharge in Fossil Creek that averages around 43 cubic feet per second (Northern Arizona University 2005).

At the watershed level (HUC 10 code) approximately 50 percent of the watershed area of the 35 watersheds that intersect the forest that lie within the forest boundary yet 72 percent of the springs in these watersheds lie within the forest boundary. The difference may be due to the higher elevation and precipitation characteristics of lands within the Forest.

Stock tanks, although a man-made disturbance within the watershed, are also a valuable water source for livestock and wildlife. Stock tanks help to distribute livestock more evenly across the landscape and help reduce the effects of concentrated livestock use at more traditional watering sources such as intermittent and perennial streams, and springs and seeps. There are approximately 1,490 stock tanks within the Forest. The percent of stock tanks on the forest is similar to the percent watershed area of the 35 watersheds that intersect the forest boundary.

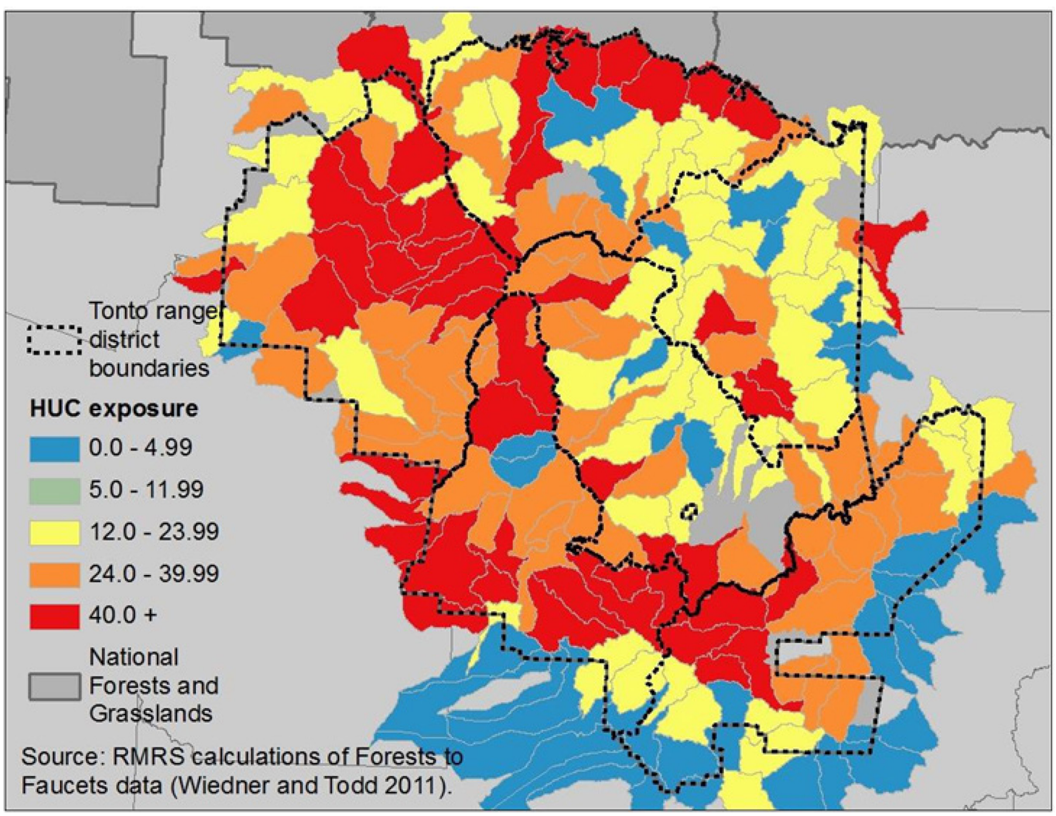

Figure 45. Exposure of surface watersheds to climate-related vegetative change for 12-digit HUCs

The exposure of surface watersheds to climate-related vegetative change for 12-digit HUCs is shown in figure 45. The areas are rated as high or very high likelihood of vegetative change and importance for drinking water. The importance rating is a standardized 0 to 40 or over index value that summarizes relative mean annual water supply, the flow of water (e.g., from upstream to downstream watersheds), and water demand (i.e., of the municipality where water is eventually consumed). HUCs with a value of 40 or over are those with the highest importance for surface drinking water. HUCs with high exposure values are those with high importance and a relatively high share of area likely to experience vegetative change. These watersheds are mostly clustered together and distributed throughout the Cave Creek, Globe, Mesa, and Payson ranger districts (USDA Forest Service 2018d).

Water Rights

The Tonto National Forest has filed numerous claims and applications for water rights within the boundaries of the national forest; the Arizona Department of Water Resources issues and manages water rights within the state. Most of these claims are for springs, stock tanks, and wells to provide water for livestock and wildlife. The Tonto has filed approximately 3,200 applications and claims for springs and stock tanks on National Forest System lands within its boundary. To reduce the likelihood of impacts from water withdrawals and maintain streamflow in many of the streams threatened by dewatering or with substantial resource values (such as threatened and endangered species), Tonto National Forest has filed a number of instream flow water right applications with the Arizona Department of Water Resources. Instream flow water rights are a type of water right recognized by the state of Arizona specifically for supporting the beneficial uses of wildlife, including fish, and for recreation. Instream flow water rights are non-consumptive rights that seek to maintain flow in the stream channel. In general, the applications submitted by Tonto National Forest personnel seek to maintain median monthly flows in specific stream reaches. A map displaying the status of streams with instream flow claims on the Tonto National Forest is displayed in figure 46.

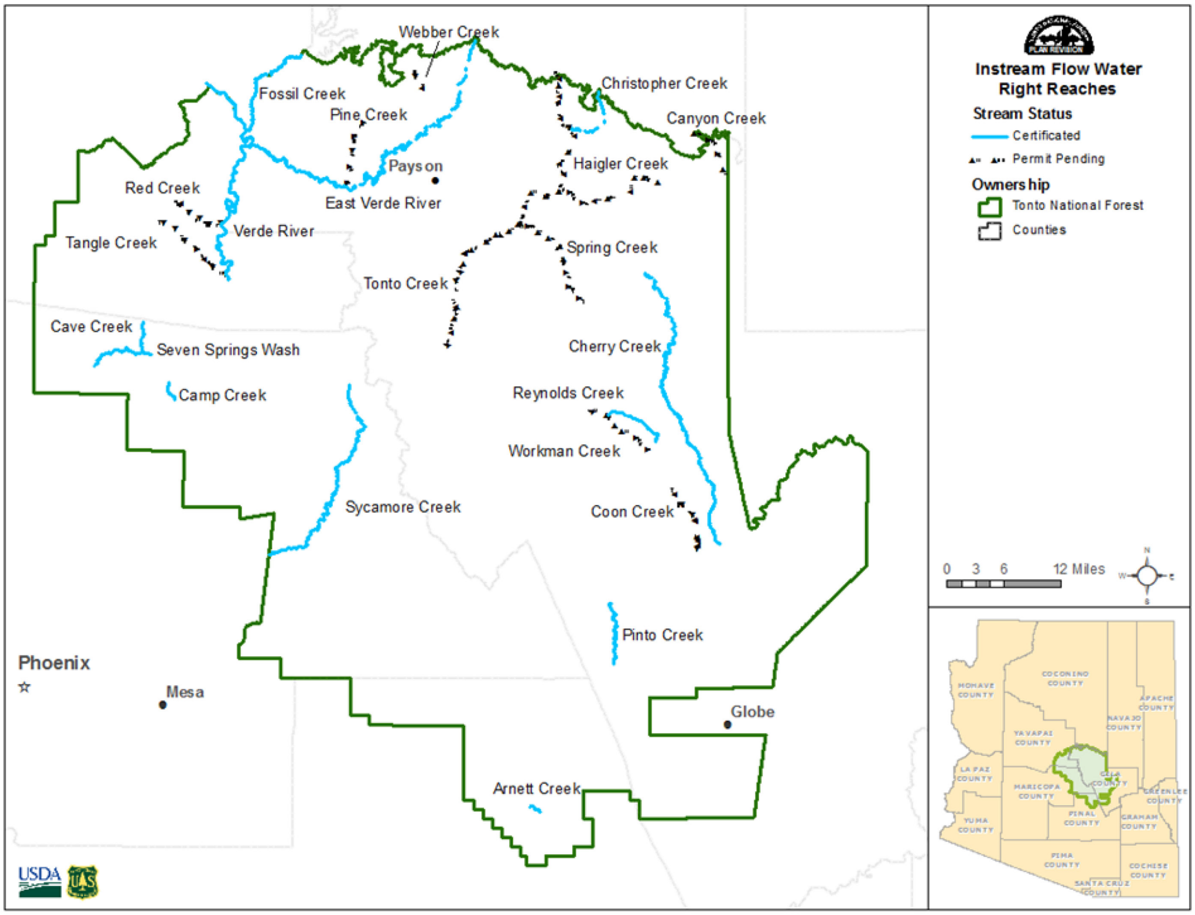

Figure 46. Stream reaches with instream flow water right certificates or pending permits

To date, the Tonto National Forest has received water right certificates for 12 stream reaches including the Lower Verde River and Fossil Creek. Instream flow assessments have been completed for another 10 stream reaches. Instream flow permits for these streams await resolution of protests or review of the instream flow assessments by the Arizona Department of Water Resources.

In addition to instream flow water rights, the Tonto National Forest also has applications, claims, or certificates for approximately 1,850 springs within its boundary. Applications for water rights for springs are typically intended to provide water for livestock and wildlife and sometimes include domestic and recreational uses. The Tonto National Forest has water right applications or certificates for approximately 1,340 stock tanks as well.

Two wild and scenic rivers are located partly on the Tonto: Verde River and Fossil Creek. When wild and scenic rivers are designated the volume of water necessary to preserve the outstandingly remarkable values associated with the rivers is reserved by the Federal government. The volume of water necessary to preserve the outstandingly remarkable values has not yet been quantified for either river but will provide additional flow protection once quantification is completed.

Water Yield

Precipitation ranges from about 9 inches annually in the lowest elevations of the Tonto National Forest to more than 32 inches along the Mogollon Rim, Pinal Mountains, and Sierra Ancha Mountains.

Precipitation distribution on the Tonto National Forest is influenced by elevation. Precipitation increases with elevation due to orographic lifting by the mountain ranges on the Tonto. Figure 47 plots relationship of precipitation to elevation based on weather station data within the Forest. Average precipitation across the Tonto is approximately 18 to 20 inches annually. Precipitation typically occurs during two seasons. During winter, precipitation is derived from frontal systems that move from west to east across the state. Approximately 40 percent of the annual precipitation occurs from December to March as rain or snow from these systems. Approximately 35 percent of annual rainfall is received from July to September from primarily convective type storms (thunderstorms). May and June are typically the driest months on the Tonto National Forest.

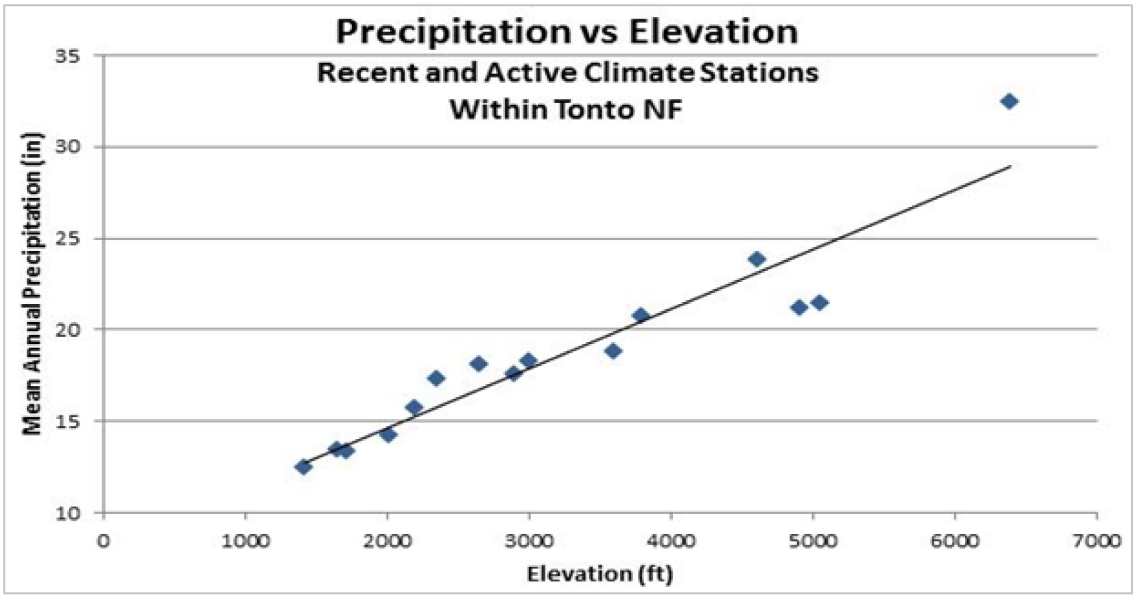

Figure 47. Effect of elevation on average annual precipitation
Source: Western Regional Climate Center Website 2015b

Although, summer rainfall typically occurs as high-intensity summer thunderstorms of limited areal extent. These storms can result in high peak flows (flash floods) in smaller drainages but do not release a sufficient volume of water to substantially affect larger drainages. Widespread winter frontal storms have lower rainfall intensity but are of longer duration and affect much larger areas than summer thunderstorms, resulting in greater runoff volumes and contributions to streamflow. Reduced evaporation rates during the winter also result in greater runoff volumes. Watershed runoff from precipitation ranges from more than 5 inches along the base of the Mogollon Rim to less than one inch in the western and southern desert areas of the Tonto. Overall, runoff averages about 1.5 inches per year. Annual water yield from each basin can vary by up to several orders of magnitude between years depending on amount and timing of precipitation, geology, or transmission losses. Streams with large base flow components have smaller variability than ephemeral streams where annual water yield is dependent entirely on rainfall or snowmelt. Total average annual runoff from the Tonto National Forest is estimated to be about 376,000 acre feet per year (Brown and Froemke 2009). Water yield from the Tonto has likely declined over the last ten years due to drought conditions which have prevailed since about 1995.

The soil burn severity that may be caused by wildland fire can also be a factor in the water yield on the forest. Rain events directly immediately following a wildfire, especially in areas where there have been high severity effects to soil and/or vegetation, can increase the initial water and sediment yield of a watershed. For watersheds that directly drain into a reservoir, fires that produce high severity effects could also cause additional sediment loading by sending ash and debris into the reservoir. This in return would reduce the ability to store water supplies as well as potentially impact existing water infrastructure. Sediment, debris, and increased peak flows from high severity fires, can also impact human life and safety on private landowners as well as municipal areas within and around the forest boundary.

Groundwater

Much of the Tonto National Forest is characterized by a band of mountains consisting of igneous, metamorphic, and sedimentary rocks. High elevations, steep topography, and extensive bedrock result in relatively high runoff and small water storage capabilities in much of the Tonto as compared to alluvial basins in the southern part of the state. A unique geographic feature of the Tonto National Forest is the Mogollon Rim, an escarpment that defines the southern boundary of the Colorado Plateau. The rim is approximately 7,000 feet in elevation with sheer drops of 2,000 feet at some locations (Arizona Department of Water Resources 2010). The rim stretches for over a hundred miles and forms much of the northern boundary of the Tonto.

Groundwater within the Tonto National Forest occurs primarily within fractured bedrock and in shallow alluvial aquifers along the margins of streams. Deeper basin fill aquifers with greater groundwater resources although limited in areal extent on the Tonto can also be valuable groundwater resources for cultural uses. They are typically hydrologically connected with stream alluvium. Basin-fill aquifers underlie the area around Globe, Tonto Basin, portions of Pinto Creek, Cherry Creek, Sycamore Creek, Queen Creek, and the Verde River. Recharge to basin-fill aquifers occurs primarily along mountain fronts and by infiltration from streams (Arizona Department of Water Resources 2008).

Groundwater recharge occurs in areas of higher precipitation, particularly along the Mogollon Rim just north of the Tonto National Forest boundary, the Sierra Ancha Mountains northeast of Roosevelt Lake, the Pinal Mountains south of Globe-Miami, and the Mazatzal Mountains between the Verde River and Tonto Basin. Precipitation at the highest elevations of these features averages greater than 30 inches annually. Groundwater recharge on the Mogollon Rim was estimated to be 4 to 17 percent (up to 5 inches) of the annual precipitation on the Rim (Parker et al. 2005). Groundwater discharging from the Coconino Sandstone (also known as the C Aquifer) and the Redwall Limestone at the base of the Rim maintains perennial flow in many of the streams that originate beneath the Rim. Several of these streams maintain perennial flow for only a mile or two before flow is lost due to seepage into permeable and occasionally karstic terrain. Examples include Webber, Chase, Dude, Bonita, Ellison, and Horton Creeks. The largest spring discharging from below the Rim is Fossil Springs which discharges at an estimate 42 to 45 cubic feet per second and maintains perennial flow in Fossil Creek. Other major springs discharging below the Mogollon Rim include Tonto Spring that discharges into Tonto Creek, See Spring that flows into Christopher Creek, and OW Springs that discharges to Canyon Creek. Tonto and OW Springs have been developed to provide water to fish hatcheries on Tonto and Canyon Creeks.

Groundwater recharge in the Sierra Ancha Mountains discharges to a number of springs on the east side of the mountains that help to sustain perennial flow in Cherry Creek. Perennial flow in Workman and Reynolds Creeks that flow to the west side of the mountains, Coon Creek on the south side and Spring and Rock Creeks on the north side are also sustained by groundwater discharged from precipitation recharged in the Sierra Ancha Mountains. Groundwater discharging from the west side of the Mazatzal Mountains sustains perennial flow in a number of streams draining through the Mazatzal Wilderness to the Verde River.

The Forest lies primarily within the Central Highlands (83 percent of the forest) and Active Management Area (13 percent of the forest), management areas established by the Arizona Department of Water

Resources. The area of the Forest within the Active Management Area is entirely within the Phoenix Active Management Area. The Active Management Areas are areas that relied heavily on mined groundwater prior to enactment of the 1980 Arizona groundwater code. This code was enacted to reduce over pumping of the state's finite groundwater resources. In the Phoenix, Prescott, and Tucson active management areas, the primary management goal is to achieve safe yield by the year 2025. Safe yield is achieved when the amount of groundwater being withdrawn equals the amount that is annually replaced. Within active management areas, groundwater rights were established; wells are regulated; and the municipal, industrial, and agricultural sectors are subject to mandatory conservation programs (Arizona Department of Water Resources 2010). Outside active management areas, which includes the majority of the Tonto National Forest, there is essentially no restriction on withdrawing groundwater as long as it is put to reasonable and beneficial use (Arizona Department of Water Resources 2010).

Groundwater-dependent Ecosystems

Groundwater-dependent ecosystems on the Tonto National Forest include slightly more than 1,000 springs that support valuable aquatic and riparian habitat. There are also approximately 700 miles of perennial streams on the Tonto that are supported by groundwater discharge and approximately 1,100 miles of intermittent streams where shallow groundwater elevations support obligate riparian vegetation. Riparian vegetation supported by groundwater discharge supports fish and wildlife habitat, filters sediment from upland runoff and flood flows, moderates stream temperatures, provides bank stability for stream channels, and helps to recharge shallow alluvial aquifers. Figure 48 displays the location of perennial and intermittent streams on the Tonto National Forest.

Most of the perennial streams on the Tonto National Forest are dependent on groundwater discharge to maintain perennial flow. Typically, headwaters areas on these streams are areas of groundwater discharge (effluent areas). Many of these streams become losing (influent) streams as they exit mountainous areas and enter broader alluvial valleys. Many of the streams draining the Mogollon Rim area become influent streams where they cross karstic terrain. Alternating zones of gaining and losing reaches are common where canyon-bound and alluvial reaches alternate along a stream channel.

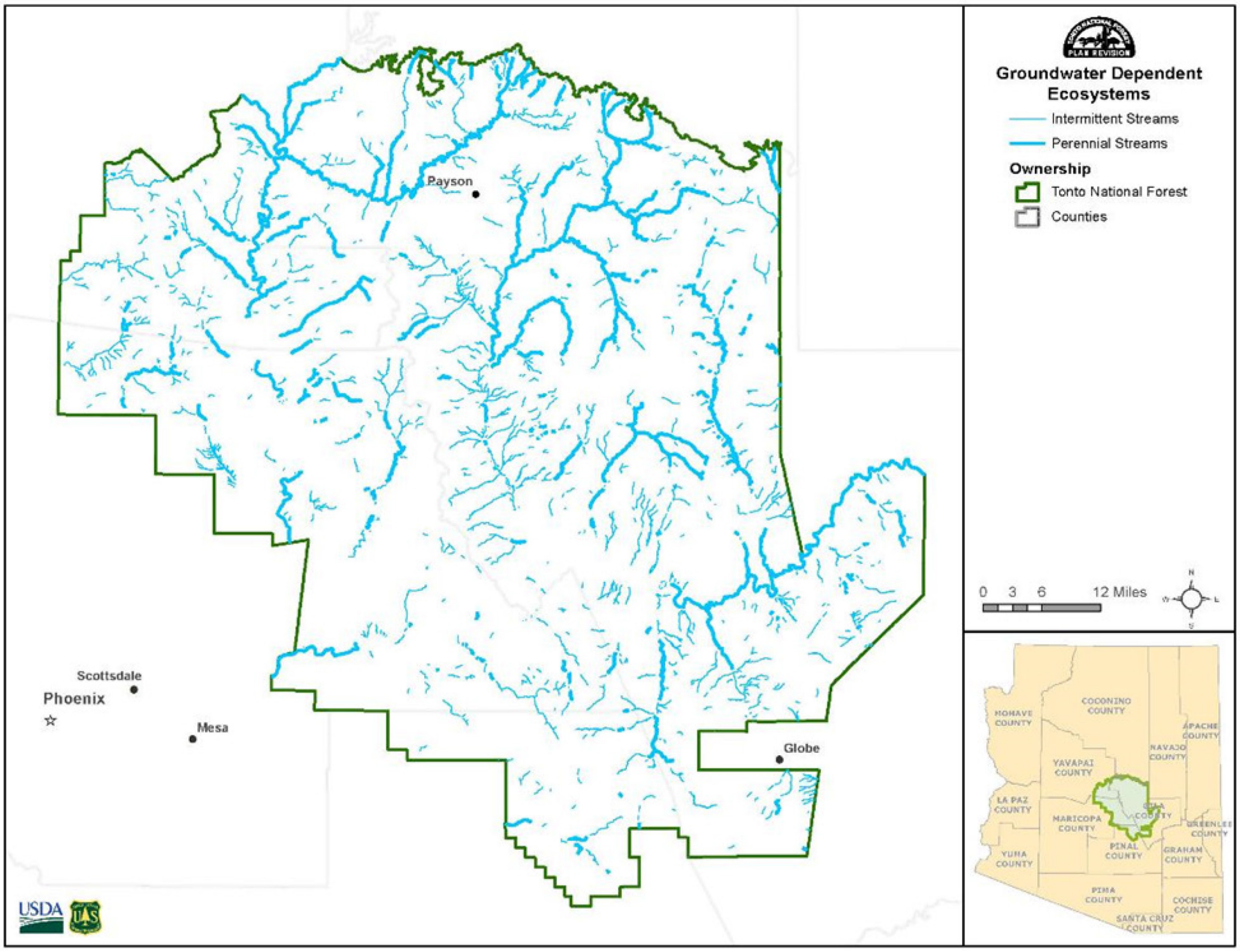

Figure 48. Groundwater-dependent ecosystems as they relate to perennial and intermittent streams

The U.S. Geological Survey has developed base flow indices for gaging stations across the United States. The indices estimate the portion of streamflow that is derived from base flow (base flow is defined as the component of streamflow that is attributed to groundwater discharge and other delayed sources such as snowmelt into streams (Santhi et al. 2008). Base flow indices developed for 13 gaging stations on perennial streams on the Tonto range from 0.30 for Sycamore Creek near Sunflower to 0.76 for Pinal Creek at Inspiration Dam, and average 0.45 for the 13 gages assessed on the Tonto. The average value of 0.45 indicates almost half of the flow in many of the streams on the Tonto is derived from groundwater discharge and other sources of delayed flow. Table 94 displays base flow indices for stream gages on perennial streams within the national forest that are minimally affected by dams, diversions, and imports.

In streams with low flow volumes, base flow conditions are critical for water quality and quantity management (Santhi et al. 2008). Maintaining groundwater discharge to sustain perennial stream flow, shallow water table elevations, or both at these sites is important for the aquatic and riparian resources dependent on these features for their survival. Examples from the table above include streams such as Cherry Creek, Pinto Creek, Rye Creek, Webber Creek, and Sycamore Creek.

Table 94. Base flow index values for selected stream flow gages within Tonto National Forest

USGS Gage No.	USGS Gage Name	Drainage Area (square miles)	Median Flow (cubic feet per second)	Average Base Flow Index Value
9497900	Cherry Creek near Young, AZ	62.1	1.5	0.351
9497980	Cherry Creek near Globe, AZ	200	8	0.474
9498400	Pinal Creek at Inspiration Dam, near Globe, AZ.	195	7	0.762
9498500	Salt River near Roosevelt, AZ	4,306	329	0.631
9498502	Pinto Creek near Miami, AZ	102	1.9	0.500
9498800	Tonto Creek near Gisela, AZ	430	20	0.313
9498870	Rye Creek near Gisela, AZ	122	2.7	0.319
9499000	Tonto Creek above Gun Creek, Near Roosevelt, AZ	675	22	0.316
9499500	Tonto Creek near Roosevelt, AZ	841	24	0.287
9507700	Webber Creek above West Fork Webber Creek near Pine, AZ	4.79	0.6	0.535
9507900	Webber Creek below West Fork Webber Creek near Pine, AZ	9.63	0.7	0.499
9508500	Verde River below Tangle Creek, above Horseshoe Dam, AZ	5,858	237	0.563
9510150	Sycamore Creek near Sunflower, AZ	52.3	0.5	0.302

The Arizona Department of Water Resources monitors index wells across the state to collect long-term water level data (Beversdorf et al. 2009). A number of these wells lie within the boundaries of the Tonto National Forest, primarily on private lands, but a few are located on National Forest System lands. An example of water level trends of selected wells within the boundaries of the Tonto National Forest is a well (55-601024) in the uplands of Tonto Basin near Lambing Creek (Arizona Department of Water Resources 2017), see figure 49. This well shows a decline in water table elevation of about 35 feet from the wet period in the late 1970s to early 1990s to the drier period in the 2000s.

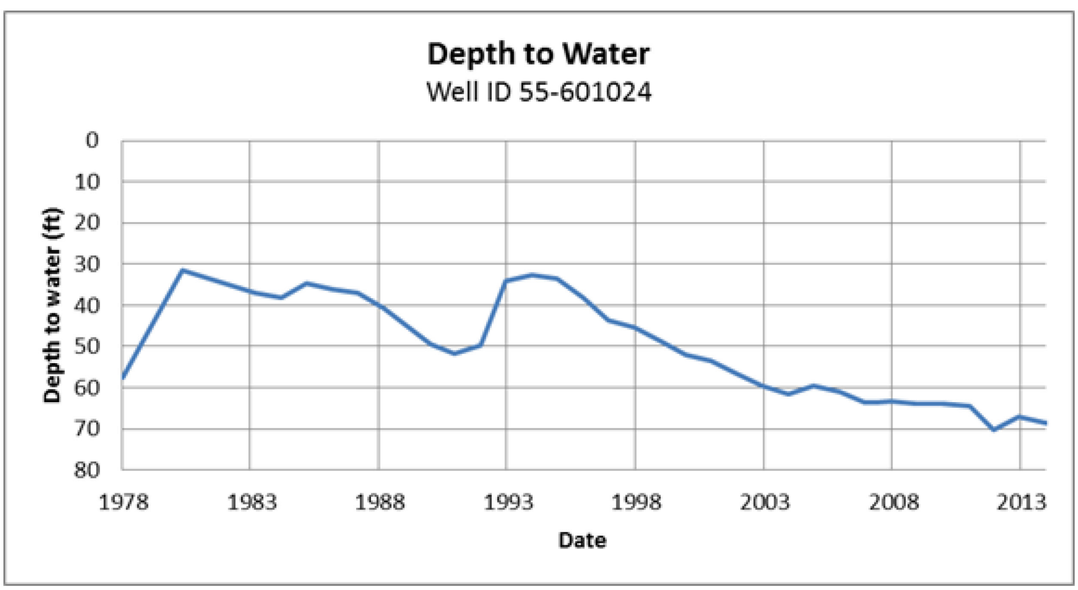

Figure 49. Depth to water, well 55-601024, 1978 to 2015

Another well (55-601022) is close to Rye Creek adjacent to Highway 87 near Rye (Arizona Department of Water Resources 2017), see figure 50. Water table elevations in this well would be expected to be influenced by recharge from surface flows in Rye Creek. Figure 50 displays a rise in water table elevations during the wet period extending from the late 1970s to the early 1990s and a decline during the drier period of the last 15 years. There is little difference between the early 1970s and today.

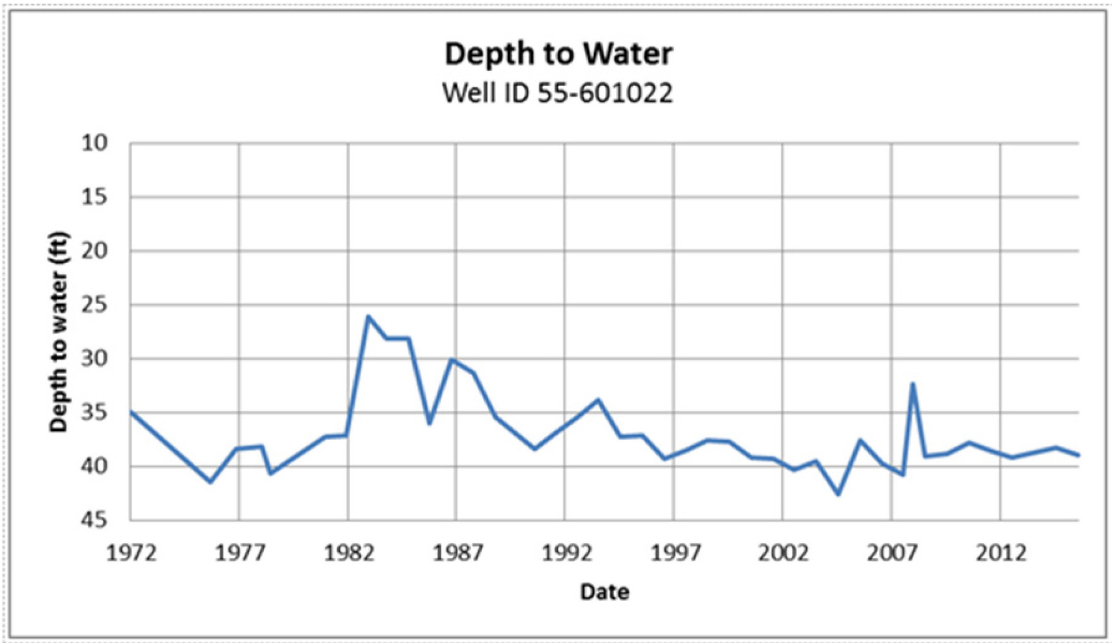

Figure 50. Depth to water, well 55-601022, 1972 to 2015

Water Uses and Demands

The cities of Payson, Globe-Miami, and Superior lie within the exterior boundaries of the Tonto National Forest. The communities of Strawberry, Pine, Star Valley, Christopher Creek, Young, Gisela, and Tonto Basin also lie within the boundaries. Population growth in these communities and other unincorporated areas within the forest is increasing water usage. The city of Payson has been entirely dependent on groundwater for its water supply and has explored for additional water sources on the Tonto. The Arizona Water Settlement Act of 2004 allocated 3,500 acre-feet of water to communities in Northern Gila County from C.C. Cragin Reservoir (formerly Blue Ridge Reservoir). The city, which has one of the lowest per capita water use rates in the state, is constructing a pipeline to import up to 3,000 acre-feet of that water to the city. Other unincorporated communities along the pipeline route, as well as the Tonto Apache Tribe, will benefit from this water. The communities of Pine and Strawberry periodically have to ration their water supplies and actively search for new water sources. The city of Globe operates a well field on the Tonto National Forest near the border with the San Carlos Reservation. Water table elevations in an index well near the well field have declined over the years. The city is looking to reuse treated effluent to improve its water supply outlook. The city of Superior receives the majority of its water supply from wells operated by the Arizona Water Company located beyond the boundaries of the Tonto National Forest. Most water supplies for other communities are provided by wells on private lands.

Several large mines exist within the boundaries of the Tonto National Forest including Carlotta, Pinto Valley, and Miami Copper Mines in the Globe-Miami area. An additional large copper mine (Resolution Copper) is proposed within the boundaries of the Tonto and is currently undergoing environmental analysis. The existing large mines are dependent on groundwater sources for the majority of their water needs. Wells and pipelines on the Tonto National Forest provide a portion of the water needs of the Carlota and Pinto Valley mines on Pinto Creek west of Miami. Smaller mines on the Tonto that produce a variety of minerals. Water needs are typically provided by wells.

A small amount of agriculture occurs in the vicinity of Gisela. Water for agricultural use and residential watering is provided by the Gisela community ditch, which diverts surface water from Tonto Creek. Diversions for agricultural (orchards) and residential watering also occur from the East Verde River. The Tonto Basin area north of Roosevelt Lake has been growing rapidly. Most of the water to support development in the basin, as well as other developments within the boundaries of the Tonto National Forest, is derived from groundwater sources. Small surface water diversions for residential uses occur from a number of perennial streams draining the Rim country. Water for pasture irrigation and a bottled water operation is diverted from Seven Springs on the Cave Creek Ranger District.

Two fish hatcheries divert water from springs on the Tonto National Forest. The Tonto Fish Hatchery diverts water from Tonto Spring in the headwaters of Tonto Creek and discharges it back to Tonto Creek after treatment. The Canyon Creek Fish Hatchery diverts water from OW Springs and discharges it to Canyon Creek.

Recreational uses of public and private lands are also a popular activity on the Tonto National Forest, particularly water-related recreation on the reservoirs and rivers. Surface water diversions from Webber Creek and Chase Creek support activities at the Camp Geronimo Boy Scout Camp and Shadow Rim Girl Scout Camp, respectively. Spring diversions provide water to recreation residence communities on Camp Creek in the Cave Creek District and Pinal Peak on the Globe District. Wells and lake intakes provide water for marinas on the reservoirs on the Salt and Verde Rivers.

Numerous springs and stock tanks have been developed across the Tonto to provide water for livestock and wildlife use. A small number of range wells have also been developed for livestock use.

Trends and Projections

Total water yield is directly related to precipitation. The current period of lower than normal precipitation is likely to result in a continuation of the recent trend of reduced streamflow and somewhat reduced base flows. Climate change modeling predicts that some of the most likely changes to expect in the Southwest (USDA Forest Service 2010) include:

- Warmer winters with reduced snowpack,
- A delayed monsoon season,
- A five percent decline in precipitation in most of Arizona and New Mexico,
- An increase in extreme flood events, and
- Temperature increases of 5 to 8 degrees Fahrenheit.

These conditions may result in reduced groundwater recharge and changes in the magnitude, frequency, and duration of stream flows. Continued growth on private lands within and beyond the boundaries of the Tonto, and the groundwater pumping associated with development on these lands, may result in reduced groundwater discharge to springs and streams on the Tonto National Forest and potentially the duration of flow in perennial streams.

Environmental Effects[125]

Effects Common to All Alternatives

In all alternatives, water quality would improve based on implementation of watershed restoration action plans in priority sixth code watersheds, implementation of treatments recommended in Total Load assessments, and application of best management practices to projects and activities proposed by other Forest management programs. Improved water quality benefits other resources such as recreation and fisheries. For example, reducing E. coli makes lakes and streams safer for the recreating public and reducing sediment load can improve habitat for native fish.

Watershed condition would be improved in all alternatives, however, the type, rapidity, and location or improvement varies by alternative and will be discussed below. Actions common to all alternatives that improve watershed condition include:

- Implementing essential projects identified in Watershed Restoration Action Plans developed for sixth-code watershed designated as priority watersheds,
- Compliance/enforcement of utilization standards for livestock grazing in uplands and riparian areas,
- Restoring aquatic habitat and riparian area function,
- Improving or maintaining the function of springs,
- Acquiring instream flow water rights for streams vulnerable to dewatering, and
- Removing nonnative invasive species in aquatic and terrestrial systems.

Because every resource and activity on the Forest occurs within a watershed, improving watershed condition improves those resources as well. For example, watershed restoration activities focused on reducing fuel loads will improve watershed function and enforcing utilization standards will improve riparian system function.

Alternative A Effects

Management of water resources would continue in accordance with direction in the existing forest plan. For watersheds affected by historic mining, grazing, hydrologic modification (dams, diversions, and imports), recreation, motor vehicle travel, and utility corridors, actions to correct these situations would continue at current rates.

The forest plan identifies improving water quality, soil productivity, watershed condition and riparian ecosystems as goals toward which management would be directed. This is accomplished, for example, through standards and guidelines that do not permit discharge from roads into streams. The intent of the forest plan is to maintain air, soil, and water resources at or above minimum local, State, or Federal standards. It also identifies increasing water yield by vegetation treatments as a goal but lacks direction on maintaining or improving other aspects of water quantity. The forest plan also lacks direction on groundwater stewardship and watershed management during drought conditions. Management direction for these resources has since been provided by regional office manual supplements that require consideration of groundwater resources in special use permit applications (R3 FSM 2500-Chapter 2540-Supplement 2500-2001-1) and consideration of grazing during drought conditions (FSH 2209.13 Chapter 10).

[125] For legal and regulatory compliance for watershed and water resources, along with the assumptions and methods used in the analysis of the alternative can be found in appendix B of volume 4 of the environmental impact statement.

The forest plan describes watershed condition primarily in terms of vegetative ground cover and focuses on range management as the primary program for maintaining or improving watershed condition. It does not address overall watershed health and function, and watershed condition is also focused on 5th code watersheds rather than the 6th code watersheds that were delineated after the 1985 plan was completed. The size of 5th code watersheds is not conducive to watershed improvement because there is too much variation in vegetation, soils, and impacts within a 5th code watershed to efficiently plan projects that can improve overall condition. Although range management continues to be an important program for maintaining or improving watershed condition, the Forest Service has developed a more comprehensive approach to watershed condition with publication of the Watershed Condition Framework (USDA Forest Service 2011b) and its companion implementing document, the Watershed Condition Classification Technical Guide (USDA Forest Service 2011a). Both documents are intended to implement guidance in the Forest Service Manual (FSM 2520) that indicates the watershed condition goal of the Forest Service is "to protect National Forest System watersheds by implementing practices designed to maintain or improve watershed conditions". The proposed forest plan (alternative B) takes a more comprehensive and integrated approach to maintaining or improving watershed condition than occurs in the current forest plan and focuses on improving watershed condition at the 6th code level.

The current forest plan does not contain direction for implementing total maximum daily load recommendations to improve impaired waters on the Tonto; therefore, water quality improvement projects would only occur on an opportunity basis but could occur in response to total maximum daily load recommendations. As of 2018, the Forest has six total maximum daily load assessments underway or completed for constituents including copper, selenium, phosphorus, nitrogen, and E. coli. Without planned treatments and management, the current water quality conditions in these stream reaches is likely to continue, which will impact aquatic resources and use of the waterways for recreation. The other three alternatives address the omission of total maximum daily load recommendations.

The current forest plan does not provide direction for management of resources in response to climate change. Climate change has begun and will continue to cause changes in temperature and rainfall patterns (Seager et al. 2013). Without management direction, climate change would directly affect forest water resources and indirectly affect resources they support, such as vegetation, wildlife, and habitat. Adverse effects to water resources from a changing climate include impairment of water quality, degradation of watersheds, loss of potential recreational uses, and loss of aquatic habitat and biota as a result of higher velocity and greater quantities of surface runoff associated with more intense storms and flooding; and lowered water yield and availability for wildlife, grazing, and human uses because of warmer and drier conditions or drought that decrease annual precipitation and snowpack (Udall 2013; Archer and Predick 2008).

Effects Common to Alternatives B, C, and D

Water quantity would continue to be largely controlled by weather events and climate. However, clear direction in the desired conditions and objectives with regard to securing additional instream flow water rights, improving or maintaining springs, restoring streams, implementing essential watershed improvement projects, stewardship of groundwater resources as well as reducing hazardous fuel accumulation and improved grazing management of riparian areas would help meet water needs on and off the forest and would assist with maintaining the functions of channels and flood plains. This would help maintain watershed condition and the number of miles of perennial waters. A functional channel and floodplain, and maintenance of water table elevations in these features improves water retention on the landscape and helps release water over a longer time period for uses on and off the forest. An indirect effect of functioning floodplains is the support of riparian habitat by maintaining natural disturbance cycles, which helps to recruit a diversity of plant species and age classes. This, in turn, benefits riparian wildlife species by providing diverse forage and nesting locations.

The objective of obtaining instream-flow water rights for the beneficial use of recreation and wildlife, including fish, results in protection of non-consumptive stream flow for water dependent ecosystems and recreation users (WAT-O-05). Existing water right certificates would be senior and take precedence over any newly procured instream-flow water right obtained under this objective. Indirect effects include support of numerous positive biological processes including riparian and wildlife habitat maintenance. Stewardship of groundwater resources that support water dependent ecosystems would also benefit these processes and habitats.

The management approach of creating watershed restoration action plans for improvement and maintenance of springs (WAT-MA-09) and the objective for implementation of aquatic and riparian restoration projects (WAT-O-04) will support aquatic and riparian habitats for plant and animal species dependent on these types of resources. Indirect effects include maintaining a more complex ecosystem and, thereby, improving viability of aquatic and riparian species, the resilience of these systems to human and natural disturbances and to the effects of changing climate conditions which are desired conditions in alternatives B, C, and D.

The proposed action contains specific desired conditions for overall watershed condition, moving watershed conditions toward properly functioning, and prioritizing treatments for watershed restoration (WAT-DC-01, 03, 04, 05 and 06). Alternatives B, C, and D all focus on treatments to improve the watershed functions where they are most needed through designation of priority watersheds, resulting in improved watershed function and water quality over that expected under the no-action alternative.

Alternatives B, C, and D include desired conditions and management approaches for the Forest’s response to climate change. Desired conditions include having forest ecosystems that are resilient to rapidly changing natural disturbances, such as drought, wind, fire, insects, and pathogens, and vegetation communities of various structure and ages across the landscape that are adaptable to changing conditions (WAT-DC-05). Improved watershed function would help sustain resilience to changing climatic conditions and help sustain vegetation that serves as a foundation of good quality forest habitat for a variety of species, including those having special status.

Salt River Horse Management Area

The Salt River Horses live primarily along the Lower Salt River and are the responsibility of the Arizona Department of Agriculture. The Salt River Horses are currently being fed by volunteers because there is insufficient natural forage available for them. There has been damage to vegetative ground cover, soils, stream banks and riparian vegetation as a result of greater numbers of horses than the resources can support. The presence of the Salt River Horses may directly or indirectly impact water quality within those watersheds where they are present. The cumulative impact of the Salt River Horses together with existing high levels of recreation, and management of the Salt River for water supply via dams and reservoirs in the areas where the Salt River Horses are present make it more challenging to achieve the desired conditions related to properly functioning watersheds (WAT-DC-03). The Salt River Horse management area is common to alternatives B, C, and D and the plan components help the Forest manage the resources in conjunction with Arizona Department of Agriculture managing the Salt River Horse herd. More information can be found in the Management Areas section of volume 2.

Alternative B Effects

Effects of Fuel Treatments

This alternative proposes to treat from 175,000 to 650,000 acres of forested and woodland ecosystems with mechanical thinning combined with wildfire, and prescribed fire over a ten-year period. This alternative proposes to treat more acres than alternative D but less than alternative C and it would treat more acres than have been treated over the past ten-year period under the current forest plan. In watersheds with forested and woodland ecosystems fuels treatments would reduce the likelihood of uncharacteristically high severity wildfire in the acres treated. Fires that cause contiguous areas of high soil burn severity can result in greater than normal peak flows, erosion, and water quality impacts (DeBano et al. 1998). These changes in turn can cause stream channels within and below burned areas to aggrade, incise, or widen. They can also cause additional sediment loading by sending ash and debris into reservoirs, which in turn reduces the ability to store water supplies and impacts existing water infrastructure. Additionally, they can also increase the risk to human life and safety of private landowners or municipal areas within and around the forest boundary.

Condition class is one of the indicators assessed during the watershed condition classification process. Fuel treatments that improve the fire class rating within sixth code watersheds also help to improve the watershed condition classification for the watersheds where fire class is rated as fair or poor. Reducing the likelihood of large areas of high severity wildfire also benefits several other watershed condition class indicators such as water quality, aquatic habitat and biota, soil erosion and productivity, and forest cover in those watersheds that contain forested and woodland ecological response units. Taken together, these actions help the Forest to meet the desired conditions of watersheds that are functioning properly, ecological components that are resilient to human activities, and watersheds that are within the natural range of variability (WAT-DC- 03, 04, 05, and 06). The objective of improving watershed condition class in at least one subwatershed (HUC12) every five years would be met and this alternative could potentially assist in meeting the objective of improving soil and water condition on at least 10,000 to 20,000 acres annually (WAT-O-02 and 03). Furthermore, fuel treatments that reduce the occurrence of uncharacteristically severe wildfires can also help to maintain the natural variability of the magnitude and timing of post fire peak flows and base flows, which will aid the Forest in meeting the riparian objective of restoring three impaired riparian reaches to proper functioning condition each ten-year period.

Effects of Riparian Area Management

The riparian objectives and guidelines identified for this alternative should improve riparian conditions in sixth code watersheds that are currently designated as priority according to the watershed condition framework. (See description of priority watersheds and in the affected environment – watersheds section) Riparian/wetland vegetation is one of the most influential (i.e., weighted more heavily in the overall watershed score) indicators assessed in the watershed condition classification process. Improvement would help achieve the watershed objectives of improving watershed condition (WAT-O-02), improving soil and water conditions (WAT-O-03), and completing aquatic habitat restoration projects because these projects often include riparian area improvement as well (WAT-O-04). Furthermore, the emphasis on riparian area management in this alternative will help guide the selection of priority watersheds and implementation of essential projects within those watersheds meeting two additional watershed plan objectives (WAT-O-01 and 02).

Watershed condition improvement could be greater in this alternative than in alternative A because riparian restoration activities would be more focused in sixth code watersheds where riparian condition is rated as fair or poor than sporadically across the forest. Depending on the areas that are closed to all uses under alternative C, improvement under alternative B could be at a slower rate than in alternative C because there are riparian systems on the forest with natural flow regimes that would improve with no additional intervention provided that all stressors are removed as proposed in alternative C. Improvement of riparian areas would be greater in alternative B than alternative D.

Effects of Rangeland Management

This alternative would implement one of three options for each vacant allotment. It could convert an allotment into a forage reserve, grant it to a current or new permittee for permitted grazing, or close the allotment in whole or in part to permitted grazing. In watersheds where the range or soil conditions are fair or poor his alternative would have the greatest impact on watersheds where the range or soil conditions are fair or poor. Converting a vacant allotment to a forage reserve would provide management flexibility to respond to conditions in other allotments such as wildfire or drought that could require resting all or portions of the allotment for a period of time. Setting aside vacant allotments as forage reserves would allow conditions on the rested portion of a damaged or potentially damaged allotment to recover at their maximum rate while minimizing impacts on the permittee. Watersheds in desert ecosystems take longer to recover from grazing impacts and could be more affected by this alternative, however, when a desert forage reserve is placed in use, employing utilization standards should protect upland and riparian vegetation while the unused allotment recovers.

Similar to forage reserves, granting vacant allotments to a current or new permittee could have more significant impacts in desert ecosystems, however, as long as utilization standards and other best management practices are implemented it should not damage watershed conditions. Closing an allotment to grazing would provide rest to soil and vegetative resources that should result in improved watershed condition, particularly soil conditions, in those allotments in the long term. This would benefit all watersheds on the Forest, however, watersheds where soil or range conditions are classified as fair or poor would more rapidly meet desired conditions related to improving watershed condition (WAT-DC-01, 03, 04, 05, and 06) as well as the objectives for improving watershed condition class in one subwatershed every five years and improving soil and water condition on 10,000 to 20,000 acres annually (WAT-O-02 and 03).

Effects to range management proposed in this alternative on water resources should be similar to alternative A. It would be less beneficial than alternative C because grazing in riparian areas, and by extension stream channels, would be removed on those reaches that are impaired and allotments would be closed as they become vacant. It would be more beneficial than alternative D because all allotments would be open as they become vacant, which would not be forage reserves.

Effects of Recreation Management

Potential for new motorized and nonmotorized roads and trails exists under this alternative. The Watershed Condition Classification direction includes road and trail density, proximity to water, and road and trail maintenance as indicators to be assessed as part of the classification process. New construction without concurrent route obliteration would increase route density and could increase percent of routes in close proximity to water. Increases in these indicators could adversely affect the condition class rating for individual sixth code watersheds because it is assumed that an increase in road or trail density increases sedimentation to streams. The objective of maintaining 30 percent of designated motorized and nonmotorized trails annually would result in more frequent maintenance of these routes than that provided for level two (high clearance) roads on the forest where approximately 20 percent of the routes are maintained each year. The improved frequency of maintenance for motorized and nonmotorized trails will decrease potential sedimentation to streams and positively impact the road and trail maintenance indicator for those watersheds where road maintenance indicator is listed as fair or poor and potentially benefit the desired condition of watersheds functioning properly if road maintenance is the primary element that impairs the watershed (WAT-DC-03).

If completed within priority watersheds, the objective of decommissioning ten miles of unneeded motorized and/or nonmotorized trails every five years under this alternative would improve the road and trail density and could improve the proximity to water indicators and thereby assist in meeting the objectives of implementing one project each year in a priority watershed and improving watershed condition in at least one watershed every five years (WAT-O-02 and 03). The overall effect to watershed condition class on the Forest as a whole would depend on the number of new routes constructed versus the number of routes decommissioned every five years.

The proposed action recommends adding 43,204 acres of wilderness to the forest. The official designation of areas as wilderness would prohibit mechanized and motorized equipment, except in special circumstances approved by the regional forester on a case-by-case basis. This would reduce or eliminate potential adverse impacts of sedimentation and soil compaction from off-road vehicles, mechanized mining operations, and construction of new infrastructure such as roads or buildings. Proposed wilderness areas under this alternative would help to maintain the watersheds within their boundaries that were determined to be functioning properly in a 2011 assessment of condition.

Effects of Mineral Materials Management

This alternative would place more restrictions on removing mineral materials from the riparian management zone than exist under the current forest plan (alternative A). Removing mineral materials from stream channels can cause stream channels to down cut and result in bank erosion, increased sediment loads, and declining water tables. Stricter controls proposed in this alternative should reduce impacts to stream channels and riparian areas. Both effects would benefit watershed conditions in watersheds where removal of mineral materials would have occurred and would be particularly beneficial to those watersheds where water quality is considered to be fair or poor due to sediment. Although the spatial extent of mineral materials removal areas on the forest is small, these areas can have upstream and downstream impacts and reducing those impacts can benefit channel shape and function (one of the watershed condition indicators). Restricting removal of mineral materials as proposed in this alterative could help the Forest move toward desired conditions related to watershed improvement and water quality (WAT-DC-01, 03, and 06).

Effects of Management Areas

In addition to recommending two additional research natural areas that occupy 2,700 acres under the existing forest plan and that are carried forward into this alternative as well as alternatives C and D, the proposed action recommends designating four botanical areas totaling 3,630 acres, two research natural areas totaling 23,006 acres, and a Lakes and Rivers Management Area that occupies 41,435 acres. Activities such as sales or extraction of common variety minerals, logging or fuelwood gathering, overnight camping and recreational campfires in botanical areas, recreational shooting in botanical areas, and some instances of permitted livestock grazing would be restricted in these areas. In watersheds that contain research natural areas or botanical areas, minimizing disturbances from these activities that can impact watershed health by increasing sedimentation, compaction, and trash from camping and other recreational activities would assist the Forest in moving toward desired conditions of properly functioning (WAT-DC-04), the ability for surface waters to provide habitat as well as water supply for downstream users (WAT-DC-08), and maintain water quality (WAT-DC-02).

In addition to the wilderness, botanical areas, and research natural areas proposed in this alternative, the alternative also includes the Lakes and Rivers Management Area, an area of some 41,000 acres that emphasizes high use developed and dispersed recreation opportunities on the Salt River from Roosevelt Lake down to the forest boundary near the Granite Reef diversion Dam and on the Verde River from Horseshoe Reservoir down to the boundary with the Fort McDowell Reservation. The area also includes the major lakes and reservoirs along these rivers. Standards for management of the area include restrictions on target shooting, some restrictions on permitted livestock, and off highway vehicles. Restrictions on these disturbances should benefit water quality and watershed condition by reducing the impact to soils and vegetation that these uses can have in those watersheds within the Lakes and Rivers Management Area.

The desired conditions for the Lakes and Rivers Management area is that it serve as a highly desirable recreation destination and provide diverse recreation opportunities. Much of the area is already highly developed, particularly along the Lower Salt River, the chain of lakes along the Salt River, and the Verde River from Bartlett Lake down to the management area boundary. Increased recreational use in these portions of the management area should have minimal impacts on water quality as long as applicable best management practices are maintained as is specified in the standards for watershed and water resources (WAT-S-01).

The Verde River above Bartlett Lake to a short distance below Horseshoe Reservoir portion of the management area, however, is much less developed than the Salt River and the Verde River below Bartlett Lake portions of the management area. It also has limited access along motorized routes that require primarily high clearance vehicles. Actions that increase recreational uses along this reach of the Verde River would increase the level of disturbance in the reach and could result in adverse effects to water quality and watershed condition, which in turn would make it more challenging to meet desired conditions related to watershed condition and water quality in these areas.

Alternative C Effects

Effects of Fuel Treatments

This alternative would treat a similar number of forested acres as alternative B, however most of the treatment would be by fire rather than mechanical treatment. Not all watersheds on the Forest include fire-adapted ecological response units, therefore, this alternative only impacts those watersheds with forested and woodland ecosystems. The risk of negative unforeseen impacts to water quality and watershed condition immediately following treatment from fire can be more than from mechanical treatment if burn severity is greater than prescribed in the burn plan. In woodland and forested watersheds, treatments proposed in this alternative would help achieve desired conditions of watershed improvement, maintaining or improving water quality, and maintaining watersheds within the natural range of variability (WAT-DC- 01, 03, 04, 05, and 06) than alternative B and substantially greater benefits than alternatives A and D due to the difference in acreage treated between the alternatives. For more details on the benefits of fire treatments in watersheds see the Vegetation, Ecological Response Units, and Fire and Fuels sections.

Effects of Riparian Area Management

The only difference between this alternative and alternative B is that this alternative prescribes a standard that would remove all permitted and allowed uses from a riparian area when it is rated as nonfunctional based on the proper functioning condition framework (USDI Bureau of Land Management 2015) until riparian recovery is achieved. This alternative could incrementally improve riparian area condition in watersheds with riparian areas and natural flow regimes compared to alternative B if the riparian areas where use is removed are good candidates for passive restoration techniques. This alternative would provide a greater improvement than alternatives A and D in watersheds with riparian areas and natural flow regimes. Riparian vegetation condition is one of the indicators assessed in the Watershed Condition Classification process (Potyondy and Geier 2011), therefore any additional improvements in riparian condition would also benefit overall watershed condition and assist the Forest in meeting desired conditions associated with watershed condition (WAT-DC- 01, 03, 04, 05, and 06).

Effects of Rangeland Management

The difference between this alternative and alternatives B and D is that it would evaluate and close vacant allotments rather than granting them to a new permittee (alternative D) or evaluate them and determine whether to convert them to forage reserves, grant to a new permittee, or close to permitted grazing, in whole or in part (alternative B). Closing vacant allotments to grazing in those watersheds where soil, riparian, vegetation, and/or channel conditions are currently in fair or poor condition should benefit these resource values and help achieve desired conditions related to watersheds that are functioning properly, water quality meeting or exceeding state standards, ecological components of the watershed that are resilient to human actions, and based on local conditions recharging of aquifers (due to less soil compaction) (WAT-DC-01, 02, 03, 04, 05, and 06).

Effects of Recreation Management

This alternative favors nonmotorized and primitive recreation opportunities and would maintain to standard 30 percent of the forest's designated nonmotorized trails annually. It would also decommission ten miles of unneeded motorized trails every five years. This alternative would maintain a smaller percentage of motorized trails than alternatives B and D. Motorized trails have a larger footprint and therefore greater impact on the land than nonmotorized trails. Reduced emphasis on maintaining motorized trails results in potentially greater erosion and sediment impacts from these trails than would occur from the other alternatives and could therefore impair the ability to achieve desired conditions associated with properly functioning watershed conditions (WAT-DC-01, 03 and 04) in those watersheds where motorized trails occur. Depending on the individual watershed conditions, these impacts would potentially be offset by the decommissioning of ten miles of unneeded motorized trails every five years proposed in this alternative.

This alternative would recommend approximately 399,029 acres of wilderness, the most of any of the alternatives. Watersheds with proposed wilderness would avoid adverse impacts such as sedimentation and soil compaction from off-road vehicles, mechanized mining operations, and construction of new infrastructure such as roads or buildings. This positive impact would help achieve desired conditions related to watershed condition and resiliency (WAT-DC-01, 03, 04, 05, and 06). Preventing these disturbances would potentially provide a greater benefit to watershed conditions by eliminating the possibility of new roads, mechanized mining operations, buildings, and off-road vehicles that can cause sedimentation and soil compaction than would occur under the other alternatives, however, these impacts would vary by area and current watershed condition. In the areas where designated wilderness is overlaid on watersheds that are functioning at risk, the wilderness designation could slow the process of watershed improvement where the methods of watershed improvement are incompatible with wilderness characteristics, e.g., use of mechanical devices to thin or to improve channel stability.

Effects of Mineral Materials Management

This alternative would not authorize personal and commercial mineral material sales from the riparian management zone. Disturbance to riparian resources in this alternative would be the least of any of the alternatives and would potentially have the greatest benefit to desired conditions related to riparian areas, stream channels, and water quality (which are indicators of watershed condition) by reducing sedimentation and other water quality impacts associated with extracting mineral materials of any of the alternatives (WAT-DC-01, 03, 04, and 05).

Effects of Management Areas

This alternative would designate all of the proposed botanical areas and research natural areas that are proposed under alternative B (Approximately 29,000 acres). Impacts from designating these areas would be similar to alternative B.

This alternative does not include the special Lakes and Rivers Management Area that is proposed for alternatives B and D, an area of approximately 41,500 acres. This alternative potentially reduces the volume of recreational use attracted to the more remote areas of the Verde River between Bartlett and Horseshoe Lakes where access is primarily via Level 2 roads that require high clearance vehicles. Recreational impacts (disturbance to the riparian management zone, erosion from roads, trails, and dispersed campsites, and water quality impacts) to this reach of the Verde River are likely to be less than in alternatives that include this reach in the designated management area. This could allow for watersheds within the proposed Lakes and Rivers Management area to improve more rapidly or maintain functioning condition as well as protect water quality in those watersheds (WAT-DC-01, 03, 04, and 05). Other portions of the proposed management area in the other alternatives are already highly developed and little change in impacts by not designating the area in this alternative would be expected as long as best management practices are installed and maintained (WAT-S-01).

Overall, the effects of implementing this alternative would include those identified for the proposed action and additional effects associated with the proposed designation of additional acres of new wilderness area on the Forest. Other differences include an increased emphasis on fire treatments over mechanical thinning in forested areas to achieve fuel management objectives but a similar number of total acres, an increase in the number of acres of fuels management in woodlands that are managed solely with prescribed fire and wildfire, an increased emphasis on protecting functioning at risk riparian areas from activities that would tend to degrade these areas, closure of one vacant grazing allotment every two years until all vacant allotments are closed, greater emphasis on motorized trail decommissioning and prohibition on mineral material withdrawal sales in riparian management areas.

Additional acres recommended for wilderness designation would prevent most mechanical disturbance in these areas and contribute to improvements in water quality and watershed condition. The increase in the number of acres proposed for fuel treatments should reduce the potential for uncharacteristically severe wildfire in these areas. Additional protections for riparian areas from removing activities that would degrade nonfunctional riparian areas would benefit riparian areas by improving channel stability and floodplain resilience as well as benefit aquatic and riparian habitat. A greater emphasis on motorized trail decommissioning would result in a reduction in disturbed area that would also benefit water quality and watershed condition. Decommissioning motorized trails may reduce road density or proximity to water in some sixth code watersheds which would benefit watershed condition in those watersheds. Prohibiting mineral material sales in riparian management areas would also reduce surface disturbance from alternatives B and D with corresponding benefits to water quality and watershed condition. The improvements in watershed condition, water quality, and riparian condition occurring in this alternative should also improve the desired conditions of resilience of watersheds and riparian and aquatic habitat to changing climatic conditions (WAT-01, 02, 03, 04, 05, 06, and 08).

Alternative D Effects

Effects of Fuel Treatments

This alternative would treat the fewest acres of forested ecological response units and would not treat any areas in woodland units to reduce the likelihood of uncharacteristically severe fire. A total of 66,000 to 252,000 acres of forest ecological response units would be treated with mechanical treatments only to reduce fire hazard. This total is several hundred thousand acres less than either alternatives B or C and similar to the amount being treated under the current plan (alternative A). Because of the reduced emphasis on treatment, the potential for adverse watershed effects from uncharacteristically severe fire in those watersheds with forest and woodland ecological response units would be greatest from this alternative. Adverse watershed effects from uncharacteristically severe include increases in erosion and sedimentation, increases in the magnitude of flood flows, channel erosion, scouring, and aggradation, impacts to riparian areas, and water quality impacts. These impacts would make it more difficult to achieve the desired conditions related to watersheds that are functioning properly, water quality meeting or exceeding state standards, and watersheds that function within the natural range of variability (WAT-DC- 01, 03, 04, 05, and 06).

Effects of Riparian Area Management

Treatments to improve or restore riparian areas are not proposed in this alternative. Guidance to maintain natural streambank stability, native vegetation, and riparian, floodplain, and soil function when projects or management activities occur in riparian stream courses is the only direction for riparian area management provided in this alternative. This alternative is likely to result in the least amount of benefit to riparian areas of any of the alternatives and therefore, because of the importance riparian areas play in watershed health also be the least likely to achieve desired conditions in watersheds with riparian areas related to watersheds that are functioning properly, keeping watersheds within a range of natural variability and having surface waters provide both habitat and water supply because of the important role riparian areas play in providing habitat and stream bank stabilization that protects water quality (WAT-DC- 01, 02, 03, 04, 06, and 08).

Effects of Rangeland Management

This alternative would evaluate and grant one vacant grazing allotment to a current or new permittee every two years until there are no vacant allotments remaining. Any additional allotments waived would also be granted to new or current permittees under the same two-year timeframe. Improvement in soil, vegetation, riparian, or channel conditions in those watersheds where these conditions are currently poor would be at a slower rate than those watersheds where allotments would continue to be vacant or managed as forage reserves in alternatives B and C. Watersheds that contain riparian areas that are currently rated as nonfunctional would not be expected to improve unless these areas can be rested until improvement occurs in currently vacant allotments that would be granted to current or new permittees. The combined impact of the range management related objectives within the alternative could hinder the Forest in its efforts to improve watershed-related desired conditions in those watersheds where vacant allotments occur because of the important role both riparian areas and upland soil conditions play in protecting water quality (WAT-DC- 01, 02, 03, 04, 06, and 08).

Effects of Recreation Management

This alternative emphasizes motorized and accessible recreation. There is potential for more new roads and both motorized and nonmotorized trails. Development of these routes would affect the road density and could affect proximity to water attributes of the watershed condition assessment. The emphasis on motorized recreation in this alternative could potentially result in more roads and trails than in alternative

B and therefore have a greater adverse impact to those watersheds where new roads occur and/or in those watersheds where road density or road maintenance is already rated fair or poor than in alternatives B and C. This would hinder the Forest from achieving desired conditions related to watershed health and water quality due to the potential for increased sedimentation within streams from roads (WAT-DC-01, 02, 03, 04, 05, 06, and 08).

In contrast to the potential adverse effect on road density and proximity to water, this alternative proposes to maintain 30 percent of the forest's designated motorized trails annually. Road maintenance is also an attribute rated in the watershed condition assessment process. The proposed maintenance frequency would result in more frequent maintenance of these routes than that currently provided for level two (high clearance) roads on a forest wide basis where approximately 20 percent of level two routes are maintained each year. In those watersheds where motorized trails occur, the improved frequency of maintenance for motorized trails could positively impact the road and trail maintenance attribute and potentially benefit desired conditions related to watershed condition by decreasing sediment in streams and thereby improving water quality, however, the impact on watershed condition from this maintenance in those watersheds would be dependent on the proximity of roads maintained to water (hydrologically connected roads) as those roads that are not hydrologically connected often have minimal impact to overall watershed health (WAT-DC-01, 03, 04, and 06).

This alternative also proposes to decommission ten miles of unneeded nonmotorized trails every five years. This would have a minimal beneficial effect on meeting desired conditions in watersheds where the decommissioning occurs of functioning watersheds and water quality because of the small footprint of nonmotorized trails.

With alternative D, there is a potential for off-highway vehicle trails and other facilities to be built in support of motorized recreation. Direct effects to watersheds from these activities include vegetation removal, soil compaction, erosion, and sedimentation. Indirect effects include an increase in upland sediments entering the stream zone, higher peak flood flows, and hydrologic modifications, such as channelization. This could result in moving watershed condition classes to a lower state of functionality, and thus move away from desired conditions (WAT-DC-01, 03, 04, and 06).

Effects of Mineral Materials Management

Although there are no standards or guidelines for mineral material sales, these sales should still be consistent with desired conditions for other resources. Minimal effects to watershed condition, riparian areas, and water quality would be expected if desired conditions are not affected by sale activities.

Effects of Management Areas

This alternative does not propose to designate any additional wilderness areas, botanical areas, or research natural areas. The Lakes and Rivers Management Area would be designated in this alternative. The impacts of the Lakes and Rivers Management Area would be the same as described in alternative B.

Cumulative Effects

The time frame for the cumulative effects analysis extends from the present into the foreseeable future. The area of analysis are the basins that include upstream of the Tonto National Forest including Verde River, Salt River, and Middle Gila watersheds (HUC 6). The Forest is at the top of the watershed for all of the Middle Gila and for portions of the Verde and Salt River watersheds. Upstream of the Tonto on the Verde River Watershed are growing communities in the Verde Valley and Prescott and the Prescott and Coconino National Forests. The majority of the Salt River Watershed up gradient of the forest consists of Indian reservations and the Apache-Sitgreaves National Forest.

This section also captures cumulative effects for riparian areas. This is because watershed conditions impact connected streams, riparian areas, and wetlands. The cumulative effects to watersheds is an appropriate measure for the cumulative effects to riparian areas because the spatial and temporal scale of impacts and effects are broad and span across multiple watersheds that intersect the forest. See the Riparian Areas section for effects to riparian areas by alternative.

Four Forest Restoration Initiative

The Four Forest Restoration Initiative (4FRI) includes 2.4 million acres of northern Arizona ponderosa pine forests and associated ecosystems, approximately 300,000 acres of which are on the Tonto National Forest. The intent of the initiative is restore the area to healthy resilient forests that support natural fire regimes and reduce the risk of uncharacteristically severe fire, which supports the desired conditions in the watersheds within the 4FRI boundary of healthy riparian areas, proper functioning watersheds, maintaining or exceeding state standards for water quality, and maintaining watersheds within a natural range of variability (WAT-DC-01, 02, 03, 04 and 05). The inclusion of adjacent National Forest System lands within 4FRI further supports the desired conditions of this proposed plan because fires that occur in the upper portions of the Salt River and Verde River watersheds will impact subwatershed resources on the Tonto National Forest because runoff from these areas flows through the Forest. Restoration of springs and streams in the 4FRI plan area is also a component of the overall restoration effort in 4FRI. Spring restoration as part of 4FRI will support the desired condition of providing quality riparian habitat that supports healthy populations of native plants and animals and provides water supply for downstream users (WAT-DC-07). The cumulative effect of 4FRI is to increase the Forest's ability to meet objectives related to improving watershed condition and implementing projects in priority watersheds because of the additional focus and funding in the 4FRI areas (WAT-O-01-05). Impacts to users downstream of the Forest's boundaries would be a reduced risk of uncharacteristically severe fire, which would:

- reduce threats to the quality of the water for the Phoenix area,
- lessen the need for water providers to invest in additional water treatment facilities,
- decrease the risk to existing water infrastructure,
- allow for ongoing water storage on the forest, and
- lessen the need for redundant water supply systems that would be necessary should the size and frequency of fires with uncharacteristically high severity continue to increase in the watersheds in the 4FRI area that flow off the Forest.

Travel Management Implementation

The Travel Management Plan designated 1,292 miles of motorized routes on the forest as decommissioned. Decommissioning these routes reduced the miles of roads within a 300-foot buffer to protect the riparian areas that line lakes, perennial, intermittent and ephemeral streams. This reduced the miles of designated roads within riparian areas and the number of crossings of perennial, intermittent, and ephemeral streams. It also reduced designated motorized route density on the forest. Reducing the number of miles of designated motorized routes helps the Forest meet the desired condition of properly functioning watersheds because it improves the attribute ratings for road density in 19 subwatersheds, proximity to water in 18 subwatersheds, and improves overall watershed condition on three subwatersheds, which assists the Forest in meeting objectives relative to implementing projects to improve watersheds and improving watershed condition class (WAT-DC-01, 02, 03, and 04 and WAT-O-01, 02, 03, and 04). The cumulative effect of travel management implementation alongside other potential watershed treatments that may occur during the planning period is to increase the likelihood that watershed conditions will improve because of the significant role that roads play in watershed heath in general and riparian area health in particular. The primary impact to areas beyond the Forest boundary are to downstream lands by improving the quality of the water that flows off of the forest by reducing the road-miles that contribute to degradation of streams.

Tribal Management Activities

The Forest is bordered on the east by the Fort Apache and San Carlos Indian Reservations. Watersheds drain primarily from the Forest to the Reservations; therefore, Forest activities can impact Tribal lands more so than vice versa. The San Carlos reservation is developing a plan for reducing fuel loadings on both the reservation and the Forest in a collaborative process with the Forest. Implementation should reduce fuel loading in the thumb area of the Tonto as well as on portions of the San Carlos Reservation bordering the Tonto. There are also fuel management efforts on the Fort Apache Reservation. These efforts should benefit and complement fuel reduction efforts on the Forest and benefit desired conditions and objectives associated with watershed conditions by reducing the risk of uncharacteristically severe fire (WAT-DC-08).

The Forest also borders the Ft McDowell Yavapai Nation and the Salt River Pima-Maricopa Indian Community on the west side of the Forest along the Lower Salt and Verde Rivers. Watersheds on the Tonto drain from the Forest to the east side of the Ft McDowell Yavapai Nation and the Lower Salt River forms the boundary between the Forest and the Salt River Pima-Maricopa Indian Community. The Ft McDowell tribe negotiated a water rights settlement that requires maintaining a minimum flow in the Verde River below Bartlett Dam of 100 cubic feet per second. This water flows through the Forest below Bartlett dam until it reaches the reservation and then flows between the Forest and the Salt River Pima-Maricopa community until it reaches Granite Reef Dam. The minimum flow requirement helps to maintain a perennial river on the Forest and supports riparian vegetation along the river, which supports desired conditions related to proper functioning riparian areas and watersheds because riparian health is an important overall component of functioning watersheds (WAT-DC-03, 04 and 08). Most other activities on these communities have minimal impacts on the Forest.

The Tonto Apache Reservation is a small reservation that is bordered by the city of Payson on the north and surrounded by the forest on other sides. A few years ago, the Forest and the Tribe completed a land exchange that substantially increased the area owned by the Tribe in exchange for privately held inholdings on the Forest. The exchange benefitted both entities. Activities on the reservation have minimal impacts on the Forest. Activities to improve Forest condition will, however, also improve the health of the watersheds that the Tonto either shares with or are upstream of the Tonto Apache Reservation.

Mining Activities

Mineral prospecting and mining is an activity within and near the Forest that has occurred for many years. Mineral prospecting by itself has only small surface disturbing activities but mining economical ore deposits can affect larger areas with tailings ponds, leach pads, power, water and other mining infrastructure. Impacts to surface water quantity and quality and groundwater quality and quantity as well as water-dependent resources reliant on them have occurred in the past and may occur in the future. The Resolution Copper Project near Superior is currently being evaluated in an environmental impact statement, along with an environmental impact statement being prepared for expansion of the Pinto Valley Mine near Miami-Globe. These projects would create surface disturbance and could affect water resources by potentially degrading water quality and decreasing groundwater levels, which would impact the ability to achieve desired conditions related to water quality, maintaining groundwater levels and discharge, and proper functioning watershed condition (WAT-DC-02, 03, 04, 06, and 08). Other mineral exploration activities are occurring on the Forest. If economically viable ore deposits are discovered and developed, they also have the potential to affect watershed conditions and water resources on the Forest. The cumulative effect of both current and proposed mining activates on the Forest has the potential to limit the ability of the Forest to meet desired conditions related to watershed health overall and riparian health in particular because of associated lowered groundwater tables and impacts to spring ecosystems (WAT-DC-02, 03, 04, 07, and 08).

Population Growth

Population in the Verde Valley and the Prescott area up gradient from the forest are growing. Population growth is resulting in increased development of groundwater resources which can impact groundwater discharge to the Verde River and its tributaries and result in reduced base flows in the river where it flows through the Forest.

Population in the Phoenix Metropolitan Area is growing rapidly. The Forest is immediately adjacent to the metropolitan area and easily accessible. Visitors come to the Forest year-round for a variety of reasons. Increasing population is likely to result in increasing visitation and some types of uses (e.g., off highway vehicle use) can result in impaired watershed conditions.

Population growth is also occurring in communities and private lands within the Forest boundary. The city of Payson is developing a new source of water (CC Cragin Reservoir) that should provide for their water needs for many years. The communities of Pine and Strawberry are currently water-short communities that may need to develop additional sources. The primary source of new water is likely to be groundwater. Impacts to groundwater dependent ecosystems from declining water tables may occur if new groundwater resources are found and developed, which would impact desired conditions related to healthy riparian conditions, maintaining groundwater discharge, and properly functioning watersheds (WAT-DC-01,02, 03, 04, 05, and 06). Similar impacts may occur from growth in Young and Tonto Basin. The Forest standard of permitting new wells on National Forest System lands and pipelines across National Forest System lands only where the water removed and/or transported by these facilities would not adversely impact springs, wetlands, riparian areas, surface flows, and other groundwater dependent ecosystems on National Forest System lands could impact the ability of these communities to secure additional supplies, if they are unable to secure sufficient supplies for growth on their lands (WAT-S-02). The overall cumulative impact of population growth is to make it more challenging to achieve desired conditions for watershed health and supporting multiple uses without long-term decline in ecological conditions because of the added pressure to resources associated with increases in population (WAT-DC-01 and 02).

Fossil Creek Wild and Scenic River Comprehensive River Management Plan

Fossil Creek was designated as a wild and scenic river in 2009. The Wild and Scenic Rivers Act of 1968 (Public Law 90-542) requires the agency responsible for administration of designated rivers to develop comprehensive river management plans (river plan) that provide for the protection and enhancement of the river's water quality, free-flowing condition and "outstandingly remarkable values," collectively referred to as "river values," for the benefit and enjoyment of present and future generations. This river plan for Fossil Creek was finalized in October 2021. Implementation of this river plan will not have adverse impacts on the river values and will not have cumulatively adverse effects on watershed conditions on the Tonto National Forest nor the adjacent landowners downstream from the Fossil Creek.

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