United States Department of Agriculture – Forest Service

Black River Landscape Restoration Project

Environmental Assessment

Springerville and Alpine Ranger Districts
Apache-Sitgreaves National Forests
Apache County, Arizona

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Cover Photo: Common conditions in ponderosa pine in the Black River project area. Courtesy of James Johnson.

TABLE OF CONTENTS

List of Tables

List of Figures

Chapter 1 - Background and Need for Action

Restoration Initiatives

Restoration has become necessary for many forests and watersheds of the western United States and is a main objective of the United States Forest Service (USFS). The United States Department of Agriculture (USDA) has a national policy to restore our nation's forests and watersheds and reduce risk of catastrophic wildfire (USFS 2016). The USDA identifies four objectives that apply to USFS activities to achieve this goal: improvement of forest health through management, implementation of climate adaptation strategies, protect and improve water and soil quality, and reduce the risk of catastrophic wildfire (USDA 2014). The USFS has a strategic goal to sustain national forests and identifies restoration work as key to achieving that goal. Restoration aims to improve air and water quality, improve recreation opportunities, maintain scenic character, provide forest products, maintain cultural sites, and improve a full suite of habitats for plant, aquatic, and wildlife species (USFS 2015a, p.10).

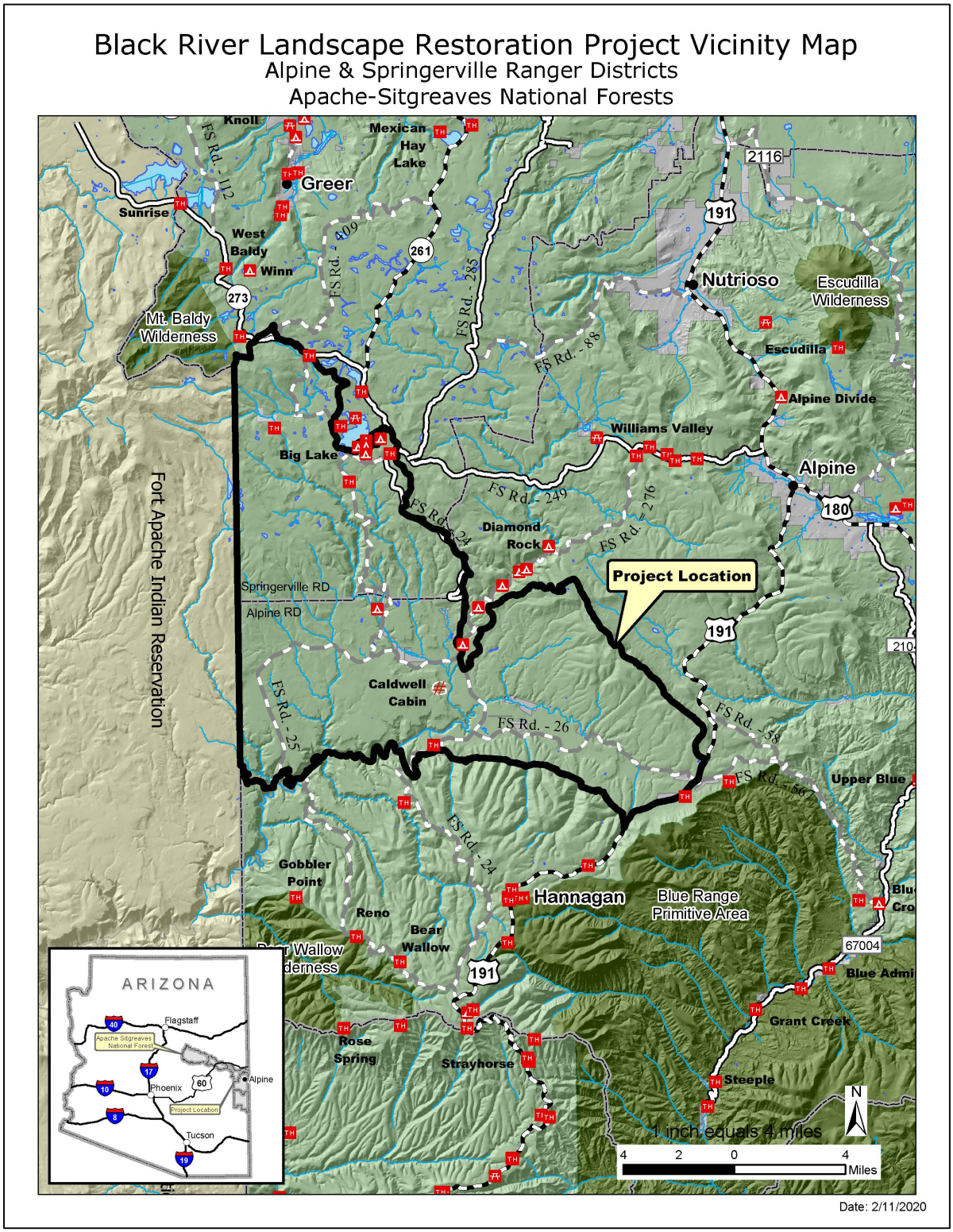
Black River Landscape Restoration Project

The Southwest Region of the USFS has a focus on restoration in the region, and the Apache-Sitgreaves National Forests Land Management Plan (hereafter, "Forest Plan") outlines standards, guidelines, objectives, and desired conditions to help guide restoration actions on the forests (USFS 2015a). The Alpine and Springerville Ranger Districts of the Apache-Sitgreaves National Forests (ASNFs) proposes the Black River Landscape Restoration Project (hereafter referred to as the Black River Project) a vegetation, aquatics, and hazardous fuels reduction project to restore forest resiliency and ecosystem function on approximately 92,434 acres in the project planning area.

This environmental assessment (EA) was prepared to determine whether implementation of the proposed restoration by mechanical and hand thinning, fuels treatments, prescribed burning, stream channel restoration, watershed restoration, reforestation, and more may significantly affect the quality of the human environment and thereby require the preparation of an environmental impact statement. By preparing this EA, the Forest Service is fulfilling agency policy and direction to comply with the National Environmental Policy Act (NEPA) and providing the informational basis for the responsible official to make a reasoned decision on action alternatives for the project area. The document is organized into four chapters:

1. Purpose and Need for Action: This section includes information on the project proposal and describes the need driving the proposal by identifying gaps between existing and desired conditions. This section also details how the Forest Service informed the public of the proposal.
2. Proposed action and Alternatives: This section provides a detailed description of the agency's proposed action as well as alternative methods for achieving the stated need.
3. Environmental Consequences: This section describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area.
4. Agencies and Persons Consulted: This section provides a list of preparers and agencies consulted during the development of the environmental assessment.

Figure 1: Vicinity Map



Resources chosen to illustrate the purpose and need for this project are indicators of ecosystem function and forest health and correspond to the resources in need of restoration work in the project area. These resource areas are forest stands, fuels, soils, hydrology, and wildlife.

The Land Management Plan for Apache-Sitgreaves National Forests (hereafter, "Forest Plan") provides objectives, desired conditions, standards and guidelines for woody vegetation (USDA Forest Service 2015a). This project tiers to the Apache-Sitgreaves National Forests Land Management Plan Programmatic Final Environmental Impact Statement (2015b) and incorporates by reference the accompanying land and resource management plan. The need for the proposed action is based on gaps between desired conditions and existing resource conditions, presented in summary form below.

Existing Conditions – Vegetation and Timber

Potential Natural Vegetation Types (PNVT) are coarse-scale groupings of ecosystem types that share similar geography, soils, vegetation, and historic ecosystem disturbances such as fire, drought, and grazing by native species. These represent the vegetation type and characteristics that would occur when natural disturbance regimes and biological processes prevail.

Table 1: acres of each major Potential Natural Vegetation Type within the area

PNVT*	Project Wide	Percent of Black River Project
Wetland/Cienega riparian areas	2,974	3.2%
Montane willow riparian forest	1,499	1.6%
Cottonwood-willow riparian forest	4	0.0%
Ponderosa pine forest	47,425	51.3%
Dry mixed conifer forest	16,726	18.1%
Wet mixed conifer forest	16,222	17.6%
Spruce-Fir forest	836	0.9%
Montane/subalpine grasslands	5,555	6.0%
Private Land (Not Analyzed)	1,193	1.3%
Totals	**92,434**	**100.0%**

Forested PNVTs within the Black River Project are overstocked, lack horizontal and vertical structure, and have altered species composition. The existing forest structure lacks diversity of diameter classes and habitat components, such as openings or interspaces. Specific components of this condition are addressed in more detail below and in the project record. These same components will be used to evaluate environmental effects in chapter 3.

Stand density – Most of the forested stands with the Black River Project area are overly dense, reducing their health and making them susceptible to drought, insects and disease and uncharacteristic wildfires. Any climate change impacts will be severe due to increased water stress. Stand density is the dominant factor affecting the health and vigor of the forest (SAF 2005).

Forest Structure - Currently there is a large imbalance between structural states with most structures being classified as medium sized trees. There is currently a lack of small tree structure and large to very large structures present across the Black River Project. While large and small trees exist in these stands, they tend to be minor components when compared to other size classes.

There are many stands that are dominated by just one size class and considered to be even aged. These stands have developed mainly due to past silviculture practices and treatments over the last 30 years. The existing uneven-aged forest structure does not comprise the desired range of diameter classes, and habitat components, such as openings. Interspaces between groups of trees consisting of mixtures of grasses, forbs, and shrubs are lacking or limited in most stands. Young and mid-aged trees are over-represented, and seedlings, saplings, mature and old trees are deficit relative to a diverse age/structure uneven-aged condition within general forest foraging areas.

Forest Disease – Dwarf mistletoe infection in ponderosa pine, Douglas-fir and western spruce are common throughout the project area (Gaylord and Wilhelmi 2017). Dwarf mistletoe continues to have a major impact on growth and mortality of conifers in the Southwest (USDA 2016c). The incidence of dwarf mistletoe is quantified during stand exams. Approximately 38,861 acres (47.9%) of the acres within the project area have infection present at some level. The effects of dwarf mistletoe on individual trees include growth loss, mortality, reduced seed production and viability, and an increased risk of bark beetle attack and mortality. The effects of dwarf mistletoe infection on stand structure include increased stand openings, lower crown canopy, and fewer larger diameter trees.

Desired Conditions – Vegetation and Timber (Forest Plan pages 37-39)

Desired conditions describe the goals for resources defined from the forest plan set of documents is incorporated by reference, with the applicable desired conditions derived from the planning process presented in summary form below. The list is not exhaustive but instead demonstrative of desired conditions driving the project in response to the existing conditions identified above.

- The Forest is a mosaic of structural states ranging from young to old trees. Forest structure is variable but uneven-aged and open in appearance. Sporadic areas of even-aged structure may be present to provide structural diversity.
- The landscape arrangement is an assemblage of variably-sized and aged groups and patches of trees and other vegetation similar to reference conditions.
- Vegetation associations are similar to reference conditions.
- Old growth occurs throughout the landscape, in small, discontinuous areas consisting of clumps of old trees, or occasionally individual old trees.
- Grasses, forbs, shrubs, needles, leaves, and small trees support the natural fire regime.
- The tree group mosaic comprises an uneven-aged forest with all age classes, size classes, and structural stages present.
- Stands in the project area have low to moderate dwarf mistletoe infection severity.
- Forest structure in the wildland-urban interface (WUI) may have smaller, more widely spaced groups of trees than in the non-WUI areas.
- Stands in the project area are in the low or moderate hazard for bark beetles.

Table 2: Summary comparison of the existing forest stand condition verses desired condition

	Existing Condition	Desired Condition
Structure - Pattern	The majority of stands are in a closed condition and lacking groups and clumps of trees or randomly spaced trees. Grasses, forbs and shrubs are underrepresented compared to historic patterns.	The majority of stands are in an open condition. Forest arrangement is in individual trees, small clumps, and groups of trees or randomly spaced trees interspersed within variably sized openings of grasses, forbs, and shrubs that are similar to historic patterns. Most forest stands in uneven-aged condition.
Structure - Trees per acre	Total trees per acre is higher than the desired condition and are overrepresented in the smaller diameter classes and underrepresented in the larger classes.	Trees are distributed across size classes with total number of trees per acre between 24 to 124.
Basal Area	Currently, 83% of all ponderosa pine stands have a basal area greater than 80 ft² per acre. High densities in terms of basal area make trees more susceptible to mortality from insects, disease, and competition and increase crown fire risk.	Maintaining ponderosa pine stands' basal area between 20-80 ft² per acre and dry mixed conifer at 30-100 ft² per acre to meet forest resilience goals while maintaining wildlife habitat desired conditions. For MSO nest/roost replacement habitat 110 to 120 ft² per acre is the minimum.
Forest Insects	Currently 74% of acreage have a high bark beetle hazard rating. The remaining 26% of stands meet the desired condition for insect hazard.	Stands in the project area are in the low or moderate hazard for bark beetles
Forest Disease	Currently 62% of the stands have some level of dwarf mistletoe. 83% of the project area meets the desired condition for mistletoe infection severity (Less than 20% of trees infected)	Stands in the project area have low to moderate dwarf mistletoe infection severity (Less than 20% of trees infected)

Existing Conditions – Fire and Fuels

Fire Regime Condition Class (FRCC, Hann et al. 2004) is a classification of the amount of departure from the historical natural fire regime and is based on a relative measure describing that degree of departure. This departure results in changes to vegetation characteristics, fuel composition, fire frequency, and other disturbance characteristics. As noted in the vegetation section above, forested stands within the Black River Project are overstocked, lack horizontal and vertical structure, and have altered species composition. The Wallow Fire burned approximate 64,889 acres within the Black River Project as a low to moderate burn severity, and although the fire reduced surface fuels, it did not induce tree mortality that would alter the forested stands' current condition. Approximately 77,456 acres of the of the project area are moderately or severely altered in their Fire Regime.

Table 3: Acres of Fire Regime Condition Class in the Black River Project

Class	Acres	Percent of Area
FRCC I	14,600	15.8
FRCC II	18,071	19.6
FRCC III	59,385	64.2

There are approximately 1,500 acres of private land inholdings within the project area creating a wildland urban interface. A primary management focus is to ensure the fire behavior within the WUI is manageable and suppression forces could use a direct suppression strategy to keep fire out of private land, see Forest Plan, "Wildland Fire Management" section, pp. 105-110.

Desired Conditions – Fire and Fuels (Forest Plan pages 37-47; 105-110)

- Fire regime is aligned with reference conditions (Fire Regime Condition Class 1). Wildland fires burn within the range of frequency and intensity of natural fire regimes. Uncharacteristic high severity fires rarely occur and do not burn at the landscape scale.
- Fire burns primarily on the forest floor and does not spread between tree groups as crown fire.
- Frequent, low to mixed severity fires are characteristic in Ponderosa Pine.
- Frequent, low to mixed severity fires are characteristic in Dry Mixed Conifer.
- Mixed severity fires are characteristic in Wet Mixed Conifer.
- In the spruce-fir forested type, mixed to high severity fires occur infrequently.
- Human life, property, and natural and cultural resource are protected within and adjacent to NFS lands.
- For all types, the composition, cover, structure, and mosaic of vegetative conditions reduce uncharacteristic wildfire hazard to local communities and forest ecosystems.

Existing Conditions – Soils

Existing soil conditions were assessed using the Terrestrial Ecosystem Survey of the Apache-Sitgreaves National Forests in conjunction with field observations and data collection during the spring and fall of 2016. Field observations and soil condition assessments were stratified and analyzed by survey map units across the project area. Soil condition was determined using the R3 Soil Condition Assessment Protocol and Rating Guide. Approximately 81% of the area within the project exhibits satisfactory soil conditions while 17% received an impaired rating. The remaining 2% received an unsatisfactory soil condition rating as these locations exhibit current soil loss generally greater than tolerable limits on slope gradients exceeding 40%. A soil condition rating map for Terrestrial Ecosystem Survey units within the project area can be referenced in in the project record. For locations that were not impacted by the Wallow Fire or burned at a low severity in these vegetation types, soil condition is predominantly satisfactory with a stable trend. Dense networks of heavy OHV use and the associated erosional impacts on trails in or within proximity to wet meadows have produced impaired soil conditions on a few sites.

Desired Conditions – Soils (Forest Plan pages 20-22)

- Soil condition rating is satisfactory.
- Soils are stable within their natural capability. Vegetation and litter limit accelerated erosion (e.g., rills, gullies, root exposure, topsoil loss) and contribute to soil deposition and development.
- Biological soil crusts (e.g., mosses, lichens, algae, liverworts) are present and reestablished if potential exists.
- Soil loss rates do not exceed tolerance soil loss rates.
- Logs and other woody material are distributed across the surface to maintain soil productivity.
- Vegetation and litter are sufficient to maintain and improve water infiltration, nutrient cycling, and soil stability.

Existing Conditions – Hydrology

Due to its elevation and location, the project area has an abundance of ephemeral, intermittent, and perennial streams in the project area, particularly relative to the arid Southwest as a whole. These streams provide important wildlife habitat for aquatic and terrestrial organisms alike. Much of the wildlife habitat in the project area has been impacted by the 2011 Wallow Fire. This can have acute, immediate effects on survival and growth of aquatic organisms, or less severe effects that persist for years. Some streams within the Black River Project area were adversely affected following the Wallow Fire due to runoff from fire-denuded slopes that overwhelmed the stream systems causing downcutting and loss of instream structure. Watershed specialists assessed conditions using the Forest Service Watershed Condition Framework and the associated indicators, see specialist report for full details.

Desired Conditions – Hydrology (Forest Plan pages 23-27)

- Watershed condition rating is at satisfactory.
- Instream flows provide for channel and floodplain maintenance, recharge of riparian aquifers, water quality, and minimal temperature fluctuations.
- Water quantity meets the needs for forest administration and authorized activities (e.g., livestock grazing, recreation, firefighting, domestic use, road maintenance).
- Stream channels and floodplains are dynamic and resilient to disturbances. The water and sediment balance between streams and their watersheds allow a natural frequency of low and high flows.
- Stream condition is sufficient to withstand floods without disrupting normal stream characteristics.

- Floodplains are functioning and lessen the impacts of floods on human safety, health, and welfare.
- Water quality meets or exceeds Arizona State standards or Environmental Protection Agency water quality standards for designated uses.

Existing Conditions – Wildlife and Rare Plants

The project area provides habitat for many wildlife species, ranging from important game species such as elk, deer, pronghorn, and turkey, to federally listed species such as the Mexican spotted owl, New Mexico meadow jumping mouse, Apache trout, Mexican garter snake, narrow-headed garter snake, and the Mexican wolf. There are nineteen Protected Activity Centers for Mexican spotted owls in or within a half mile of the project boundary. New Mexico meadow jumping mice have been located within the major water systems in the project, including the East and West forks of the Black River, the main stem of the Black River, as well as Centerfire, Boggy, and Beaver creeks. Multiple Mexican grey wolf packs den or hunt within the project boundary. Twelve Northern goshawk management units have been established within the Black River Project area as a result of survey information.

Riparian areas throughout the project area have experienced reductions in the amount of stabilizing vegetation such as alders, willows, sedges and rushes. The Apache trout is considered present in only about 6 miles of the project area, while it could potentially occur in approximately 59 miles. The endangered loach minnow was once present in the East Fork Black River, but this stream is currently unoccupied by this species.

Desired Conditions – Wildlife and Rare Plants (Forest Plan pages 25-27; 61)

- Habitat and ecological conditions are capable of providing for self-sustaining populations of native, riparian-dependent plant and animal species.
- Ecological conditions for habitat quality, distribution, and abundance contribute to self-sustaining populations of native and desirable nonnative plants and animals.
- Habitat configuration and availability allows wildlife populations to adjust their movements (e.g., seasonal migration, foraging) in response to climate change and promote genetic flow between wildlife populations.
- Large blocks of habitat are interconnected, allowing for behavioral and predator-prey interactions.
- Northern goshawk nest areas have forest conditions that are multi-aged but are dominated by large trees with relatively denser canopies than the surrounding forest.
- Streamflows provide connectivity among fish populations and provide unobstructed routes critical for fulfilling needs of aquatic, riparian-dependent, and many upland species of plants and animals.

Resource Management Needs

Each of these sections represent an area in which current management of the project area can be updated to help move the project area towards desired conditions as summarized from the Forest Plan above. This section effectively serves to summarize and highlight the contrasts identified above. These resource management needs tie into Regional priorities for ecosystem restoration.

Condition of Forest Stands

- Across the project area, forested stands within the Black River project area are overstocked, lack horizontal and vertical structure, and have altered species composition.
- The existing forest structure does not comprise the desired range of diameter classes and habitat components, such as openings or interspaces.
- Tree species composition is departed from desired conditions in mixed conifer PNVTs.

Condition of Fire and Fuels

- Fire Regimes are currently departed from reference conditions due to historic management practices around fire suppression. The loss of frequent low-severity surface fire has allowed for the establishment of trees, which has increased forest density, and potential for uncharacteristic fires.
- Alteration of disturbance processes has resulted in increased fuel loadings and connectivity.
- In high severity burned areas, insects and disease are contributing to tree mortality in the remaining live trees that then contributes to further surface fuel loading as trees fall.

Hydrological Conditions

- Soil conditions are impaired across portions of the project area.
- Watershed conditions are impaired across portions of the project area.
- Portions of the road system and unauthorized routes are contributing to sedimentation.

Condition of Wildlife and Aquatic Habitat

- Aquatic species habitat is in a degraded condition following the Wallow fire, and species are not present in areas they historically occupied.
- Existing conditions of riparian inclusions within much of the project area are highly departed from the desired conditions for riparian PNVTs.

Purpose and Need for Action

Each of the above leads to an identified need for action in the project area:

- The ASNFs has identified the need to restore forest structure, composition, density/basal area and landscape patterns to create uneven-aged landscapes more resilient to disturbances so natural ecological processes may return to their characteristic roles within the ecosystem.

- The Forests need to restore fire to its more natural function (in terms of frequency, intensity, and extent) based on historical reference conditions.

- The Forests need to improve and where applicable, maintain the hydrologic and ecological function of the watershed conditions, streams, riparian and wetland areas and the habitats they support.

- The Forests need to restore habitat quality, distribution and abundance necessary to support the recovery of federally listed species and encourage native and game species to thrive.

Public Involvement and Tribal Consultation

The Black River Restoration Project has been under development since late 2016. Partners such as the Natural Resources Working Group which includes state and federal agencies (USFWS, AZGF), universities, counties, conservationists, and industry representatives weighed in on the project proposal during quarterly meetings with the ASNFs. The USFS listed the proposal for this project in the ASNFs' Schedule of Proposed Actions (SOPA) on March 21, 2018.

On March 21, 2018, the ASNFs sent a letter to approximately 200 agency and local government officials, tribes, landowners bordering the project area, and any identified possibly interested parties. A legal notice published in the *White Mountain Independent Newspaper*, both Apache and Navajo County editions on March 21, 2018, initiated the combined scoping and official comment period on the project. The published notice included a brief description of the proposed action for the project. The comment period extended the required 30-calendar days closing on April 25, 2018, as required by 36 CFR 218. Eleven letters with multiple comments were received.

Tribal Consultation

Initial consultation letters were mailed on January 18, 2018 to inform the tribes of the project and invite participation in the planning effort. Letters included were sent to 29 tribes, two of which responded. The letter informed the tribes about the types of activities proposed for the Black River Project area, the number of known sites in the project area, the number of previously surveyed acres, and plans for additional, phased cultural resource surveys.

Issues

Issues are statements of cause and effect, linking environmental effects to proposed activities, and developed through public involvement in addition to the interdisciplinary work required by NEPA. The public comments received during the scoping period from March 21 to April 25, 2018 presented five issues that are within the scope of the proposed action, and relevant to the decision to be made. Three of these issues were used to formulate a new action alternative for the analysis (cf. FSH 1909.15, 12.42), while two are sufficiently addressed through comment response and effects analysis in the revised Environmental Assessment.

Issue 1 - Large and Old Tree Retention

To meet the desired conditions for creating a mosaic of structural states ranging from young to old across the landscape, there is a concern that large and old trees would be mechanically treated and removed under the proposed action. Alternative 3 was developed in part to respond to this issue. While the proposed action includes implementation strategies for old trees retention and large trees there were concerns requesting that the Forest Service follow the Old Tree Implementation Plan and Large Tree Implementation Plan from the Four Forest Restoration Initiative due to concern about how the proposed action would address old and large trees. One specific concern was the definition of a "large tree" at 20" diameter at breast height (DBH) in the Black River Project versus 16.0" DBH under the 1st 4FRI EIS. This issue will be further addressed in the analysis.

Indicators / Measures

- Number of acres of stands meeting collaboratively established "Stands with a Preponderance of Large Young Trees" criteria.

Issue 2 - Dwarf Mistletoe Mitigation

Points of concern include targeting mistletoe in large trees and even-age treatments such as shelterwood regeneration systems and overstory removals. The proposed action plans to target treatments for dwarf mistletoe, focusing on pockets within stands that have infections of dwarf mistletoe. Alternative 3 will not target mistletoe in large and old trees and will removed overstory removal treatments. Dwarf mistletoe will also not be a decision variable in the flexible toolbox. This issue will be addressed in the analysis.

Indicators / Measures

- Anticipated percent change in dwarf mistletoe infection ratings across the project area.

Issue 3 - Degree of Openness Pre- and Post- Treatment

To meet desired conditions for both fire behavior, density and structure, there is a concern that the proposed action would create a forest that is excessively open in appearance. There is also concern about the scientific validity of regeneration openings (Group Selection) in ponderosa pine ecosystems. Treatments with interspaces from 55% - 70% interspace were also of concern within the project, as they can appear too open. Alternative 3 was developed in part to respond to this issue, as with issues 1 and 2. In removes treatments with interspace between 50-70%, removes regeneration openings (Group Selections) and has a narrower definition of Wildland-Urban Interface.

Indicators / Measures

- Tree density within forested areas as measured by average basal area (BA) per acre,

Issue 4 - Threatened & Endangered Species

To meet the desired condition for lower fuel loadings upon the landscape, there is a concern that treatments could go beyond what is needed for T&E species such as Mexican-spotted owl and goshawk habitat needs. This issue is addressed in the effects analysis for all alternatives using the best available science and with design features and conservation measures consistent will all applicable recovery plans. Treatments are designed to follow the Endangered Species Act, 2012 Mexican-Spotted Owl Recovery Plan, and Forest Service standards for Northern Goshawk protections. See Appendix B-Design Features and Appendix E Flexible Toolbox Approach for Vegetation Restoration Using Mechanical Treatments.

Indicators / Measures

- Stand density as measured by reduction of average BA of large young trees;
- Acres of MSO recovery habitat compared to existing habitat (Specifically for Pine-Oak habitat).
- Acres of MSO nesting / roosting recovery habitat compared to existing habitat.

Issue 5 - Road Decommissioning

To meet the desired condition for less resource impacts from roads, there is a concern that some roads will be decommissioned to recover and thus not be available for public motorized use. The roads to be decommissioned are maintenance level 1 roads (roads not available for public travel) and unauthorized (non-system) roads. Closing these will move the project area towards desired conditions for motorized opportunities (Forest Plan pp. 75-77). Some members of the public were concerned about closing roads in current use – no roads that are currently opened to the public that are proposed for decommissioning in the project area.

Chapter 2 - Proposed Action and Alternatives

This section describes and compares the alternatives considered for the Black River Project. It includes a description of each alternative considered. This section also presents the alternatives in comparative form, defining the differences between each alternative and providing a basis for choosing among options by the responsible official.

Alternative Development Process

As a result of scoping, collaboration and public involvement several issues were identified (See the Issues section above). Three of these issues drove the development of an additional action alternative, with details on this development process available in the project record.

Alternative Considered but Eliminated from Detailed Study

A "fire-only" approach to restoration in the area was considered but dismissed from detailed study in the alternative development process. A lack of periodic fires within the Black River project has resulted in a dense, unhealthy forest lacking in structural and age diversity. However, reintroduction of fire as the sole management tool relating to reducing overstocked stands would not address the need for a reduction in stand density and an increase in heterogeneity nor would it address the mission of the Forest Service to provide sustainable wood products.

Alternatives Considered in Detail

This EA documents the analysis of three alternatives, including the no action (Alternative 1), the proposed action for scoping (Alternative 2), and Alternative 3 – the current Preferred Alternative. Alternatives 2 and 3 respond to issues by the public during the scoping period. The alternatives are described below.

Alternative 1 – No Action

Alternative 1 is the no-action alternative. It represents no changes to current management. Ongoing vegetation treatments and fire management activities, as well as road maintenance, recreation, firewood gathering, authorized livestock grazing, and other activities already authorized in separate decisions would continue. The potential direct, indirect, and cumulative effects from no action will be analyzed. The no-action alternative is the baseline for assessing the action alternatives (Alternatives 2 and 3).

Alternatives 2 and 3

Alternative 2 is the proposed action as presented during the scoping period. Alternative 3 is now the current preferred alternative put forward by the agency. The two alternatives are comparable in terms of types of activities that would be implemented, and therefore the following sections describe areas of overlap, and where the two alternatives differ.

Under both alternatives, implementation of vegetation management actions would be accomplished using mechanical and hand treatments to reduce stand densities, and re-establish structural, species and age diversity; this would be accomplished by means of timber sales and service contracts. Fire may be reintroduced either prior to thinning if conditions allow or upon completion of the thinning work through broadcast and pile burning. Mechanical equipment would also be used for instream and riparian work, and in road construction, maintenance and decommissioning.

Thinning treatments would target individual stands of trees to increase the heterogeneity within the stands by delineating groups of trees and increasing the interspaces within the stand to allow grasses, herbs, and shrubs to re-establish. Groups of underrepresented diameter classes would be retained throughout the stands in order to develop an uneven-aged structure. Large oaks would be considered underrepresented in the landscape and would be retained whenever possible. Areas would be treated with periodic low severity prescribed burns or allow natural ignited wildfires to be managed on the landscape when and where feasible. Specific vegetation treatments have been developed to address the forest characteristics needed to support northern goshawks and Mexican spotted owls as well as other unique ecosystem types while still providing for forest health and resiliency. See Appendix A-Maps.

All work such as road construction, maintenance, decommissioning would be overseen by Forest Service Engineering Specialists, and all in-stream work would be overseen by either a Forest Service Hydrologist or Fisheries Biologist to ensure all mitigating measures are followed.

Thinning Treatments – Overview

The proposed vegetation treatments include group selection, individual tree selection, intermediate thinning, stand improvement thinning, mistletoe treatments, slash treatments, and hazard tree removal. These treatments are shown by potential natural vegetation type (PNVT) in table 4, below. Under Alternative 2 the treatments result in thinning on approximately 59,604 acres, with approximately 44,794 acres of mechanized thinning and approximately 14,808 acres of manual/hand thinning. Under Alternative 3 the treatments thin approximately 59,248 acres, with 44,782 acres of mechanized thinning and 14,466 acres with manual/hand thinning.

Table 4: Mechanized and hand thinning treatments by PNVTs for Alternatives 2 and 3

Potential Natural Vegetation Type	Alt 2 Treatment Acres	Alt 3 Treatment Acres
Ponderosa Pine Forest	38,434	38,424
Dry Mixed Conifer Forest	6,979	6,901
Spruce-Fir Forest	47	44
Wet Mixed Conifer Forest	5,814	5,551
Cottonwood-Willow Riparian Forest	4	4
Montane Willow Riparian Forest	880	880
Wetland/Cienega Riparian Areas	2,340	2,340
Montane/Subalpine Grasslands	5,106	5,104
Total	**59,604**	**59,248**

The vegetation treatments are determined based on the existing conditions of each forested stand and the PNVT, as described in the Forest Plan. The proposed action would move the project area toward the desired condition of uneven-aged stand conditions, as outlined in the Forest Plan. The goal would be to distribute tree groups to attain high heterogeneity within stands. Groups of underrepresented diameter classes would be retained throughout the stands in order to develop an uneven aged structure. Large oaks are underrepresented in the landscape and would be retained whenever possible. Areas would be treated with periodic low severity prescribed burns when and where feasible to move towards historic fire regimes (see Ch. 1).

The vegetation treatments include uneven aged (UEA) group selection (GS), Single Tree Selection (ST), intermediate thinning (IT), stand improvement (SI), even-aged (EA) treatments, overstory removal (OR), slash treatments, and hazard tree removal. These treatments are defined and summarized in table 5.

Table 5: Silviculture treatments and associated descriptions

Treatment Type	Treatment Description / Objective
Intermediate Thin (IT)	Mechanical and fire treatments that thin stands with up to moderate infection levels of dwarf mistletoe, thins tree groups to an average of 20 to 80 square feet of basal area (BA) in pine cover types and 30-100 BA in dry mixed conifer cover type, and establishes non-forested grass/forb interspace/openings between residual tree groups or individual randomly-spaced trees. Manages for improved tree vigor and growth by retaining the best growing dominant and co-dominant trees with the least amount of dwarf mistletoe and as many old and/or large trees as possible.
Single Tree Selection (ST)	Mechanical and fire treatments that leaves fewer tree groups and more randomly spaced trees. Designed to increase or maintain age class diversity and reduce understory brush and shrub response, creating small openings less than or equal to ¼-acre in size where seedlings and saplings are underrepresented, and brush cover is greater than 40%. Maintains higher basal area where brush competition is expected to be strong to suppress woody understory response.
Stand Improvement (SI)	Mechanical and fire treatments that thin young, even-aged stands dominated by trees less than 8.5 inches in diameter. Establishes tree groups and interspace adjacent to tree groups. Manages for improved tree vigor and growth by retaining the best growing dominant and co-dominant trees within each group and as many old and/or large trees as possible and establishes non-forested grass/forb interspace/openings between residual tree groups or individual randomly spaced trees. Begins conversion to uneven-aged structure.
Uneven-aged (UEA)	Mechanical and fire treatments designed to develop uneven-aged structure and a mosaic of interspaces and tree groups of varying sizes. Thins tree groups to an average of 20-80 BA in pine cover types and 30-100 BA in dry mixed conifer cover type, and establishes non-forested grass/forb interspace/openings between residual tree groups or individual randomly-spaced trees Manages to enhance growing space for younger trees, while retaining as many old or large trees as possible. Establishes regeneration openings where seedlings and saplings are underrepresented. Locates interspace in currently non-forested areas and lacking pre-settlement evidence.
Prescribed Fire Only (in and outside of PACs)	Prescribed burning to improve structure, maintain and develop large trees, and reduce risk of high severity. Retain old growth attributes, protect large oaks, and ensure snags and coarse woody debris post-fire. Reduce conifer litter/duff at ground level to promote increased herbaceous species cover and species richness. Restore/regulate vegetation mosaics, including woody and herbaceous species
Aspen Restoration (in and outside of PACs)	Mechanical treatments that removes post-settlement conifers within 66 feet (one chain) of the aspen clone. Managed to stimulate suckering by removing aspen, disturbing the ground, and/or applying fire as needed.
MSO Recovery – Replacement Nest/Roost	Mechanical and fire treatments designed to develop uneven-aged structure, irregular tree spacing, and a mosaic of interspace and tree groups of varying size. Intent is to continue to develop replacement Nest/Roost where possible, and to develop a diverse mix of heterogeneous stand structures and densities to provide for owl dispersal and foraging.
MSO PAC Mechanical	Mechanical and fire treatments outside core areas that thins to improve structure, maintain and develop large trees, and reduce hazard of high-severity fire in PACs. Designed to increase tree vigor and health, to promote irregular tree spacing, and to create canopy gaps more conducive to fire treatment (reduce fire risk). Retain old growth attributes, protect large oaks, and ensure snags and coarse woody debris post-treatment.
Wildland-Urban Interface (WUI) and Infrastructure Protection	Mechanical treatments that allow maintenance of a more open structure and/or lower fuel load than elsewhere in the project area, up to but not exceeding 70 percent interspace within a ½-mile buffer surrounding critical infrastructure (transmission lines and communication sites) and high value Forest Service infrastructure (buildings and recreation sites), and around non-Forest System lands where structures are present. Treatments are designed to: reduce fire transmission to and from communities, improve firefighter safety and effectiveness, increase evacuation time in emergencies, reduce ember production, increase decision space for fire managers, and allow for more frequent prescribed fires.
Grassland and Wet Meadow Restoration	Mechanical and fire treatments to reduce or eliminate woody species encroachment (pines, junipers and various shrubs). Remove trees established since interruption of the historic fire regime. Promote and re-establish the historic meadow edge. Retain all pre-settlement trees and leave replacement trees where evidence of historical large trees exist.
Riparian Restoration	Combination of restoration treatments, including mechanical and fire treatments to maintain riparian vegetation and habitat. Remove encroaching upland tree and shrub species. Remove noxious or invasive plants. Promote, protect, or plant native aquatic or riparian species. Prescribed fire to regenerate riparian species and reduce fuels accumulation.

Table 6 shows a summary of treatments that are planned under alternative 2 and alternative 3 and that were modeled for the Black River Restoration Project, showing the treatments, relative interspace, basal area range, intensity, and acres analyzed under each alternative. Table 6 shows the differences in treatments for alternatives 2 and 3, which were modeled accordingly. The main change is that the uneven-age treatments with group selections shifted towards single tree selection treatments. Most other treatments had little change between alternative 2 and 3 and were mainly the result of reductions in thinning intensities. These treatments could be modified based on forest conditions at the time of treatment, the flexible toolbox approach as described in Appendix C, would be utilized to make decisions for alternative 3 treatments.

Table 6: Silviculture treatment acres for mechanized treatments under Alternative 2 and Alternative 3

Treatment	Interspace Range (%)	Basal Area Range (ft^2) PP / DMC	Treatment Intensity	Alt2 (Acres)	Alt 3 (Acres)
Intermediate Thin IT 10 - WUI	10 - 25%	20-50 / 30-60	Low	186	186
IT 10-25	10 - 40%	50-80 / 60-100	Low - Medium	13,317	13,620
IT 25	25 - 40%	50-80 / 60-100	Medium	0	1374
IT 25 - WUI	25 - 40%	20-50 / 30-60	Medium	3,600	2,226
IT 25-40	25 - 55%	50-80 / 60-100	Medium - High	2,928	2,928
IT 40	40 – 55%	50 – 80 / 60 – 100	Medium	0	544
IT 40 - WUI	40 - 55%	20-50 / 30-60	Medium	970	622
IT 55 - WUI	55 - 70%	20-50 / 30-60	Very High	35	0
Single Tree Selection[2] ST 10	0 -25%	50-80 / 60-100	Low - Medium	0	5,006
ST 10 - WUI	25%	20-50 / 30-60	Medium	0	1,111
MSO Nesting / Roosting Intermediate Thin	0 - 10%	120-160 / 120-200	Low	1,500	1,500
MSO PAC Treatment	0 - 10%	120-160 / 120-200	Low	276	264
Overstory Removal OR 40-55	40 -70%	20-30 / 30-40	High	302	0
OR 55 - WUI	55 – 70%	20-30 / 30-40	Very High	161	0
Stand Improvement SI 10-25	10 – 40%	50-80 / 60-100	Low - Medium	505	505
SI 25	25 – 40%	50-80 / 60-100	Medium	0	235
SI 25 - WUI	25 – 40%	20-50 / 30-60	Medium	564	329
SI 25-40	25 – 55%	50-80 / 60-100	Medium - High	55	55

Treatment	Interspace Range (%)	Basal Area Range (ft^2) PP / DMC	Treatment Intensity	Alt2 (Acres)	Alt 3 (Acres)
Uneven-aged Group Selection[1]					
UEA 10-25	10 - 40%	50-80 / 60-100	Low - Medium	7,692	5,390
UEA 25	25 – 40%	50-80 / 60-100	Medium	0	817
UEA 25 – WUI	25 – 40%	20-50 / 30-60	Medium	3,950	2,029
UEA 25-40	25 - 55%	50-80 / 60-100	Medium - High	1,097	842
UEA 40	40 – 55%	50–80 / 50-100	High	0	4,332
UEA 40 - WUI	40 – 55%	20-50 / 30-60	High	1,333	867
UEA 40-55	40 – 70%	50-80 / 60-100	High	4,989	0
UEA 40-55 - WUI	40 – 70%	20-50 / 30-60	High – Very High	62	0
UEA 55 - WUI	55 – 70%	20-50 / 30-60	Very High	1,271	0
Total	N/A	N/A	N/A	44,793	44,782

Alternative 3 – current Preferred Alternative

Alternative 3 is designed to address three issues raised by comments received during the scoping process. The changes in Alternative 3 are entirely silviculture prescription changes and do not change the number of acres being treated but the intensity of treatments only. There are three main areas were Alternative 3 is different from Alternative 2 and include old and large tree retention, dwarf mistletoe mitigation, and pre- and post-treatment openness.

Old and Large Trees

This alternative will use the Old Tree Implementation Plan and Large Tree Implementation Plan from the Four Forest Restoration Initiative. This changes some of the language overall and will affect how within-stand opening and heavily stocked stands with high basal areas generated by a preponderance of large, young trees are treated. It will also change the definition of a large tree to 16.0” diameter at breast height, from 20” diameter at breast height as proposed for alternative 2.

Dwarf Mistletoe

For alternative 3, dwarf mistletoe in large and old will not be targeted under this alternative but will be targeted in trees <16.0”. Modeled treatments follow this criterion and allow dwarf mistletoe to persist in large and old trees across the landscape. This is different from alternative 2 where large trees are able to be targeted. Dwarf mistletoe will not be used as a decision variable. Mistletoe was not a decision factor when assigning silviculture prescriptions for the modeling of Alternative 3 (see issues section above). Overstory removal treatments from Alternative 2 were removed and replaced with lower intensity treatments.

[1] For all UEA treatments in Alternative 2 (Proposed Action) Single Tree Selections may be implemented to obtain uneven-aged stand structure if stand conditions are conducive. UEA treatments were modeled and analyzed as they are deemed more intensive. Final determination will be made at the time of silviculture prescription development.

Reduced openness

This alternative will change treatments based on the existing structure of each individual stand. For existing uneven-aged stands, group selections (regeneration openings) will not be implemented, with Single Tree Selection methods being used instead. For existing even-aged stands, uneven-aged treatment with group selections will be implemented. All high intensity 55 – 70 % treatments will be removed and replaced with lesser intensity treatments. Treatment intensities using the flexible toolbox approach will not utilize open reference condition modifiers and will remain within the normal range of intensities for treatment. A strict definition of ½ mile from structures will be used for Wildland Urban Interface (WUI) instead of the Forest Plan definition used in alternative 2. This will reduce the amount of defined WUI within the Black River Project from 20,170 acres in Alternative 2 to 11,123 acres in Alternative 3.

Elements Common to Alternatives 2 and 3

Thinning within Northern Goshawk Habitat

Both the northern goshawk post-fledgling area (PFA) and nest areas would be treated by increasing the basal area by 10 to 20 percent in mid-aged to old tree groups. As an example, if a ponderosa pine General Forest management area is being treated typically at 50 ft^2 of basal area the PFA areas would be increased to 55-60 ft^2 BA. The proposed action would ensure denser canopy conditions in nest areas. Ideally, northern goshawk nest areas have forest conditions that are multi-aged and dominated by large trees with relatively denser canopies than the surrounding forest.

Thinning within Mexican Spotted Owl Habitat

All Mexican spotted owl (MSO) habitat would be treated according to the direction provided in the revised Mexican Spotted Owl Recovery Plan (USDI FWS, 2012). Treatments would vary by protected activity center (PAC), recovery nesting and roosting habitat; and recovery non-nesting and foraging habitat (see Silviculture Specialist Report for greater detail).

PACs are areas intended to sustain and enhance areas that are presently, recently, or historically occupied by breeding pairs of Mexican spotted owls. Each PAC has a 100-acre no treatment area around the known nest site (Low intensity prescribed fire is allowed). Outside the 100-acre no treatment area, trees may be thinned and/or light prescribed burns may be used to treat fuels and mitigate fuel hazards where feasible. Each PAC to be treated would have an upper diameter limit of trees that may be thinned with the maximum cap being 16.0” DBH in order to emphasize obtaining 50% or greater of the stand basal area being from 16.0” DBH trees; all trees above the prescribed limit would be retained. The cap would be prescribed on an individual stand basis and may be lower than 16.0” DBH based on individual stand conditions and objectives. The proposed action would utilize irregular tree spacing to create canopy gaps (0.1 – 1 acre) to move toward or facilitate stand conditions that may be more conducive to low severity prescribed fire treatment. Groups of oaks would be protected, where feasible, from fire impacts either through burn prescriptions or other techniques. Timing restrictions will be implemented from March 1st through August 31st unless non-breeding is confirmed that year per accepted protocol outlined in the MSO Recovery Plan Appendix D.

Within the Black River Project, limited thinning treatments are planned within five of the thirteen PACs within the project area under both alternatives 2 and 3. PACs with planned treatments include: Campbell Blue, Firebox, Reservation Tank, Wildcat, and Burro. The remaining eight PACs either have no treatment planned or have tree planting in areas burned during the Wallow Fire and include: Bear Creek, Deer Creek, Hannagan Creek, Home Creek, Lost Bear, McKibbins, Side Canyon, and West Fork. Alternative 2 thins approximately 22.4% of the total PACs, while alternative 3 thins approximately 13.8% of the PACs. Table 7 shows a summary of the treatments within Black River Project PACs.

Table 7: Comparative MSO PACs Treatments within the Black River Project under alternatives 2 and 3

Treatment	Alt 2	Alt3
Mechanized thinning & Burn	277	265
Hand Thinning & Burn	658	315
Rx Burn Only	718	721
Site Prep and Tree Planting	269	262
No Treatment	2,255	2,614
Total Acres	4,177	4,177

Treatment rationale for implementing thinning and burning within the PACs is based on field verification and recommendations from an interdisciplinary team. The location of these PACs would prevent much of the surrounding landscape from burning successfully without thinning treatment, as fire would likely move into the PAC during adjacent prescribed fire operations. The thinning treatments within the PACs are adjacent to other timber treatments outside of the PACs and would help to provide needed protection for the MSO PAC core area. The fire regime of most of the PACs is suitable for frequent fire and sufficient holding features exist within and around the PACs to enable application of prescribed fire, along with hand thinning, to keep fire to low severity effects. The Burro PAC is in wet mixed conifer and spruce-fir habitat and any thinning and prescribed fire treatments will be strategically placed using jackpot burning. All burning will be reviewed by biologist and fuel management specialists.

Treatments within the PACs are planned to compliment adjacent treatments outside of PACs while managed towards nesting and roosting habitat for the owls. Post treatment densities will range from 120 ft^2 of basal area per acre to over 200 ft^2 based upon forest type. For ponderosa pine and dry mixed conifer PACs, treatments will be towards the lower end of the range to reduce fire effects in these frequent fire ecosystems. For wet mixed conifer and spruce-fir PACs, treatments will be towards the higher end of the range, as the fire regime ranges from III to V, and typically ranges from mixed severity to stand replacing in nature.

MSO Recovery Nesting and Roosting Habitat

Within MSO recovery nesting/roosting habitat and stands designated to be managed towards nesting / roosting habitat, the stands would be managed using a conditions-based management approach following the MSO recovery plan guidelines (USFWS 2012). Treatment of these stands may include thinning trees and/or light prescribed burns to treat fuels and mitigate fuel hazards where feasible. Irregular tree spacing would be utilized to create canopy gaps and create stand conditions that may be more conducive to low severity prescribed fire treatment. This approach allows for treatments to reduce fire risks, lessen insect or disease problems, maintain seral species, or meet other ecosystem objectives. Ten percent or greater of the ponderosa pine/Gambel oak recovery habitat would be managed for replacement nest/roost habitat, along with 25 percent or greater of the mixed conifer recovery habitat, with the goal of obtaining greater than

the minimum acreages where suitable. The following guidelines will be followed when treating MSO recovery nesting / roosting habitat:

- Emphasize attainment of nest/roost conditions as quickly as reasonably possible.
- Retain large trees.
- Strive for spatial heterogeneity.
- Manage for species diversity.
- Retain key owl habitat elements (large trees, snags, large logs, hardwoods, etc.).
- Emphasize large hardwoods, where appropriate

Conditions-Based Management Approach for MSO Recovery Nesting and Roosting Habitat- A conditions-based management approach will be used to determine treatment and treatment intensity within MSO recovery nesting and roosting habitat. This approach allows for treatments to reduce fire risks, lessen insect or disease problems, maintain seral species, or meet other ecosystem objectives. The following situations and conditions will be used:

- **No Treatment –** Designated nesting / roosting stands that do not currently meet minimum nesting and roosting basal area thresholds, no treatment will be prescribed in order to continue moving the stand towards the minimum threshold levels.
- **Minimum Threshold Prescribed** – Treatments that would lower the MSO recovery nesting and roosting habitat to the minimum basal area thresholds would occur under the following stand situations.
    - High basal area stand, with an active insect or disease outbreak which is causing mortality within the stand. The prescription would focus on targeting recent mortality, active infested trees, and small diameter trees to improve overall forest health and maintain the stand attributes at or above threshold levels. The rational for this treatment is that if left alone, the insect or disease outbreak would likely worsen and move the stand below thresholds levels. Large trees over 18.0” DBH would not be targeted for removal.
    - High basal area stand that is dominated by small diameter trees in frequent fire ecosystems (Ponderosa Pine and Dry Mixed Conifer). The prescription would focus on thinning small trees to increase the vigor and growth of remaining trees to maintain a healthy stand condition and reduce the risk of uncharacteristic fire. Small trees would be targeted for removal. This would move these stands as close to the ASNF desired conditions as possible while maintaining minimum nesting / roosting conditions. Large trees over 18.0” DBH would not be targeted for removal.
    - Stands within a WUI area – Stands within a WUI would be prescribed the minimum thresholds levels in order to improve public safety and reduce impacts to private property and nearby infrastructure. Large trees over 18.0” DBH would not be targeted for removal.
- **Above Minimum Threshold Prescribed** – Treatments that would maintain higher than the minimum nesting / roosting thresholds would occur under the following stand situations.
    - Wet Mixed Conifer Stands – Basal Areas would range up to from 120 ft² to 180 ft² based on the Forest Plan desired conditions for wet mixed conifer PNVTs. Large trees over 18.0” DBH would not be targeted for removal.

MSO Recovery Foraging and Non-Breeding Habitat

Within MSO Recovery habitat that is foraging, non-nesting / roosting, the treatments will follow the desired conditions outlined in the forest plan and the following guidance from the MSO recovery plan:

- Emphasize Large Hardwoods: Within pine-oak and other forest types where hardwoods are a component of owl habitat, emphasis should be placed on management that retains, and promotes the growth of additional, large hardwoods.
- Retain Large Trees: Retain all 24" + DBH trees.
- Retain Key Owl Habitat Elements: Retain most hardwoods, large snags (18.0" + DBH), large downed logs (18.0" + at any point), trees (18.0" + DBH). Unless this conflicts with forest restoration and/or owl habitat enhancement goals.

Late Successional Habitat and "Stands with a Preponderance of Large Young Trees" (SPLYT)

As part of the Black River Project, groups of young large trees with potential to develop into late seral habitat would be identified and managed with this goal in mind. These stands would be treated with the lowest range of cutting intensities to help maintain a denser canopy and yet provide growing space within the stand which would improve the health and vigor of the residual trees and encourage them to grow bigger faster. Pre-European settlement trees (trees established prior to 1870) would be retained regardless of their diameter, except where they pose a threat to human health and safety.

For ponderosa pine SPLYT, criteria are that: a) the Quadratic Mean Diameter (QMD) of the top 20% of trees is >15" diameter at breast height (DBH), and b) there is >50 square feet/acre of basal area (BA) in trees >16" DBH. All stands would be field verified prior to mechanical thinning. Stands (or portions thereof) meeting SPLYT criteria, including those not captured by the data filter, would be treated at the lowest range of intensity within the identified silvicultural prescription up to 10% of the total Ponderosa Pine PNVT acres. For example, a stand identified by the decision matrix to receive an uneven-aged treatment leaving 10 to 25% interspace (UEA 10-25), would be treated to 10% interspace and to the upper end of its natural range of variation for trees per acre (TPA) and basal area in order to maintain large tree dominance and conditions favorable to canopy-dependent species. Stands (or portions thereof) that are identified by the SPLYT criteria data filter but, upon field verification, are determined not to meet the SPLYT criteria, will be treated within the range of intensities applied to other non-SPLYT stands. The 10% chosen to be treated with the lowest range of intensities will be determined by picking the stands that have the most basal area dominated by larger trees, soil conditions conducive to sustaining higher basal areas and have high stand site indexes

Thinning to Restore Grasslands and Meadows

Meadow and grassland restoration would include reducing and/or eliminating tree encroachment and applying prescribed fire to promote and re-establish the historic meadow edge. Pre-settlement trees would be retained; trees not meeting pre-settlement characteristics may be removed using limited mechanized or hand treatment options. Where evidence of pre-settlement trees exists, it may be desirable to also leave post-settlement replacement trees if they occur. Where oak occur, they would not be cut.

Pronghorn movement corridors within the project area have been identified ranging from the open grasslands around Big Lake south to PS Ranch, and then east to the grasslands around Sprucedale Guest Ranch. Within these pronghorn movement corridors, the encroaching conifers and small diameter snags would be removed to re-establish free movement for pronghorn. If additional movement corridors within the grassland and meadow restoration treatment areas are identified, they would receive similar treatment.

See the aquatic restoration section for more details on the proposed wet meadow and montane meadow restoration.

Thinning to Restore Aspen

Within portions of the project area, aspen clones would be maintained and enhanced by removing all post settlement conifers within a half to one chain (33-66 feet) of the clone. Some removal of aspen within the clone as well as ground disturbing activity or burning may occur to stimulate regeneration suckering. Each clone would be evaluated to determine if fencing or other barriers are needed to reduce ungulate browsing of regenerating aspen.

Reforestation

The areas of high burn severity, as a result of the Wallow fire, within the project area would be evaluated for reforestation with native tree species where natural regeneration is not occurring (see Map 6, Appendix A). This would enhance the overall recovery process and move the vegetation component toward desired conditions. Table 8 summarizes the anticipated reforestation need by PNVT. Prescribed fire and mechanized pretreatment of fuels may be used as site preparation for reforestation treatments to prepare the seed bed and reduce residual fuel loading to be within Forest Plan desired conditions.

Table 8. Proposed reforestation activity, by potential natural vegetation types for both alternative 2 and 3

Potential Natural Vegetation Type	Alt 2 & 3 Acres
Dry Mixed Conifer Forest	6,395
Ponderosa Pine Forest	3,431
Spruce-Fir Forest	269
Wet Mixed Conifer Forest	6,233
Total Acres	**16,328**

Prescribed Burning

The objective of using prescribed fire is to reduce surface and ladder fuel, begin re-establishing fire's natural function within the ecosystems, and move toward desired conditions in forest, grassland, and watershed health within the project. Thereby helping to address issues 1 and 3 described in Chapter 1 and in accordance with desired future conditions in the Forest Plan identified in Chapter 1, Purpose and Need.

Prescribed fire is proposed on approximately 25,707 acres within the project area, where active ignitions will occur to meet restoration and fuels reduction objectives. On approximately 8,483 acres prescribed fire will not be actively ignited but may occur passively if adjacent active prescribed fire ignition moves into these areas. The remaining 58,244 acres within the project area are to be treated under the Wallow West Landscape Prescribed Fire Project. These treatments may include the use of low intensity fire such as broadcast or maintenance burning for forest health and fuels reduction, pile burning, mechanized vegetation treatments such as pre-commercial thinning or mastication. Other treatments may include hand thinning, hand-piling or grapple piling of slash, snag removal, and mechanized or handline construction to establish firelines. Firelines would be rehabilitated after project implementation.

Lands adjacent to private land inholdings in the project area, or wildland urban interface (WUI) would be considered a priority in fuels management treatments – including prescribed burn and mechanical treatment. Project objectives for WUI would be to reduce surface and ladder fuels and canopy connectivity.

Maintenance burning is the application of fire after initial fire treatments. Maintenance burning would be conducted when opportunities arise, including the use of naturally occurring wildfire when appropriate. Prescribed fire would also be used for maintenance burns when possible and the timing of these prescribed burns would be based on the time and proximity to the last fire and coordinated with current and anticipated activities within the area. The maintenance burning within the project area is described by vegetation type below.

- Ponderosa pine forest areas that have not experienced fire in the last 10 years should be a priority for maintenance burning while areas that have experienced fire in the last 2 years should be of lowest priority. The mean fire interval for ponderosa pine forest types is 2 to 17 years. Within a 17 year-period, all areas should experience fire at least once, but not more than 5 times.
- Dry mixed conifer forest areas that have not experienced fire in the last 22 years should be a priority for maintenance burning, while areas that have experienced fire in the last 10 years should be of low priority. Areas in dry mixed conifer should not experience fire in consecutive years. The mean fire interval for dry mixed conifer forest types is 2 to 26 years. Within a 26 year-period, all areas should experience fire once, and no more than 2 times.
- Wetlands, montane subalpine grasslands, and wet mixed conifer should not be prioritized for prescribed fire or maintenance burning, as they have long scale fire return intervals with a high degree of variability. These PNVTs may be included in prescribed fire implementation activities when deemed appropriate by land managers.

Areas in any forest type adjacent to recent fires would be of lower priority than those farthest from recent fires. This approach would continue to build a spatial mosaic of disturbance across the landscape that can serve as refugia for wildlife, regeneration, soil recovery, watershed stability, and seedbank reserves. Where and when possible, maintenance burn blocks would be greater than 100 acres and would be lit to allow natural fire to spread through the fuels creating a mosaic burn pattern.

Aquatic Restoration

Within the project area, there are opportunities to improve conditions within the watershed over the long-term by improving riparian and wetland conditions, hydrologic function, and habitat for native fish and aquatic species as well as by minimizing sedimentation. The opportunities include meadow restoration, instream treatments, culvert armoring/replacement and stream crossing improvements, riparian treatments, fencing, spring restoration, and stream gage and unneeded fish barrier removal. For any new exclosures in the project area on streams walkthroughs and gates would be part of the project design to allow for administrative access for vehicles and equipment, and recreationists. Table 9 below summarizes the proposed activities by watershed.

The flexible toolbox approach for aquatic restoration would describe current conditions, assess needs, and define treatment options to move streams and riparian areas toward desired conditions. Resource protection measures are incorporated into treatments through design features, conservation measures for

aquatic species, and best management practices for soils and water quality. For any activities not identified in Table 9, a flexible toolbox approach (i.e., adaptive management) would be applied for restoration of streams and riparian areas across the project area. All survey and consultations required would be done prior to implementation. Prioritization would occur as part of implementation to provide flexibility. Assessment by Forest Service specialists would be part of the flexible toolbox approach, to assess needs and possible restoration treatments. See Appendix C-Flexible Toolbox.

Instream Treatments

Instream channel restoration would treat perennial, intermittent, and ephemeral streams in order to reduce erosion, improve stream and watershed function, and restore habitat for native fish and aquatic species. Specific treatments to restore riparian streams and stream channels would be identified prior to vegetation and fire treatments in the vicinity. Generally, these treatments include channel restoration (*e.g., one rock dams, grade control or induced meandering*) and mechanical channel structural improvements (*e.g., felling, tree tipping, or girdling trees to provide large woody debris for cover and habitat complexity, beaver dam analogs, wicker weirs*). Specific treatments to restore aquatic and native fish habitat include installing and rebuilding instream structures, removing fish barriers that are no longer needed, and improving channel form and function to create more complex habitat (*e.g. pools, spawning gravels*). There are also approximately 30 existing instream structures in Apache trout streams that need to be installed, restored, or removed. Treatments also could include resizing, replacing, and installing stream crossing structures to ensure that they are functioning properly and not creating barriers for aquatic species.

For activities in the streams, work would be done at low flow periods. Estimated ranges of opportunities for low flow instream work are the beginning of March to the end of June, and again the beginning of September to the end of December. Other activities not requiring low flow would follow timing stipulations for TES species.

Estimated time and tools to complete certain activities:

- Road crossings improvements 3-4 days (doesn't require low flow) and an excavator/bulldozer would be used.
- Fish barrier and stream gage removal 1 week (would require low flow), and excavator/bulldozer equipment would be used.

Spring Restoration

Approximately 67 springs are identified within the project area. The condition and function of springs exhibiting downward trends or static-degraded conditions need to be improved to sustain these features. Many previously unknown springs have been located since the Wallow fire. Specific treatments to restore springs would be identified prior to mechanized and prescribed fire treatments in the vicinity.

Spring restoration treatments may include the following:

- Reducing tree encroachment near the spring;
- Returning fire to the system (low intensity prescribed fire);
- Placing protective barriers (e.g., fencing);
- Restoring flow to historic areas of influence;
- Re-plumbing the spring improvements to conserve water;

- Removing or relocating adjacent roads;
- Restoring or repairing damaged infrastructure;
- Removing dilapidated or non-functioning infrastructure where appropriate.

Restoring these springs would benefit species dependent on this specialized habitat as well as species in the downstream areas that receive spring flow. Spring restoration also would improve the quantity and quality of water downstream.

Table 9 lists the watersheds where spring restoration needs have been identified. More springs have become evident following the Wallow fire, and a more complete inventory needs to be done. This inventory may expand the spring restoration needs within the project area.

Riparian Habitat Restoration Treatments

Proposed riparian habitat treatments may be needed within all or some portion of the existing riparian areas. Restoration treatments may include channel restoration as described above under instream treatments. Restoration treatments also include riparian planting or seeding, thinning, prescribed fire, and installing or repairing enclosures to protect resources. There are approximately 5,100 acres where riparian treatments are needed within the project area, including riparian wet meadows.

There is also an opportunity within the project area to modify, replace, or remove old structures that are no longer serving their intended purposes. Old, deteriorating stream gage weirs often create artificial barriers for fish and other aquatic species, and can pose public health hazards. Modification, replacement or removal of these stream gages would improve watershed function.

Meadow Restoration

There are some locations where riparian wet meadows and montane meadows within the project area are functioning properly. A few stream channels reach within riparian wet meadows have experienced erosion from accelerated flows and unstable channel conditions resulting from the Wallow fire. There are also localized areas with impaired soil conditions on the terraces and floodplains of some wet meadows. Restoration treatments may be needed in these locations as soil function has been degraded. Specific treatments to restore wet meadows would be identified prior to mechanized and prescribed fire treatments in the vicinity. These treatments may include the following:

- Planting of native riparian shrub or tree species;
- Hand thinning encroaching upland tree species; drop and lop in place;
- Prescribed burning;
- Native grass, sedge, and forb seeding or plantings;
- Stream channel restoration work;
- Floodplain and stream terrace restoration work;
    - Installing rock structures such as Zuni bowls or one/multiple tier rock dams (trincheras)
    - Rock materials would be used from onsite, or hauled in by wheelbarrow or ATV
- Obliteration of unauthorized roads;
- Decommissioning of unneeded NFS roads;
- Site protection via fencing;
- Terrace and floodplain erosion control

Soil conditions in montane meadows are generally a mosaic of satisfactory and impaired states. Impaired soils exhibit noticeable degradation to soil function. Specific treatments would be identified prior to mechanized and prescribed fire treatments in the vicinity. These treatments may include the following:

- Hand thinning encroaching upland tree species; drop and lop in place;
- Prescribed burning;
- Native grass, sedge, and forb seeding or plantings;
- Channel restoration work;
- Obliteration of unauthorized roads;
- Decommissioning of unneeded NFS roads;
- Site protection via fencing; and/or,
- Terrace and floodplain erosion control

Watersheds where riparian wet and montane meadow restoration are needed are identified in the table below. If additional meadow restoration needs are identified during implementation, they would be restored using the flexible toolbox approach found in Appendix C.

Summary by Watershed

The proposed action includes the following known aquatic restoration activities for each 6th code watershed within the project area. During implementation if further needs are identified for aquatic/watershed resources, they would be restored using the flexible toolbox approach found in Appendix C. All survey and consultations required would be done prior to implementation.

Table 9. Aquatic restoration proposed activities by watershed

Watershed	Proposed Restoration Activities

Upper West Fork Black River	*Stinky Creek (unnamed on maps)*
	• Fish barrier would be removed (similar construction to Hayground barrier)
	• No vehicle/equipment access-walking access only along old RR grade
	• Project would be done by hand
	• Would utilize rock materials from barrier to stabilize short section of stream above (50-75 ft.).
	• Would carry out by hand metal gabions or other non-native materials
	• Riparian planting
	• Meadow restoration (see section above for proposed methods)
	• New exclosures (2-5 depending on size)
	Hayground (or Hay Creek)
	• Fish barrier would be removed by hand
	  ○ Barrier is gabion structure with thin cap of rock and mortar; lots of fines built up above barrier
	  ○ Barrier materials would be utilized to stabilize the stream above
	• Upper meadow of Hayground
	  ○ New exclosures
	  ○ Instream structures
	  ○ Riparian planting
	• Top of canyon upstream to FSR 72M
	  ○ Riparian plantings

	○ Instream structures (low gradient reach) SUMMARY: 15 -25 instream structures • Meadow restoration (see section above for proposed methods) *Upper West Fork of the Black River (WFBR)* • New exclosure for meadow • Meadow and instream channel restoration (see sections above for proposed methods) • Riparian planting • Below Thompson Ranch: Old rock and log instream structures need maintenance ○ Maintenance includes: stabilizing existing logs; cutting off rebar; removing cables ○ Project would be done by hand SUMMARY: 50 instream structures *Upper WFBR crossing at FSR 116* • 2 fish barriers below FR 116 ○ The upper fish barrier would be retained ○ The lower fish barrier would be removed (gabion, and was capped with rock and mortar with a concrete spillway) ○ Would use small excavator/backhoe to remove ○ Barrier materials would be utilized to stabilize the stream above ○ Non-native materials would be removed from the site *Thompson Ranch-Thompson and Burro Creeks above crossing FSR 116* • Structure maintenance and new structures in lower Burro and Thompson Creeks, and upper WFBR ○ Would occur 1.5 miles from FSR 116 through the meadow to the WFBR canyon ○ New exclosures (2-5) ○ Meadow restoration (see section above for proposed methods) ○ Instream channel restoration (see section above for proposed methods) • Stream gage on Burro Creek tributary (near decommissioned road crossing on FSR 402-on map as Burro Mt. Weir) ○ Would remove streamgage ○ Utilize materials above for stream stabilization or remove ○ Would use an excavator and take 2-3 days • Old road (FR 402) crossing on Burro Creek ○ Pull back remaining fill from old bridge (bridge previously removed) so it is not confining stream channel ○ Would use excavator/backhoe
Lower West Fork Black River	*West Fork Dispersed camping area* • Improve and widen parking area before the 1rst crossing of the West Fork of the Black River (WFBR) • Riparian planting and instream structures (~25) above dispersed camping area • New exclosures • Repair headcut in the meadow above 1st crossing; utilize

	excavator/backhoe (would cross the river), and native materials • Remove non-functional vault toilets (crushed and buried); utilize excavator/backhoe and native materials • Remove downed wire fence just below the confluence of Hayground and WFBR; debris jam cutting into bank; would be addressed by handwork and riparian planting *Old borrow pit west of the FSR 68 Rd crossing (dispersed camping area)* • Address erosion in associated drainage; heavy equipment and hand work *FSR 8944 crossing WFBR* • Improve road crossing *Stream gage above the 25 RD crossing* • Would remove streamgage • Stabilize the stream above with instream structures (instream channel restoration) *Home Creek 1 mile above road crossing (FSR 8944)* • Whole reach to lower barrier o Riparian plantings o Instream structures and channel restoration (see section above for proposed methods) o Exclosure fencing • Remove both upper and lower fish barriers o Lower barrier-large dirt and gabion structure with a concrete spillway. Heavy equipment needed to recontour and place instream structures above the barrier site to stabilize stream o Upper barrier-gabion structure with cement cap. Heavy equipment, vehicles, and ATV/UTVs could be needed for removal and stabilization o Between barriers instream structures and instream channel restoration and riparian plantings o Instream structures would consist of log and rock; downed trees would be utilized, or dropped if needed; this would occur at both the upper and lower fish barrier sites o Some non-functioning log structures (K dams) may need modifying or removing if causing stream damage *Upper Home Creek on FSR 68 south of Big Lake (Conklin spring) at dispersed camp site* • Riparian planting • Rebuild exclosure *Bridge at crossing on FSR 25J on Horse Creek* • Bridge would be removed for safety reasons • It would be replaced by a hardened low water crossing utilizing heavy equipment for both activities *WFBR from the FSR 25 to the FSR 68 Rd crossing* • Instream work-handwork or heavy equipment needed o Boulder-log structures o Logs felled in the 100-year floodplain to provide roughness and reduce erosion • Riparian plantings *FSR 68 low water crossing of the WFBR* • Berm would be removed adjacent to the crossing that is constricting the flood plain

	• Low water crossing would be replaced by a bridge. • Would use excavator/bulldozer SUMMARY: Estimated 50-100 instream structures needed for the Lower West Fork of the Black River (WFBR and Home Creek)
Upper Beaver Creek	*Hannagan Creek* • Riparian plantings • Bank and instream channel restoration (see section above for proposed methods) • Lower section of creek focus on bank stabilization and riparian plantings • Would use ATVs, UTVs, or heavy equipment to do the work *Thomas Creek* • Riparian plantings • Rock check dams • Meadow restoration (see section above for proposed methods) *Beaver Creek* • Reshape steep banks • Recreate floodplain • Instream channel restoration (see section above for proposed methods) • Riparian plantings • Would use heavy equipment (e.g. track excavator) *Lower Horton Creek* • Riparian plantings *Hannagan, Beaver, Horton, and Thomas creeks* • Instream channel restoration (see section above for proposed methods) • Meadow restoration (see section above for proposed methods) • Would utilize skidsteer, ATV, UTV, bobcat to do the work SUMMARY: 50-100 instream structures for watershed ○ Most on Beaver Creek ○ 15-20 on Hannagan Cr ○ Up to 5 on Thomas Cr
Lower Beaver Creek	*Lower Beaver Creek* Whole section of creek to canyon confluence with Black River • Instream structures *Johns Canyon* • 10 instream structures to address deep downcutting • Repair exclosure *Heifer Branch* • 10-15 Instream structures • Extension and repair of existing exclosure SUMMARY: 25-50 instream structures for the watershed *Lower Beaver Creek, Johns Canyon, and Heifer Branch* • Handwork or excavator would be used • Meadow restoration (see section above for proposed methods *Stream gages on Beaver Creek and Heifer Branch* • Would remove streamgage on Heifer branch near Beaver Creek

	confluence • Modify streamgage on Beaver Creek • Would use heavy equipment (e.g. track excavator) • Native materials utilized for instream stabilization above stream gages once removed • Meadow restoration (see section above for proposed methods)
Centerfire Creek	*Centerfire, Wildcat and Boggy Creeks* • Instream channel restoration (see section above for proposed methods) and riparian plantings • Meadow restoration (see section above for proposed methods) • Existing jersey barriers for headcuts/bank stabilization o Now mostly buried o Would need minimal maintenance/earthwork around them if causing issues o Excavator for earthwork, or handwork for maintenance • Existing exclosures o 10-15 exclosures need maintenance o Exclosure where Centerfire creek crosses FSR 72 C needs maintenance (heavy tree fall) • 10-15 new exclosures o Upper Centerfire wetland needs a 3-4 acre exclosure o Additional exclosures needed below the 25 Rd in the Boggy Creek and Wildcat creek area SUMMARY: 50-100 instream structures for all three creeks *East Draw (tributary to Centerfire creek north of the FSR 25)* • Headcuts need to be addressed • Moderate gradient • Would use check dams; may need to bring in materials • Excavator would be used or handwork SUMMARY: 5-10 check dams
Bear Creek-Black River	• Improve three road crossings over Bear Creek on FSR 24 to reduce sedimentation in Bear Creek and Black River • Channel restoration below the three crossing to reduce downcutting and sedimentation to Black River • Instream structures (approximately 20 – 25) below existing log culvert to slow downcutting in creek • Would utilize an excavator or handwork to place down trees in creek for structures • Meadow restoration (see section above for proposed methods)
Snake Creek-Black River	• Relocate NFS roads out of the creek bottom to reduce sedimentation and improve riparian habitat • Meadow restoration (see section above for proposed methods)
East Fork Black River	*Streamgage and infrastructure on the East Fork Black River* o Would remove stream gage o Utilize materials above for stream stabilization or remove o Would use an excavator and take 2-3 days • Meadow restoration (see section above for proposed methods)

Transportation

Existing NFS roads and temporary roads would be used to facilitate restoration activities. The use of existing NFS roads would include opening and re-closing maintenance level 1 roads. Approximately 290 miles of maintenance level (ML) 1 roads are expected to be opened during the project to implement

vegetation, watershed, riparian, and stream treatments. Approximately 16 miles of NFS roads would be added to the road system within the project area for access for various treatments. These new roads would follow historical logging road prisms as much as practical if they would not cause resource damage. The opened ML1 roads and additional new roads would be closed and placed in long-term storage (ML 1) following the completion of the various treatments.

Thirty-one miles of existing ML 1 roads would be decommissioned through implementation of the project. Many of these ML 1 roads are in canyon or stream bottoms, steep slopes, or unstable soils and are no longer required for treatment activities. Appropriate clearances would be obtained prior to ground disturbing activities.

Based on the review of the project area transportation system, approximately 29 miles of unauthorized roads not needed for appropriate access would be decommissioned during the project, to reduce resource damage which helps to address issue number 5 and meets the desired future conditions in the Forest Plan identified in Chapter 1. These unauthorized roads are offshoots from existing access roads and provide potential impacts to multiple resources due to locations in meadows, streams, wildlife areas and sensitive soils, causing severe rutting and associated vegetation disturbance.

Existing roads would be maintained to provide safe and efficient travel routes for project implementation and the public. The Buffalo Crossing bridge would also be replaced or re-enforced prior to implementation of sales that would use the bridge as a haul route. Approximately twenty miles of temporary roads potentially would be created and then obliterated for the completion of the treatments. Temporary roads are constructed to facilitate access into treatment unit areas to limit the length of whole tree skidding. See table 10 below and transportation specialist report in the project record.

Table 10. Summary of existing and proposed road changes in the Black River project

Black River Project Roads*	Miles
National Forest System Roads (NFSR) in the project area (ML 2-5-open to public use)	340.5
NFSR ML1s within the project area	319
Unauthorized roads	29
Treatment Road Access Needs and Proposed Changes	**Miles**
*Utilize existing ML 1s	290
Proposed changes	**Miles**
*Proposed new NFSRs roads for access	16
**Proposed temporary roads for access	20
Proposed ML 1s decommissioned (to prevent resource damage)	31
Proposed unauthorized roads decommissioned (to prevent resource damage)	29

***After treatment these roads would be closed and placed in long-term storage for future treatment use. **Temporary roads would be closed and rehabilitated after treatments.**

Previously disturbed areas would be used whenever possible, including old temporary or unauthorized routes to minimize the effects to the environment and its natural resources. There are cases where it is not feasible nor desirable to use the same alignments or landings. In some places, to protect residual trees,

soil, and water, new temporary roads are proposed to access landings where existing system roads and old alignments are not adequate for accessing strategic locations on the ground.

In addition, the proposed action includes road relocation/reconstruction, minor extensions of existing roads rather than temporary roads to reduce surface disturbance, decommissioning roads, and obliterating unauthorized routes to improve watershed condition. A summary of proposed road changes is in the table above.

Specific treatments for NFS roads that are affecting water resources would be evaluated prior to mechanized and prescribed fire treatments in the vicinity. Generally, roads crossing and those within 300 feet of streams and waterbodies are the highest priority for evaluation and treatment. Treatments on NFS roads could include:

- Stabilizing slopes and restoring vegetation;
- Installing or removing culverts;
- Re-establishing drainages;
- Removing unstable fills;
- Relocating a segment of road that is causing sedimentation issues;
- Pulling back road shoulders; and/or,
- Scattering slash on the roadbeds.

Road decommissioning is the stabilizing and restoring of unneeded NFS roads to a more natural state. Road decommissioning can be accomplished with a variety of methods, including: ripping compacted road surfaces and seeding; re-establishing former drainage patterns; removing culverts; scattering slash and/or large rocks on the road surface; blocking the entrance to the road; completely eliminating the road by returning it to natural contours; constructing water bars to prevent erosion; and/or, adding berms. Most of the proposed road decommissioning would focus on the ML 1 roads. These same methods can be used to obliterate unauthorized routes and close temporary roads.

Flexible Toolbox

There are a variety of proposed restoration activities and possible combinations of treatment types for restoration activities for the Black River Restoration Project. Using the Flexible Toolbox Approach for aquatic and watershed restoration activities found in Appendix C, and vegetation restoration adaptive management, treatments would address issues and concerns. Whenever possible, restoration treatments would be coordinated with other activities such as mechanical thinning contracts or stewardship agreements. Some may be stand-alone projects specifically developed to address high priority needs for comprehensive restoration.

Before carrying out restoration treatments the project specialist would evaluate a specific area to be treated and select the appropriate restoration tool(s). The flexible toolbox would be applied in the context of existing design criteria, best management practices, mitigations and conservation measures developed for the project.

Chapter 3 - Environmental Impacts of the Alternatives

This section is organized by resource and presents a comparative analysis of the effects that are projected to occur from implementation of the alternatives on the human environment. Scientific information is used to provide comparative analysis of the effects on each resource. The effects on silvicultural resources are analyzed at the beginning of this section and provide the foundation for the analysis of the resources that follow.

Implementation of the Black River Project is expected to occur over a period of up to fifteen years, spreading the effects over that time. Although individual timber sales that would implement the actions can be scheduled for a particular year, the purchaser may take several years to conduct the work with possible time extensions. Implementation of fuels treatments would depend upon the evaluation of fuels conditions by fuels experts and may occur prior to a timber sale or several years after a timber sale. The introduction of fire for fuels treatment would occur over time based on assessed conditions and needs.

The implementation of actions would be spread over an estimated period of up to 15 years. Following implementation, the treated forest would respond by increasing growth resulting in increased tree diameter and canopy closure, increased crown bulk density, surface and ladder fuels. Generation of young trees and shrubs would occur in the understory resulting in increased structure and improvement to wildlife habitat.

All comparative metrics are based on the project area except for the wildlife and aquatics metrics, which are based on the Wildlife Action Area, which may be species specific, and include areas outside the project to encompass possible effects beyond the project boundary

Past, Present, and Reasonably Foreseeable Activities

Past, present, and reasonably foreseeable future actions that have occurred over the last 25 years within the project area were evaluated are displayed in table 11.

Table 11. Activities contributing to cumulative effects common to all alternatives

Activity	Timeframe	Location	Comments
Fence Timber Sale	1989-1992	Springerville RD	Timber Sale
Duck Lake Timber Sale	1989-1994	Springerville RD	Timber Sale
Conklin Timber Sale	1993-1995	Springerville RD	Timber Sale
Kettle Timber Sale	1993-1994	Alpine RD	Timber Sale
Bearcat Timber Sale	1993-1994	Alpine RD	Timber Sale
Burro Timber Sale	1996	Springerville RD	Timber Sale
Horton Timber Sale	1998-1999	Alpine RD	Timber Sale
Wallow Wildfire	2011	Alpine and Springerville RD	534,000+ acre fire with suppression activities.
Wallow Roadside Salvage	2011 - 2014	Alpine and Springerville RD	Salvage of roadside fire killed trees located along level 2, 3 and 4 forest roads.

Activity	Timeframe	Location	Comments
Hazard Tree Removal Around Big Lake Campground	2011-Present	Springerville RD	Removal of Hazard tree in and around Big Lake Campground
Wallow BAER Restoration	2011-2013	Alpine and Springerville RD	Road repair and flooding mitigation. Aerial Seeding and mulching of high severity burned areas. Hazard tree cutting along roadsides.
Wallow West EA	2012-Present	Alpine and Springerville RD	Salvage Sales and Planting. Overlaps Black River Project
Wildlife Tree Planting CE	2016-Present	Alpine and Springerville RD	This project plants conifer in upland areas and Willows in Riparian areas.
Wallow West Prescribed Fire EA	2017-Present	Alpine and Springerville RD	Prescribed Fire project which overlaps with Black River Project
Powerline Maintenance	On-going	Alpine and Springerville RD	Removal and mastication of trees every five years encroaching on the power line corridor.
Grazing	On-Going	Alpine / Springerville / Quemado RD	Several different allotments are within the Black River Project.
Road maintenance	On-Going	Alpine and Springerville RD	Routine road maintenance on already existing roads across the district.
Dispersed camping	On-Going	Alpine and Springerville RD	The project area contains locations popular for dispersed camping.
Fuelwood Gathering	On-Going	Alpine and Springerville RD	Visitors to the forest collect fuelwood for home heating
Buckaloo Restoration Project EA	Future	Alpine RD	Thinning and Prescribed Fire Project
Crow Poison Salvage and Planting CE	Future	Alpine RD	Removal of fire-killed trees and planting of conifers

Table 12. Fire history for the Black River Project area

Fire Name	Year	Total Acres	Acres in project area	Percent of project area Burned
Fires <10 acres*	1970-Current	2,153	1966	<1%
Middle	1998	376	376	<1%
Beaverhead	2006	1,409	1,108	<1%
Wildcat	2009	587	587	<1%
Boggy	2010	886	886	<1%
Wallow	2011	538,049	88,709	96%

* Does not include large fires greater than 300 acres listed in above table.

Cumulative Effects Common to all Alternatives

Past Actions

The past activities that have influenced vegetation described in the affected environment section are found in table 11 and table 12. Activities such as timber sales, pre-commercial thinning, salvage sales, wildfires and broadcast burning that occurred within and outside the boundary of the project area were used in the vegetation cumulative effects. Past activities and wildfires that modified vegetation contributed to the structural stage distribution and to the stand density percentages. Much of the area has not received thinning or vegetation treatments over the last thirty years which contributes to the existing conditions and many of the problems that the Black River Project is currently seeing in terms of insects, disease and density related mortality.

On-going present actions

Several range allotments cover the project area. The status of each of these allotments is covered in the Range Specialist Report and not discussed in detail in this EA. Grazing is a continued action that reduces the amount of fine fuels such as native grasses that would tend to carry wildfires throughout the forested areas. The reduction of wildfires throughout the project landscape has influenced the forest structure leading to an excess of mid-sized sized trees. Tree removal along Forest Service roads in the area is limited to fuelwood collection and hazards from dead, dying and defective trees, which does not result in a significant change to the overall structure and composition at a landscape level. This approach has resulted in increased mortality from insects such as bark beetles. The Wallow West Salvage and Wallow West Prescribed fire projects are active in the project area which authorize reforestation in the Wallow Fire footprint, along with prescribed burning activities throughout a portion of the project area.

Foreseeable Future Actions

Future actions within the project area include thinning of trees within powerline corridors of approximately every 5 years. The District is planning the Buckaloo Environmental Analysis which is approximately 60,000 acres and the Crow Poison Categorical Exclusion to salvage fire-killed trees and plant conifers which is approximately 2,000 acres. These projects are north and east of the Black River Project and would not provide measurable cumulative effects to woody vegetation. The mastication of trees within the powerline corridor is very limited in size and the powerlines are continually maintained as openings by the power companies on 5-year intervals and for this analysis, were considered as grassland maintenance. No other foreseeable future activities are currently planned for the Black River Project area.

Vegetation and Timber

Affected Environment

A summary of the existing conditions for forest vegetation in the project area is presented in chapter 1 and is briefly restated here. Full descriptions of existing vegetation conditions in the project area can be found within the Silviculture Specialist Report.

Vegetation conditions in the project area have been altered by the Wallow wildfire in 2011, and past management activities including grazing, fire suppression, roads, and timber harvest. Many of the forested stands are overly stocked, and have uncharacteristic tree species composition and structure, which is unsustainable. Outside of forested areas, conifer trees have been encroaching on wetlands, meadows, and riparian areas displacing historic vegetation due to the lack of frequent low-severity surface fires.

Forest vegetation composition, structure, density and spatial arrangement are the primary forest conditions which can be manipulated by silvicultural treatments. Table 13 provides a comparison of the existing and desired conditions for forested areas, as identified in the forest plan.

Table 13. Summary comparison of the existing forest stand condition verses desired condition

	Existing Condition	Desired Condition
Basal Area	Currently, 83% of all ponderosa pine stands have a basal area greater than 80 ft² per acre. Average basal areas for dry mixed conifer are over 150 ft² per acre. These two forest types represent most of the treatment areas in the project area.	Maintaining ponderosa pine stands' basal area between 20-80 ft² per acre and dry mixed conifer at 30-100 ft² per acre to meet forest resilience goals while maintaining wildlife habitat desired conditions.
Forest Structure	Most stands are in a closed condition and lacking groups and clumps of trees or randomly spaced trees. Grasses, forbs and shrubs are underrepresented compared to historic patterns.	Most stands are in an open condition. Forest arrangement is in individual trees, small clumps, and groups of trees or randomly spaced trees interspersed within variably sized openings of grasses, forbs, and shrubs that are similar to historic patterns (see Natural Range of Variability in *Silviculture Specialist Report*). Most forest stands are in uneven-aged condition.
Forest Disease	Currently 62% of the stands have some level of dwarf mistletoe. 83% of the project area meets the desired condition for mistletoe infection severity (Less than 20% of trees infected)	Stands in the project area have low to moderate dwarf mistletoe infection severity (Less than 20% of trees infected)

Alternative Comparison

To model future forest conditions, Common Stand Exam and other spatial data for the project area was compiled into a database and modeled in the Forest Vegetation Simulator (FVS) tree growth model within the FSVeg Spatial Data Analyzer program. The FVS is a model used for predicting forest stand dynamics that is used extensively in the United States and is the standard model used by various government agencies including the USDA Forest Service, USDI Bureau of Land Management, and USDI Bureau of Indian Affairs (Dixon 2015). Silviculture modelling descriptions, results and summaries are provided in the Silviculture Specialist Report.

Three metrics are described for potential changes in forest conditions in the planning area:

1 – Stand density as measured by average basal area

2 – Forest structure

3 – Forest disease - dwarf mistletoe outbreak conditions

The status for each of these measures are summarized in table 14, organized by alternative.

Table 14. Alternative Comparison for Vegetation and Timber resource elements

Resource Element	Resource Indicator / Measure	Alternative 1 - No Action	Alternative 2 – Proposed Action for Scoping	Alternative 3 – Preferred Alternative
Stand Density	Number of acres above forest plan basal area desired condition range – 20 to 80 ft² per acre for ponderosa pine forest and 30 to 100 ft² per acre for dry mixed conifer forest.	Average basal area would remain high, with approximately 39,000 acres of ponderosa pine forest above desired conditions and 12,000 acres of dry mixed conifer forest above desired condition.	Stand densities would be reduced. - basal area would be maintained at lower levels with approximately 22,000 acres of ponderosa pine forest above desired conditions and 6,000 acres of dry mixed conifer forest above desired condition.	Stand densities would be reduced. Basal area would be reduced with approximately 30,000 acres of ponderosa pine forest above desired conditions and 8,000 acres of dry mixed conifer forest above desired condition.

Resource Element	Resource Indicator / Measure	Alternative 1 - No Action	Alternative 2 – Proposed Action for Scoping	Alternative 3 – Preferred Alternative
Forest Structure	Structural Stages - Percentage of structural stages are in mosaic of states across the project area and are contributing towards the Forest Wide desired conditions. - Forest structure is variable but uneven-aged and open in appearance. Sporadic areas of even-aged structure may be present on 10 percent or less of the landscape to provide structural diversity.	Due to the Wallow Fire re-setting many stands back to early seral stages, the no action provides for a better balance of age class distribution by 2049 as many mid-size trees grow into large size classes and as natural regeneration creates new cohorts creating young age classes. Many of these young age classes are Aspen. Structural states (density and open versus closed canopy) overall continue to move away from forest wide desired conditions.	Through implementing the thinning across the project, a better balance is obtained with a higher proportion of trees across the project area being in the larger size classes by 2049. The thinning treatments helped to increase growth rates with typically > 50% of the trees being greater than 18.0" DBH. Structural states moved closer to forest wide desired conditions.	Through implementing the thinning across the project, a better balance is obtained with a higher proportion of trees across the project area being in the larger size classes by 2049. The thinning treatments helped to increase growth rates with typically > 50% of the trees being greater than 18.0" DBH. Structural states moved closer to forest wide desired conditions.
Forest Disease	Percent of acres of ponderosa pine trees infected with dwarf mistletoe in 2049	0-20% - 55,245 acres 20-80% - 32,896 acres 80%+ - 4,270 acres	0-20% - 66,337 acres 20-80% - 25,709 acres 80%+ - 366 acres	0-20% - 54,803 acres 20-80% - 35,929 acres 80%+ - 1,679 acres

Alternative 1 – No Action

Direct and Indirect Effects

Stand Density

Under the no action alternative stand densities within the Black River Project will continue to increase over time which will lead to many forest health impacts. Modelling showed that most forested stands move into higher basal areas ranges about 120 ft² per acre. For the Ponderosa Pine PNVT, approximately 39,371 acres (83%) are projected to be outside Forest Plan Desired Conditions assuming no large-scale disturbances such as wildfire or insect and disease outbreaks interrupt the trajectory. Most of these acres are above 120 ft². Approximately 12,000 acres (70%) of the dry mixed conifer PNVT would be outside of desired conditions assuming no large-scale disturbance. Table 15 shows the basal areas that will develop in the 30-year time frame for analysis, for more details on analysis see the Silviculture specialist report in the project record) under the No Action alternative.

Table 15. Black River Project density ranges in 2049 under Alternative 1 (No Action) by acres and basal area compared to the Desired Conditions ranges for each PNVT

PNVT	Desired Conditions (Basal Area)	Number of Acres by Basal Area Range						
		0-20	20-40	40-60	60-80	80-100	100-120	120+
Ponderosa Pine	**20-80**	1,818	1,006	1,788	3,443	3,011	5,200	31,160
Dry Mixed Conifer	**30-100**	1,648	852	803	870	658	1,728	10,167
Wet Mixed Conifer	**30-180**	1,171	521	529	1,663	510	1,779	10,048

PNVT	Desired Conditions (Basal Area)	Number of Acres by Basal Area Range						
		0-20	20-40	40-60	60-80	80-100	100-120	120+
Spruce Fir	**30-250**	15	6	32	12	0	42	729

Without action forest basal areas would continue to rise, overstocking stands and increasing tree mortality. There would not be enough critical resources such as nutrients, water, and sunlight for all the trees, which would lead to increased stress, which would lead to increases in insect and disease levels as these stressed trees are more susceptible to bark beetle attack.

Without action, the amount of down fuel would rise as trees continue to die. Small, shade-tolerant trees, like the white fire and Engelmann spruce, would continue to grow in the understory, creating an increase in ladder fuels. With an increase in down fuel as well as ladder fuels, stands would be at increased risk for uncharacteristic wildfires.

Forest Structure

A key forest vegetation management direction found in the forest plan (USDA 2015a) is to develop or maintain sustainable uneven-aged forest structure. Under alternative 1, no conifer regeneration treatments would occur. Even-aged stands would remain even-aged in structure for the next several decades and no new age classes would be created and/or managed until the existing stands have natural mortality due to age or natural disturbances (e.g. fire, insects, wind). Uneven-aged stand structures would not be maintained over time, due to lack of regeneration of new age classes.

Restoration of sustainable forest mosaic patterns with canopy gaps and forest openings would not occur, and canopy continuity would remain high throughout the project area. Mixed conifer forest stands would continue to be dominated by shade tolerant species or would continue to convert to dominance of these species over time. Natural meadows and openings would not be maintained. Quaking aspen and Gambel oak patches would not be released or favored to develop.

However, even with no action the Black River Project does continue to shift to a more balanced mosaic of vegetation structures over time, mainly as a result of the Wallow fire disturbance in 2011. Modeling shows that natural regeneration will occur over the next 30 years and increase the number of trees in the smaller size classes and those mid-aged trees that do remain continue to grow into larger classes. This results in moving the overall forest structure to have a better mosaic and towards desired conditions as outlined in the Forest Plan.

Forest Disease

Without thinning treatments, which target these mistletoe trees and fire which kills infected branches in the lower crowns, mistletoe continues to spread increasing the impacts project wide. Dwarf mistletoe would continue to impact regeneration, reduce cone production, reduce DBH and height, and reduce survival of sapling-sized trees. Over approximately 2 to 4 decades this would severely limit sustainability of uneven-aged stands and interrupt the progression of existing age classes into larger trees over time wherever infection occurs. Trees with severe dwarf mistletoe infection levels exhibit low vigor and these trees are more susceptible to bark beetle and density-induced mortality. Resistance to bark beetle mortality would continue to decline due to increased density and rise of mistletoe infection.

Cumulative Effects

The analysis area for cumulative effects is the same as the project area, the time frame for analysis is 30 years – to 2049. With implementation of this Alternative, no treatment other than ongoing activities and foreseeable future projects would occur in the Forest Service landownership within the Black River

Project. The effects of past, present and reasonably foreseeable projects in combination with the no action are not expected to result in any measurable changes to forest cover type, stand density as it relates to fire regime condition class (FRCC), fuel loadings, potential flame lengths relating to fire fighter safety, diameter classes, Mexican spotted owl habitat, and old growth characteristics.

Within the analysis area, there would be continuing change from the existing condition regarding the vegetation. Increasing densities, insect activity, and stresses from climate change deepening droughts, would be the result of natural processes and disturbances occurring over time in conjunction with future unintended and intended fire activities. When large enough openings are created through natural disturbances such as insect epidemic, wildfire, or other disturbances, regeneration would occur either immediately or episodically post-disturbance, favoring the species currently present in the area. Existing grasses, shrubs, and forbs would decline in vigor and growth under increasing canopy densities until individual trees begin to die creating small openings in the tree canopy at which time ground vegetation would be released to increase. Individual tree mortality would increase until stocking levels are decreased. The risk of loss of trees, large and old, and possibly stands from insect epidemic or wildfire would increase as stand densities within the area increase through time.

Alternative 2

Direct and Indirect Effects

Compared to the No Action, Alternative2 would be more effective in increasing forest health and vigor, by reducing stand densities towards Forest Plan Desired Conditions, thereby improving forest resiliency and sustainability to stresses such as insects, disease, and climatic variability. Decreasing stand densities will release dominant and co-dominant trees allowing them to become more vigorous, more resistant to insect and diseases more resilient to climate change and establish younger cohorts where desired.

Stand Density

Under Alternative 2, tree growth, especially diameter growth, will increase at a greater rate and allow trees to take advantage of additional growing space, water availability, and sunlight. Table 16 shows the projected basal areas that will develop under Alternative 2 in 2049. In general, most of the forested acres within the Black River Project would be within the Forest Plan Desired conditions with some stands remaining at higher densities. For the Ponderosa Pine PNVT, 21,803 acres are above the Forest Plan Desired Conditions with only 4,471 acres above 120 ft² per acre in 2049. Most of the stands that are above desired conditions are stands that would have just grown to the 80 –100 ft² per acre range showing a need for another entry by around this timeframe.

Table 16. Black River Project density ranges in 2049 under alternative 2 by acres and basal area compared to the Desired Conditions ranges for forested PNVT

PNVT	Desired Conditions (Basal Area)	Number of Acres by Basal Area Range						
		0-20	20-40	40-60	60-80	80-100	100-120	120+
Ponderosa Pine	20-80	1,959	1,564	4,463	17,637	10,456	6,876	4,471
Dry Mixed Conifer	30-100	1,397	1,441	1,610	3,702	2,447	1,560	4,570
Wet Mixed Conifer	30-180	1,318	1,108	2,089	2,345	3,060	1,651	4,651

PNVT	Desired Conditions (Basal Area)	Number of Acres by Basal Area Range						
		0-20	20-40	40-60	60-80	80-100	100-120	120+
Spruce Fir	30-250	133	23	11	79	51	79	449

Forest Structure

Under Alternative 2 the diameter distribution quickly shifts to where much of the basal area of the project area is dominated by 18"+ DBH trees while also increasing the basal area distribution among trees less than 5.0" DBH. Mid-aged trees are reduced over time as these grow into larger size classes. Alternative 2 moves the forested areas into desired conditions that are currently lacking within these forested PNVTs across most of the Apache-Sitgreaves National Forests. Large to very large size trees, that are both multistoried and singles storied with open and closed canopy will be created which will move many stands towards desired conditions for this area (USDA 2015a).

Restoration of sustainable forest mosaic patterns would occur, and the resulting forest canopy would be discontinuous and clumped throughout much of the area, based upon desired conditions. Natural meadows and openings would be maintained by removing conifers which have encroached upon these areas. Quaking aspen and Gambel oak patches would be released or favored to develop. Understory grasses, forbs and shrubs would respond to these opened canopy conditions and increase in abundance and vigor. Management would focus on favoring and regenerating of Southwestern white pine in locations where it currently exists.

Forest Disease

Alternative 2 would provide opportunities to manage dwarf mistletoe severity, incidence, and distribution; in order to move towards desired endemic forest disease levels within the project area. The restoration of forest interspace openings proposed in Alternative 2 would greatly reduce continuity of mistletoe occurrence, spread, and mortality; such that the host-pathogen biological dynamics function like historic conditions.

There is an increase in heavy mistletoe stands which is due to many stands not being thinned in the proposed action due to various wildlife habitat restrictions such as MSO nesting roosting thresholds or protected activities centers. However, stands with greater than 80% of the ponderosa pine being infected is reduced from 650 to approximately 366. Some stands shift from less than 20% infection to higher infection rates. Some of this can be directly attributed to diameter restrictions in MSO PACs and recovery habitat.

This alternative makes progress in shifting the most acres across the landscape toward trace to light infection levels thereby addressing issue number 2 described in Chapter 1. In mixed conifer stands, non-host species would be favored over severely diseased trees, as local forest conditions permit. This alternative has the greatest overall mitigation of mistletoe infection.

Cumulative effects

With implementation of alternative 2 in conjunction with the past, ongoing and foreseeable future management activities, it is expected that very little if any long term measurable changes would occur to forest cover type as it relates to fire regime condition class (FRCC), fuel loadings, potential flame lengths relating to fire fighter safety, diameter class distribution, Mexican spotted owl habitat, and old growth characteristics. Short term reductions in density and fuel loadings will occur but over time these reductions will diminish without future actions.

Regeneration would occur in openings created through management activities, favoring the species currently present in the area. Existing grasses, shrubs, and forbs would be released to increase in number until tree canopy closure. Individual tree mortality would decrease until stocking levels increase. The risk of loss of trees and possibly stands from insect epidemic or wildfire would decrease with the decrease in stand densities. Compared to no action, diameter classes within the area would move faster towards that which is desirable for Mexican Spotted Owl and Northern goshawk habitat. As regeneration occurs there would be an increase in smaller diameter classes. Individual tree growth and total stand growth would increase due to less site occupancy and competition with other trees for nutrients, moisture, and sunlight. Mid-size diameter class trees would move more rapidly into the next larger size class than with no treatment. Larger size trees would retain health for a longer period due to fewer smaller trees present within the stands that are competing for nutrients and moisture. Canopy closure would be low to moderate in most of the analysis area. Grassland areas would be maintained and remain open areas for a longer period. This would increase the available herbaceous vegetation over the entire area. Mexican spotted owl threshold characteristics and old growth variables would be obtained over time.

The past management policy to actively suppress all wildfires is a contributor to the abnormal irruption of dense small trees, which would have been reduced with natural thinning by fire under a normal pine fire regime. Past grazing was also likely a contributing factor by reducing grass that used to carry wildfires. The risk of losing these characteristics through stand replacement would be reduced with this alternative.

Cumulatively, the effects from implementing either alternative 2, in addition to other nearby vegetation treatments would move the overall landscape area closer to the historical range of variability. Forest vegetation across the landscape would be more resilient and resistant to disturbances such as wildfire, drought, and insects and diseases because of the appropriate stocking levels, forest composition, and pattern. The cumulative effects of alternative 2 would be more beneficial than alternative 1, no action, because of the reduction in stand density and shift toward early seral tree species that would occur would shift the overall landscape closer to the Forest Plan desired conditions and NRV for the area.

Alternative 3 – Preferred Alternative

Direct and Indirect Effects

Stand Density

Alternative 3 would make progress in the short term in reducing stand densities towards desired conditions but at reduced amounts than Alternative 2 and would result in the majority of the Ponderosa Pine PNVT (64%) being outside desired conditions by 2049. Table 17 shows the basal areas that will develop under alternative 3 in 2049. For the Ponderosa Pine PNVT, approximately 15,675 acres will remain within Forest Plan desired conditions, with approximately 30,231 acres being above the Forest Plan Desired Conditions with 5,288 acres above 120 ft^2 per acre. The reduced intensity of this alternative leaves more trees across the landscape which allows stands to quickly grow outside the desired basal area range. In comparison to the existing condition and no action under Alternative 1, Alternative 3 is an improvement in reducing high densities, however, it does not maintain lower densities on the landscape for the length of time as alternative 2 does. Due to this decreased longevity of treatment another entry would be need prior to 2049 in order to maintain Forest Plan desired conditions.

Table 17. Black River Project density ranges in 2049 under Alternative 3 by acres and basal area compared to the Desired Conditions ranges for each PNVT

PNVT	Desired Conditions (Basal Area)	Number of Acres by Basal Area Range						
		0-20	20-40	40-60	60-80	80-100	100-120	120+
Ponderosa Pine	20-80	1,518	2,775	3,247	9,653	15,505	9,438	5,288
Dry Mixed Conifer	30-100	1,223	1,498	1,268	2,349	2,313	1,900	6,174
Wet Mixed Conifer	30-180	1,068	877	1,264	1,727	2,643	1,604	7,041
Spruce Fir	30-250	16	6	35	11	61	11	697

Forest Structure

Under Alternative 3, restoration of sustainable forest mosaic patterns would occur to a lesser extent and the resulting forest canopy would be discontinuous and clumped throughout parts of the area. Where single tree selection treatment methods are implemented there would be less mosaic patterns and more of a random distribution of trees. Much of the treatment benefits described under Alternative 2 will be similar but will have some shifts in how spatial patterns and forest structure develop across the landscape.

Under Alternative 3 the diameter distribution quickly shifts to where much of the basal area of the project area is dominated by 18"+ DBH trees while also increasing the basal area distribution among trees less than 5.0" DBH. Mid-aged trees are reduced over time as these grow into larger size classes.

Alternative 3 moves most of the project area into desired conditions that are currently lacking within these PNVT's across most of the Apache-Sitgreaves National Forests. Large to very large size trees, that are both multistoried and singles storied with open and closed canopy will be created which will move many stands towards desired conditions for this area (USDA 2015a).

Forest Disease

Alternative 3 has the greater overall increase in the percent of mistletoe infection as dwarf mistletoe increases across the landscape there will be reduced management options for future entries as the infection levels will reduce uneven-aged management options and force more even-aged management methods during the next entry.

Stands with greater than 80% of the ponderosa pine being infected is increased from 650 to approximately 1,679. Many stands shift from less than 20% infection to higher infection rates with approximately 21,151 acres increasing to the 20 –80% range of infection. The majority of this is directly attributed to leaving overstory trees with high levels of infection. This alternative makes little to no progress in mitigating the dwarf mistletoe infection across the project area and in some stands is worse than doing nothing in terms of dwarf mistletoe infections. Overall dwarf mistletoe increases across the landscape and results in many acres having higher levels of infection compared to existing conditions. The reduced amounts of interspace and openings would increase the continuity of mistletoe occurrence, spread, and mortality. Through reducing stand densities and leaving the overstory infected with high levels of dwarf mistletoe, it results in increased vertical and horizontal spread. The lower tree productivity due to dwarf mistletoe will reduce future volume in subsequent entries directly impacting the economic viability of future timber sales. Alternative 3 also provides some flexibility to manage for maintenance or improvement of forest genetics but at a reduced extent as compared to Alternative 2.

Cumulative Effects

With implementation of Alternative 3 in conjunction with the past, ongoing and foreseeable future management activities, it is expected that any cumulate effect would be similar in nature to what is

described under Alternative 2. Cumulatively, the effects from implementing Alternative 3, in addition to other nearby vegetation treatments would move the overall landscape area closer to the historical range of variability but with some different structure and density levels. Forest vegetation across the landscape would be more resilient and resistant to disturbances such as wildfire, drought, and insects because of the appropriate stocking levels, forest composition, and pattern. Diseases such as dwarf mistletoe would have a cumulative effect of increase forest health issues for any future actions and dwarf mistletoe is expected to increase.

Economics and Viability of Harvest

Affected Environment

The combination of small towns and rural settings along with people from a wide variety of backgrounds provides a diverse social environment for the geographical region around the Black River Project. Local residents pursue a wide variety of lifestyles, but many share a common theme of outdoor and natural resource-oriented living, either recreationally or professionally. Vocational and recreational pursuits include employment in logging and milling operations, outfitter and guide businesses, hiking, hunting, fishing, camping, and many other recreational activities.

Timber, tourism, and power generation industries are important to the economy of local area. Despite a common concern and dependence on natural resources within local communities, social attitudes vary widely with respect to their management. On the ASNFs the largest land use type is forest at 83%, of which 44% is available for forest products like timber. Other land use types on the ASNFs are Non-forest at 17% and water at .1%. Rangeland cover is found on 14% of the forests, across both forested and non-forested land.

Historically, the forest products industry in the Southwest had been a boon to the local economy, though the most recent 30 years has been tenuous. The period of 2009 through 2011 were some of the worst years for home building and wood products, rivaling the Great Depression (Keegan et al., 2012). In the western states, most mills suffered in some way, while 30 large mills closed permanently. Up to 71,000 workers lost their jobs and nearly 50% of lumber production was lost from the period of 2005 to 2009, the value of the industry fell by 31%, and in 2007 the "output of softwood lumber from the South exceeded output from the West for the first time since at least 1955" (Keegan et al., 2012). Particularly in Arizona, which lost 7,062 jobs, a 50% decrease from 2005 through 2009.

Since the fallout from the latest recession, the forest products industry has been slowly recovering. In Arizona from 2012 to 2016 sales through sawmills increased by 34% and employment increased by 180% (Hayes et al., 2018). This increase is largely due to an increase in use of alternative products and the use of residual woody material for bioenergy for power generation and pellet fuel.

Employment and Income

Using the socioeconomic profile system tools by © 2020 Headwaters Economics, a socioeconomic indicators report was generated for the study area. This tool generates a report based on multiple datasets within the study area. Trends show that from the year 2000 to 2018 the population is up 8.8%, employment is up 18.4%, personal income has risen 64.9%, average earnings per job have risen 3.9%, and per capita income has changed upwards at 51.6%. During this same time period, unemployment has risen 0.5% compared to the United States overall where unemployment has dropped -0.1%. During 2018

the unemployment rate in the study area shows 8.3% compared to the U.S. rate of 3.9% (U.S. Department of Commerce, 2019). With the recent Covid-19 pandemic the current unemployment rate is expected to be higher.

The figures below show a range from 1970 to 2018. Figure 3 shows population growth from 83,000 to 185,841 people, an increase of 123%. Figure 4 shows that employment grew from 22,985 to 71,193, an increase of 210% increase. And Figure 5 shows that personal income grew from $1,359.0 in millions to $6,244.8 in millions, (in real terms), a 360% increase.

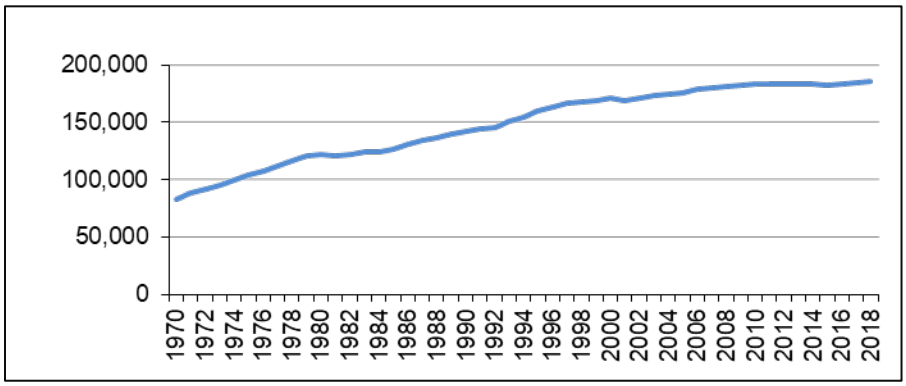


Figure 2. Population growth from 1970 to 2018: U.S. Department of Commerce. 2019. Bureau of Economic Analysis, Regional Economic Accounts. Washington D.C.

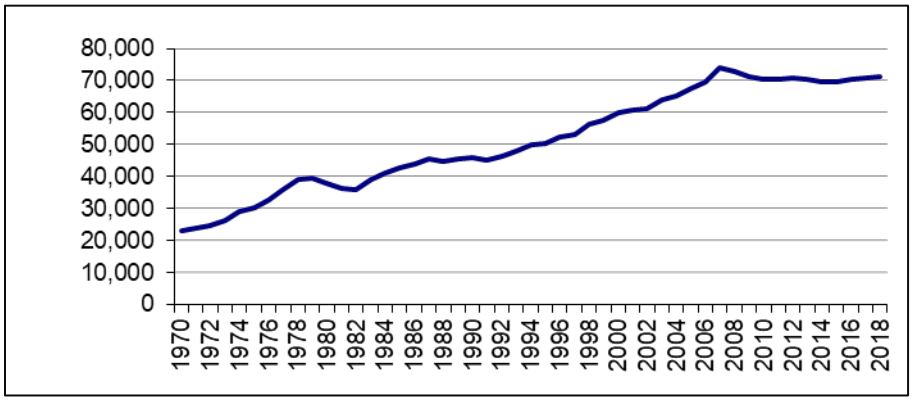


Figure 3. Employment Growth from 1970 to 2018: U.S. Department of Commerce. 2019. Bureau of Economic Analysis, Regional Economic Accounts. Washington D.C.

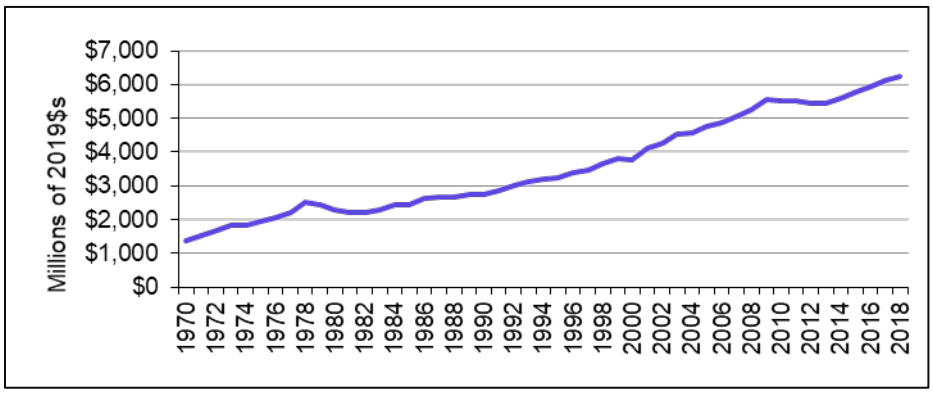


Figure 4. Personal Income Growth: U.S. Department of Commerce. 2019. Bureau of Economic Analysis, Regional Economic Accounts. Washington D.C.

A steady growth shown in the above figures can generally indicate a healthy growth in the local economy, as opposed to an erratic or long-term declining trend which would indicate a struggling economy. Both the population and employment growth do seem to be flattening in the previous decade which may show some uncertainty in the health of the economy, though the trend does continue to rise.

Figure 4 shows the measure of the annual unemployment rate by month from 2016 through half of 2020. A measure that can show well-being of a local economy and how types of employment can influence the resilience of the workforce compared to the economy. A workforce with a lot of seasonal or other temporary jobs, such as construction and tourism, will show similar trends throughout each year from month to month. The lowest unemployment rate during this time period for the study area is found in May of 2018. Downturns such as the one in 2020 can have a large effect and show erratic behavior due to a lack of diversified jobs and lack of stability found from manufacturing and high-tech jobs, with manufacturing down by 27.5% from 2010 to 2018. However, the downturn in 2020 is directly related to a novel event following unprecedented circumstances.

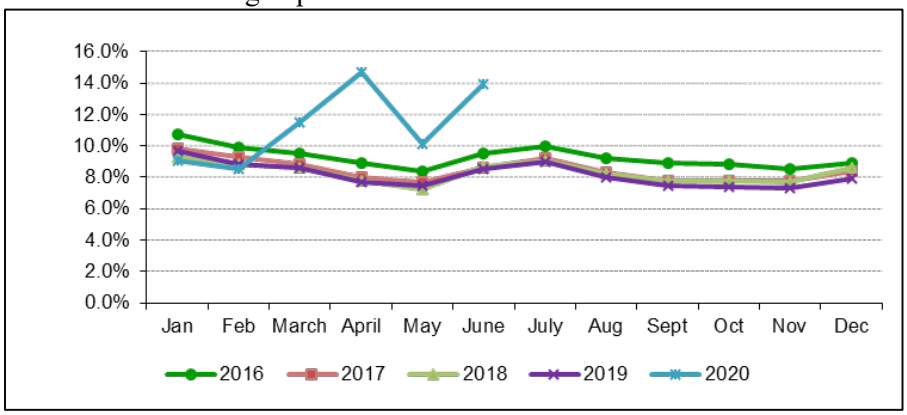


Figure 5. Unemployment Rate (Monthly) for combined Counties of Navajo, Apache, and Catron. U.S. Department of Labor. 2020. Bureau of Labor Statistics, Local Area Unemployment Statistics, Washington, D.C.

The population of the area is predominantly white along the National Forest boundary. American Indians make up the largest population for Navajo and Apache Counties with 52.2% and 77.1% respectively. The white population in these counties are 47.8% and 22.9%, and Hispanic ethnicity for each of these counties is 11.3% and 6.2%.

Table 18. Families in Poverty. U.S. Department of Commerce. 2019. Census Bureau, American Community Survey Office, Washington, D.C.

	Catron County, New Mexico, NM	Apache County, Arizona, AZ	Navajo County, Arizona, AZ	Combined counties	United States
Total families for whom poverty status is determined, 2018*	882	13,759	23,917	38,558	78,697,103
Families in poverty	64	3,878	5,347	9,289	7,930,699
Families with children in poverty	57	2,485	3,924	6,466	5,909,657
Single mother families in poverty	45	1,313	2,312	3,670	3,563,666
Percent of Total, 2018*					
Families in poverty	7.3%	28.2%	22.4%	24.1%	10.1%
Families with children in poverty	6.5%	18.1%	16.4%	16.8%	7.5%
Single mother families in poverty	5.1%	9.5%	9.7%	9.5%	4.5%
Change in Percentage Points, 2010*-2018*					
For example, if the value is 3% in 2010* and 4.5% in 2018*, the reported change in percentage points is 1.5.					
Families in poverty	-2.9	1.3	3.2	2.6	0.0
Families with children in poverty	0.6	0.0	1.6	1.1	-0.4
Single mother families in poverty	1.3	0.6	2.5	1.8	-0.3

High Reliability: Data with coefficients of variation (CVs) < 12% are in black to indicate that the sampling error is relatively small.
Medium Reliability: Data with CVs between 12 & 40% are in orange to indicate that the values should be interpreted with caution.
Low Reliability: Data with CVs > 40% are displayed in red to indicate that the estimate is considered very unreliable.

With implementation of either action alternative 2 or 3, there would not be disproportionately high adverse human or environmental effects on minority or low-income populations, nor restrict opportunities for hunting and fishing sustenance by Native American tribes. Rather implementation may provide an opportunity to benefit minority and low-income households by providing jobs, employment, and other smaller scale forest products such as affordable energy sources. Racial and cultural minority groups also frequently work in forestry and land management activities such as harvesting, milling, thinning, tree planting, and prescribed fire. Activities within the project area will be governed by Forest Service contracts, which are awarded to qualified purchasers based on equal opportunities. While activities identified by proposed alternatives would create jobs and the timber harvest would provide consumer goods, no quantitative output, lack of output, or timing of output associated with these projects would affect the civil rights, privileges, or status quo of consumers, minority groups, or women. Table 19 shows a breakdown and racial demographics for the study area.

Table 19. Race and Ethnicity. U.S. Department of Commerce. 2019. Census Bureau, American Community Survey Office, Washington, D.C.

	Catron County, New Mexico, NM	Apache County, Arizona, AZ	Navajo County, Arizona, AZ	Combined counties	United States
Total Population, 2018*	3,539	71,522	108,705	183,766	322,903,030
White alone	3,504	16,362	51,934	71,800	234,904,818
All other races	35	55,160	56,771	111,966	87,998,212
Black or African American	0	513	964	1,477	40,916,113
American Indian	2	52,708	48,328	101,038	2,699,073
Other races	33	1,939	7,479	9,451	44,383,026
Hispanic ethnicity	635	4,445	12,329	17,409	57,517,935
Non-Hispanic ethnicity	2,904	67,077	96,376	166,357	265,385,095
Percent of Total, 2018*					
White alone	99.0%	22.9%	47.8%	39.1%	72.7%
All other races	1.0%	77.1%	52.2%	60.9%	27.3%
Black or African American	0.0%	0.7%	0.9%	0.8%	12.7%
American Indian	0.1%	73.7%	44.5%	55.0%	0.8%
Other races	0.9%	2.7%	6.9%	5.1%	13.7%
Hispanic ethnicity	17.9%	6.2%	11.3%	9.5%	17.8%
Non-Hispanic ethnicity	82.1%	93.8%	88.7%	90.5%	82.2%

High Reliability: Data with coefficients of variation (CVs) < 12% are in black to indicate that the sampling error is relatively small.
Medium Reliability: Data with CVs between 12 & 40% are in orange to indicate that the values should be interpreted with caution.
Low Reliability: Data with CVs > 40% are displayed in red to indicate that the estimate is considered very unreliable.

Economic Efficiency

With a fragile history in the past timber industry, and slow economic gains in the study area, action alternatives found below will be compared to show variations in economic efficiency. How variations in intensity between alternatives 2 and 3 may drive support of jobs and value among project designs.

Viability of Harvest

The viability of harvest is dependent upon market prices for woody fiber and the costs of harvest. Market processes are determined by the supply and demand relationships that exist for wood fiber on a national and global scale. Local sawmills and loggers supplying these mills that could bid on the saw timber from this project are in all three counties of the study area. Among these local sawmills there are a range of small to large logging operations that may be interested in purchasing timber sales from the project area, which in turn may cooperate with mills for moving material from stump to mill gate.

Desired Conditions

Social and economic needs are integrated into ecosystem desired conditions from the Forest Plan. Some key desired conditions, objectives, standards and guidelines include:

- The Apache-Sitgreaves NFs provide a sustainable supply of forest products (e.g., small roundwood, sawlogs, biomass, firewood, cones, Christmas trees, wildlings) to businesses and individuals within the capability of the land.
- Annually, prepare and offer up to an average of 122,000 CCF_{29} from suitable timberlands resulting from sustainable harvest to provide wood products to businesses and individuals.
- Annually, treat 5,000 to 35,000 acres to reduce tree densities, restore natural fire regimes, promote species habitat and ecosystem health, reduce fire hazard, maintain desired conditions, initiate recovery from uncharacteristic disturbance, and provide forest products, leaving a desired mix of species with the range of desired densities that are resilient to changing climatic conditions.

Alternative 1 – No Action

Employment and Income

This alternative would not harvest timber and therefore, would not support direct, indirect, and induced employment, or increased income to local economies. Lack of timber supply available for local mills to purchase would adversely affect employment in local communities in Navajo County, and particularly Apache and Catron Counties in context of this project. Lack of timber supply available for regional mills to purchase from outside the economic impact area would potentially affect employment in surrounding counties. Other smaller products would also be negatively impacted with the unavailability of house logs, poles, and other alternative products that could otherwise supply smaller purchasers. Declining trends of timber harvest availability from National Forest lands in the area would flatten the growth of local forest products industry, an industry that is needed for treatment to meet federal and state goals in forest restoration.

Economic Efficiency

The public would incur no costs, nor realize any benefits of timber harvest in this area. Benefits including forest health, vigor, and fire resistance would not be addressed which in turn would decrease the economic value over time and negatively affect future potential harvests. Ongoing costs associated with management of the area, including the continuation of economic losses in stand values from recurring forest health problems and uncharacteristic wildfire would continue.

Viability of Harvest

The No Action alternative would not harvest timber, so harvest viability is not analyzable on this alternative.

Cumulative Effects

With No Action there are no direct or indirect effects on this resource, and thus no cumulative effects.

Alternative 2 and 3 – Action Alternatives

Differences between action alternatives were considered when estimating present net value, based on estimated volumes through common diameter ranges. Alternative 3 is a reduced intensity action with less volume throughout all diameter ranges, especially among larger trees. This includes a less intense approach to treating insect and disease issues in trees larger than 16 inches DBH, less openness or high intensity treatments for added interspace between individual or grouped trees, and less area considered Wildland Urban Interface (WUI). The cost and revenues, estimated by the ton, were then used to compute an estimate of value for each alternative by diameter range. Conversions from ton to hundred cubic feet (CCF) were performed using an average conversion factor from previous cruised sales on the Springerville and Alpine Ranger Districts.

Table 20. Estimated Value comparison by Alternative showing CCF, tons, revenue, logging costs and net value.

DBH Range	Alternative 2					Alternative 3				
	CCF	Tons	Revenue	Logging Cost	Net Value	CCF	Tons	Revenue	Logging Cost	Net Value
5" - 9"	28,106	98,371	$3,344,605	$4,525,054	-$1,180,449	20,618	72,163	$2,453,542	$3,319,498	-$865,956
9" - 12"	113,302	396,556	$13,879,459	$15,465,683	-$1,586,224	76,920	269,222	$9,422,753	$10,499,639	-$1,076,886
12"+	290,621	1,017,174	$40,686,952	$34,583,909	$6,103,043	269,999	944,998	$37,799,914	$32,129,927	$5,669,987
Total	432,029	1,512,101	$57,911,016	$54,574,646	$3,336,370	367,538	1,286,382	$49,676,209	$45,949,064	$3,727,145

In table 20, the value and costs are to be used as an estimate, as the true cost and value to each sale will vary based on market factors at that time. These estimates are only meant to show a comparison between alternatives and estimates between diameter ranges of product. Shortcomings for this data include incomplete and unavailable information for commercial activities in the Black River project area, since the data used was based on operations in other project footprints typically closer to mills. Haul routes were estimated by using a consistent method with local timber sale appraisals, using 2 appraisal points that are used in local timber sale appraisals. The location for sub 12" DBH material was estimated to Snowflake Arizona; the other location for 12" DBH plus material, was estimated to Nutrioso Arizona. The overall average haul distance to Snowflake is 148 miles and for Nutrioso is 47 miles, which includes level 2-5 roads from each sale area. Access to the interior portions of most sales will rely on level 1 roads. This will both increase the mileage for hauling and the cost associated with longer haul times.

Direct and Indirect Effects

Employment and Income and Economic Efficiency

Several factors would influence the ability of any one county or community to experience the largest extent of the harvest-related employment and income effects. The financial viability of the timber sale proposals would influence whether potential purchasers closest to the project area could compete with other purchasers to acquire most of the supply. Changes to bid rates would likely occur during appraisal, depending on actual market conditions at that time. Employment projections would depend on other factors such as market conditions, quality of volume offered for each sale, timing of the offerings, and financial conditions of local industry. Table 21 shows the employment and labor income for alternatives.

Table 21. Alternative 2 and 3 comparison showing the number of jobs and estimated labor income.[2]

Alternative 2

EMPLOYMENT (Jobs)				LABOR INCOME (2020 Dollars)			
Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
270	100	100	**470**	$11,396,000	$1,440,000	$1,750,000	**$14,586,000**

Alternative 3

EMPLOYMENT (Jobs)				LABOR INCOME (2020 Dollars)			
Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
240	90	90	**420**	$9,919,000	$1,299,000	$1,538,000	**$12,756,000**

[2] Definitions:

- *Employment* is the annual average of monthly jobs, such that 1 job lasting 12 months = 2 jobs lasting 6 months each = 3 jobs lasting 4 months each. A job can be either full-time or part-time.
- *Labor income* includes all employment income, including employee compensation (wages and benefits) and proprietor income.
- *Direct effects* are the result of spending in the immediate industry (e.g., when loggers harvest timber).
- *Indirect effects* are those occurring in firms linked to the immediate industry (e.g., firms that supply inputs such as gas to logging firms).
- *Induced effects* result from workers in the directly or indirectly affected industries spending their earnings on goods and services in the local area.

Alternative 2 would support the most jobs and income to a labor force. The biggest difference for input between the model of alternative 2 and 3 is the intensity of treatment. Considering the reduced treatment of alternative 3, differences in material harvested may provide a reduction in saw volume up to 7%. This shows an 11% reduction in support of employment and a 13% decrease in labor income with alternative 3 compared to alternative 2. It should be noted that with the display of jobs and labor income in table 21, that these estimates are spread across the 8-year period. These estimates are not new jobs, but rather jobs and income supported by the project in the estimated time period within the study area. Additionally, the total income estimate does not reflect the present net value.

Viability of Harvest

One of the largest hindrances to the timber sales within the project area will be associated charges in the form of surface rock replacement, a need for the upkeep of roads. Using $0.60 per mile per CCF on all level 3 and 4 roads, the total cost of surface rock replacement in current dollars is an estimate of $4.8 million for Alternative 2, and $4.1 million for Alternative 3. Averages among the sale areas comes to approximately $280,000 for Alternative 2, and $240,000 for Alternative 3. The smallest estimate for surface rock replacement comes to $61,000 in the Beaverhead area. With this much cost associated, there is a large chance these sales will be unaffordable to any potential purchasers. For viability of harvest, and alternative method of road upkeep may be needed. Another measure of viability is the mix of product and the volume of larger saw material needed to support operations in the project area. Particularly in a period of recovery, industry will need a fair amount of valuable material to make operations worthwhile, especially in areas of long hauling distances and limited offerings for marketable timber.

The reduced intensity treatment in alternative 3 will shift the mix of material harvested to a more intensive focus on medium or small saw trees. This will reduce the residual growing stock for future harvest, and further reduce the value of product based on lumber recovered from estimated volumes. Alternative 2, with a more aggressive treatment, would provide a better distribution of residual growing stock for future harvest, and provide better longevity for maintenance of desired conditions.

Lumber recovered, or yield, from the estimated cubic volumes will benefit the most from a more aggressive treatment such as alternative 2. Smaller saw logs will not as efficiently produce valuable material within a sale, which is much needed for viability of harvest due to operational costs. A larger size range for product removed will provide a better yield in harvesting, reduce percentage of volume lost from milling residuals, and increase grade of material. Lumber size and grade also had some minor influence on changes in recovery over time because the cubic volume of a nominal board foot varies based on the mix of lumber products sawn. Wider lumber has more cubic feet of solid wood per thousand board feet (MBF) than narrow lumber" (Keegan et al. 2010). This is important to point out for viability of harvest in the project area, and for the support of a healthier industry in the local area. A declining lumber market will instead favor chip-able residue over marginal lumber grades (Keegan et al. 2010).

Cumulative Effects

Cumulative effects would include the continuation and perseverance of available material offered to commercial timber operations. This includes offerings added to current available timber provided under the West Escudilla Restoration EA, Nutrioso Wildland Urban Interface Fuel Reduction EA, Greens Peak Farm Bill CE, and other project areas across the forest. Making available timber land may not necessarily increase gains for the local economy or industry but is needed to provide availability and continuity of commercial and noncommercial forest products. Cumulative support in both direct and indirect jobs from both this project and those mentioned above, in an area reliant on natural resources.

Fire and Fuels

Affected Environment

A summary of the existing conditions for forest fuels in the project area is presented in chapter 1 and is briefly restated here. Full descriptions of existing vegetation conditions in the project area can be found within the Fuels Specialist Report. As noted in the vegetation section above, forested stands within the Black River Project are overstocked, lack horizontal and vertical structure, and have altered species composition. This results in approximately 77,456 acres of the of the project area are at an FRCC of 2 or 3, indicating moderately or severely altered, respectively.

Alternative 1 – No Action

Direct and Indirect Effects

Fire

The no action alternative does not allow for vegetation treatments to actively shift the project area toward desired conditions. Canopy cover is anticipated to continue increasing across all PNVTs unless vegetation treatments or natural disturbance were to occur. Structural changes in vegetation may lead to increased departure from historic fire regimes and ecosystem function. In general, more fuel accumulates and persists in forests with longer fire return intervals than in those with more frequent surface fire (Minnich et al., 2000). Excessive advanced regeneration establishment tends to increase presence of ladder fuels and increase canopy densities over time. Ladder fuels allow fire to spread from the surface into tree crowns. Dense forest structures can facilitate crown fire by providing a potential path for fire through tree crowns (Fulé et al., 2004). Interlocked tree canopies are more likely to produce running crown fire than trees spaced apart. Tighter crown spacing and availability of ladder fuels may contribute to creating uncharacteristically severe wildfire events. Treatments around private lands (WUI) would not occur, increasing the likelihood of wildfire and damages to property. Natural processes may allow fire to burn large areas which may lead to undesired hydrological functions and unfavorable conditions for wildlife.

Fire regime condition class is expected to continue to depart from healthy conditions without the presence of fire. Areas exhibiting FRCC 2 and 3 are likely to remain in their current condition class or continue to depart from desired conditions and are likely to support uncharacteristic fire and insect outbreaks.

Air Quality

The no action alternative does not allow for prescribed fire and the opportunity to mitigate smoke impacts to nearby communities. Wildfire potential would still exist within the project boundary and smoke would be produced from these fires.

Cumulative Effects

The no action alternative allows for no additional actions within the project area, and existing conditions would continue. Continuance of existing conditions is likely to allow the forest to return to the pre-Wallow Fire conditions, which consist of increased fuel loading and fire hazard, decreased forage and browse vigor and availability, departure from natural fire return intervals, a general long-term decline in forest health, and would move the forest further from desired conditions as time progresses. This would also result in no additional protection to public life and properties from existing hazards, and no

protection of natural or cultural resources from future wildfire risk. The ASNFs could not provide for forest sustainability, or improve forest health and landscape resiliency, and the project area may shift toward or away from desired conditions through existing practices and natural processes.

Alternative 2 and 3

Direct and Indirect Effects

Fire

Both Alternatives 2 and 3 promotes a patchy mosaic pattern across the landscape. Prescribed fire activities would have an immediate effect on understory vegetation. Grasses, forbs, shrubs, and small trees are likely to experience some mortality, which may lead to short term soil instability. The ecosystem would benefit through nutrient cycling. Shifts in fine scale vegetation structure, such as increased canopy spacing and raised crown height would reduce the threat of undesired fire effects. Prescribed fire would reduce the threat of uncharacteristic wildfire to human life, property, and natural and cultural resources. Indirectly a patchy mosaic of fuel conditions is likely to reduce the overall threat of uncharacteristic wildfire and promote the ability for fire management to be successful in suppressing fire. This mosaic pattern would facilitate conditions for variability in fire behavior and effects. The action alternatives proposed in the Black River project would continue to promote mosaic conditions across the landscape.

The action alternatives would maintain or shift current conditions towards desired conditions across the landscape. Vegetation treatments would facilitate restoration towards desired stand structure, historic fire regimes, resilience to uncharacteristic disturbance, species diversity, forest health, and ecosystem function.

Air Quality

The Black River Landscape Restoration Project area is heavily used as a recreation area for many people. This area represents clear and clean air for many visitors and is important to the continued health of surrounding communities both economically and physically. Smoke, in general is a nuisance and can be averse to health but is also part of the natural disturbance associated with these types of ecosystems. Two criterion pollutants, carbon monoxide and particulate matter, are produced in wood smoke and are regulated by the Clean Air Act. The Arizona State Smoke Management Rule implements the Clean Air Act and contains regulations that all State and Federal natural resource agencies must follow before a prescribed burn is ignited.

Both prescribed fire and wildfire will create smoke, however the amount and timing of these smoke events can be mitigated with prescribed fire. Any prescribed burning will be conducted only with approved site-specific burn plans with standard smoke management mitigation and approvals. Burning would be conducted in favorable atmospheric conditions to minimize effects from smoke to nearby communities, class 1 airsheds and recreationists. All burning will be conducted according to the Arizona State Smoke Management rule to mitigate smoke impacts. These regulations ensure that effects from all burning within the area are mitigated and that Clean Air Act requirements are met. In general, south southwest winds are preferable to avoid impacting Class 1 airsheds, as are days with good transport winds and ventilation categories. The communities of Greer, Springerville, Eagar, Nutrioso, Alpine, private inholdings, and the Big Lake Recreation Area will have the most smoke impacts due to their proximity to the project area and are in line with prevailing winds, therefore measures to mitigate long durations of smoke should be implemented. Prescribed fires are initiated under conditions which allow managers control and favorable effects. Prescribed fires will be conducted when conditions are such that overstory tree mortality will be low, which leaves much of the live-tree carbon pool intact. This results in less

biomass being combusted than if the area were to burn under higher severity wildfire, therefore less carbon emissions are expected in controlled situations (Wiedinmyer and Hurteau 2010).

Smoke impacts from wildfires are less easily mitigated. Wildfires primarily occur during summer months when the Black River Landscape Restoration Project area is most used by recreationists and therefore would most likely have more of an impact on recreation values. The amount of biomass consumed during a wildfire is also not easily mitigated, the more biomass is consumed by fire the more smoke will be produced. When comparing alternatives, Alternative 1-the no action alternative does not propose any prescribed burning; however, it will continue to maintain large amounts of biomass available for consumption in the event of a wildfire, which will have direct and most likely uncontrollable impacts on recreation, the class 1 airshed (Mt. Baldy) north and west of the project area, as well as the surrounding communities. Alternative 2 and 3, which would propose prescribed burning, will have an impact on surrounding communities but in a controllable manner. The outcome of this alternative would also reduce the amount of biomass available to fire during wildfires, which would reduce the impact of smoke from such an event.

Cumulative Effects

Large areas of continuous burning may have negative short-term effect on soil stability and available forage for wildlife or grazing. The use of prescribed fire would allow land managers to determine an appropriate size and spatial/temporal rotation for burning which allows for more control in managing the short-term fire effects and the recovery process. Natural processes may allow fire to burn large areas which may lead to undesired hydrological functions and unfavorable conditions for wildlife.

Proximity to recent fire activity should be considered when prioritizing prescribed fire operations. Mosaic disturbance effects would benefit soil recovery, watershed stability, seedbank reserves, tree regeneration, and wildlife. Maintenance burning should be conducted as needed in accordance with the fire return interval that correlates to the PNVT. Opportunities to use wildfire for benefit should be considered as an alternative to fire suppression. Areas in any forest type adjacent to recent fires should be of lower priority than those farthest from recent fires. This would continue to build a spatial mosaic of disturbance across the landscape that can serve as refuge for wildlife, regeneration, soil recovery, watershed stability, and seedbank reserves.

The effects from prescribed fire are not likely to cause a long term negative cumulative effects and there is a benefit of resilience from the creation of heterogeneous forest conditions. Negative effects from low to moderate intensity fire such as soil instability and forage loss, generally recovers within a year to a few years depending on the site. Smoke should disperse within a few days of the prescribed fire so there is little chance of this becoming a cumulative effect.

Watershed, Soils and Hydrology

Alternative 1-No Action

Direct and Indirect Effects

This alternative would not improve, or improve slowly, water quality. Water quantity would continue to decline as less water would be available for stream flows due to the closing of the overstory and continued forest recovery post-Wallow Fire. Little changes to stream water temperatures would occur.

Locations across the project with impaired soil conditions, such some grasslands and meadow types, due to tree encroachment would remain on a stable trend or have the potential for a downward trend overtime if treatments are not implemented and/or maintained. Grass biomass and cover decrease as encroaching woody species biomass and cover increase. If these site conditions continue to exist in their current state, infiltration rates may gradually decrease as water compacted, bare soil cover increases and a reduction in organic matter accumulation in the topsoil occurs. Bare soil exposure and connectivity would increase erosion rates and loss of vegetative ground cover could have long-term, negative impacts on site stability and productivity.

Risk of uncharacteristic wildfire would increase over time as crown and ladder fuel connectivity increase due to high tree density and cover in forested stands increases. Uncharacteristic wildfire has the potential to affect not just long-term overstory productivity, but understory productivity as well as burn behavior and intensity becomes less predictable under these types of site conditions. Proliferation of ponderosa pine trees in a close proximity also creates conditions where herbaceous understory is outcompeted for sunlight, water, and nutrients. This hinders the establishment of a robust understory vegetation component which is more aligned with desirable conditions for forested vegetation types (USDA 2015a) within the project area. If thinning restoration treatments do not occur in these areas, there is the potential for a downward trend in site conditions over the long term.

No road decommissioning, obliteration of unauthorized travel routes, or rehabilitation stream crossings would occur improving water quality. The absence of road improvements or decommissioning/obliteration under this alternative has the potential to negatively impact soil conditions in some locations across the project area in the long term, particularly those locations where current road or crossing conditions and road usage on un-authorized routes are contributing to increased soil erosion / sedimentation. Ultimately, the project area would not move toward desired conditions, as outlined in the Forest Plan.

Cumulative Effects

Under the no action alternative existing conditions would not be addressed. Aquatic, riparian, and wet meadow systems would not be treated. Riparian areas, stream channels, seeps and springs, water quality, and water quantity would continue to degrade in some areas or would remain in a less than desirable condition which limits management options. This alternative would not provide for reduced vegetative conditions that are more resistant to uncharacteristic wildfire nor would fire be introduced into the ecosystem in a controlled manner. The effects to water quality and quantity in the case of high intensity fires resulting in high soil burn severity are well documented and result in heavy sediment and ash inputs to streams, as well as increased risk of damaging flows to streams, riparian areas and downstream structures. It is likely that under any conditions, a high intensity wildfire entering these untreated watersheds under Alternative 1 would have considerably greater impacts to water quality and channel stability than wildfire occurring after implementation of Alternative 2. Opportunities for improving water quality and quantity by reforestation in high severity areas of the Wallow Fire that are not naturally regenerating, would not occur.

Watershed conditions would remain at current conditions for the foreseeable future. Overstocked and dense stands within the project area would not be treated, therefore not moved towards the desired conditions of a healthy, vigorous, and productive forest. Under this Alternative and considering the absence of wildfire, this alternative is not anticipated to produce any changes for the future to existing water quality trends in the streams, springs and surface water bodies in or downstream of the project area.

Open roads still being used for motorized travel would continue to discharge runoff and sediment to project area streams, especially where the roads are poorly located in valley and stream bottoms, have

inadequate drainage structure, and are hydrologically connected to the stream network. Stream crossings on both authorized and unauthorized routes would continue to cause water quality and stream channel and habitat issues. Twenty-nine miles of unauthorized trails would not be obliterated and would continue to contribute to watershed road densities and impact overall watershed condition. Thirty-one miles of maintenance level 1 system roads would not be decommissioned/relocated under the no-action alternative and they would continue to contribute sediment and reduce watershed condition and function.

Alternative 2 and 3

Direct and Indirect Effects

A combination of vegetation treatments, prescribed fire, aquatic restoration, road maintenance, road relocation and decommissioning, and reforestation projects would be used to meet the purpose and address the need for action. These proposed activities and the project area were defined using the watershed condition framework for the Apache-Sitgreaves National Forests.

Locations across the project that have not received any previous restoration with dense canopies and heavy coarse woody debris loading in the understory would largely benefit from the proposed action. The benefit of reducing stand density is that remaining trees would have the opportunity to grow more rapidly and vigorously compared to an over-stocked condition. Short-term increases in soil loss related to ground cover and soil disturbance are expected from mechanical thinning and skidding operations as well as the use of existing roads for product transportation under the proposed action. Effects, however, can be adequately minimized by soil and water conservation project design criteria (in Appendix B-Design Criteria) and BMPs (Watershed Specialist report-project record). With site-specific soil and water conservation measures properly implemented, soil condition across the project area would maintain a satisfactory rating or improve areas where soil condition is impaired in the long term.

Traditional slash disposal activities across these treatments can extend the time of or temporarily re-initiate ground cover disturbance and its related soil erosion. However, on-site use of slash for ground cover purposes can help mitigate some impacts that ground disturbance has on site stability and productivity. Brockway et al. (2002) found that scattering slash across treatment sites to serve as mulch over equipment travel courses was beneficial for conserving soil and water.

Sensitive soils, like the ones that occur on moderately steep slopes on cinder cones or very erosive, volcanic-sedimentary derived soils on moderately steep slopes have the potential to improve to an upward trend under the hand-based thinning methods being proposed. Tree density and vegetative cover in some locations are at levels that pose a risk of intense, uncharacteristic wildfire behavior which, as previously mentioned, indicate an increased susceptibility of high soil burn severity. Therefore, it is important these areas are thinned to more desirable conditions. ASNF soil disturbance monitoring has shown that operating traditional ground-based harvesting equipment on slopes over 25 percent on cinder cone and Datil geologic formation soil types can have detrimental impacts to potential site stability and productivity (Robertson, 2016 and 2017).

Forested vegetation types across the project have the potential to maintain satisfactory conditions and improve areas of impaired soil conditions under the proposed action for prescribed fire activities. Stands with coarse woody debris loading well above natural conditions may be susceptible to high soil burn severity in the event of a wildfire. Soil conditions in meadows and grasslands would be maintained or improved from regular prescribed burn activities proposed as part of the project. Burn severities are

naturally low because fuel loading is low in these vegetation types. Generally speaking, prescribed fire in meadow or grassland systems can enhance production, photosynthesis rates, and/or nutrient content for native herbaceous plants without altering species composition (Augustine et al., 2014).

Retaining adequate levels of coarse woody debris on the ground for soil protection and productivity considerations after prescribed burning operations should maintain or increase soil fertility levels as well as decrease potential soil loss over the long term while not leaving the soil susceptible to high soil burn severity in the event of a wildfire. This provides site conditions which are ample for soil protection and long-term productivity and do not pose an unacceptable risk of high soil burn severity. It is important to recognize, though, management of timing and spacing with prescribed fire activities across the landscape can limit the severity of the impact to soil resources.

Road improvements and potential decommissioning/obliteration under this alternative has the potential to improve soil conditions and areas with current soil loss issues to an upward trend in the long-term, particularly in areas where road crossings and/or the concentrated use of OHVs and other vehicles are contributing to accelerated run-off. Opening, temporary road construction, and closing of roads in order to implement treatments would follow well established BMPS. Road decommissioning and unauthorized travel route obliteration would promote improvements to the Roads and Trails, Water Quality, Aquatic Habitat and Soil Condition indicators by addressing road density, location, and distribution of these features. Too many or poorly located roads can directly or indirectly cause loss of soil productivity, soil erosion, and sediment delivery, which can degrade water quality and aquatic habitat.

Satisfactory soils would be maintained, and impaired soils have the potential to improve with riparian tree planting and/or the use of fence exclosures to protect riparian areas under the proposed action. Tree planting would help introduce some woody species age class diversity to riparian areas as well as help stabilize stream banks or terraces in the long-term that may have been degraded due to use and localized trampling by large ungulates. Exclosing select areas from use by large ungulates also has to potential to improve soil conditions overtime in riparian areas where overgrazing and localized trampling may have contributed to ground disturbance, loss of herbaceous cover, and/or degradation of stream bank stability.

The use of structures (log weirs, Zuni bowls, cross vein weirs, rock check dams, plug and pond, etc.) to stabilize channels, banks, and headcuts and to control erosion / sediment delivery within streams has the potential to improve locations of impaired soil conditions with current soil erosion issues as well as help maintain satisfactory conditions under the proposed action. Additionally, removing non-functional structures that have caused instability and subsequent erosion issues, such as historical fish barriers or small dams, can improve soil and watershed conditions in these locations over the long term.

Soil restoration opportunities specifically on-stream terraces or floodplains under the proposed action has the potential to maintain satisfactory or improve impaired soil conditions in some select areas where localized, soil loss has led to some degradation downstream of other resources. The use of native, on-site source material like rocks or large downed woody debris can be utilized in a check-dam design to help mitigate overland flow and soil erosion. This approach could be used to lessen run-off and erosion in locations adjacent to a stream channel where degraded soil conditions may be contributing to headcut formation in the channel.

The interdisciplinary team identifies resource protection measures or design criteria as part of this project to minimize or avoid potential adverse effects from the proposed action. These resource protection measures are based on Forest Plan direction and policy, best available science, and site-specific evaluation. They are an integral part of this project and would be applied during project implementation. See Appendix B-Design Features.

Below is a summary table of soil and water indicators direct and indirect effects to the no action (Alternative 1), the proposed action (Alternative 2) and the preferred alternative (Alternative 3):

Table 22. Summary of direct and indirect effects to watershed resources.

Resource	Alternative 1	Alternatives 2 & 3
Upland Soils	Existing satisfactory soil conditions will remain in their current state. Soils would be susceptible to severe soil burning where dense ponderosa pine and other forested PNVT stands and heavy coarse woody debris loading exists. Soils in dry and riparian wet meadows would remain encroached and may degrade from their current impaired conditions with current user-created road densities and usage	Satisfactory soil conditions would remain stable. Impaired conditions have the potential to be improved. Susceptibility to severe soil burning is reduced. Some short-term soil loss and soil compaction expected. Monitor soil disturbance during treatment to ensure soil impacts stay within soil condition guidelines. Coarse woody debris would meet prescribed amounts by vegetation type.
Riparian Area & Stream Channel Condition	No riparian enhancement. Increased potential for uncharacteristic crown fire and accompanying increase in riparian & channel degradation. No additional exclosures and existing ungulate exclosures would continue to decline and remain ineffective. Further heavy foraging and trampling by ungulates may also implicate soil conditions from the desired state. No improvements to existing instream structures would be made. No improvements to existing stream channel condition, riparian and aquatic habitat through direct restoration activities and a potential for increased degradation.	Reduces canopy in riparian areas to allow for improved vegetation condition. Reduces potential for uncharacteristic crown fire and associated affects to riparian areas. Stream Channel condition would improve through direct restorative actions reducing bank erosion and improving riparian and aquatic habitats. Additional exclosures and maintenance/improvements to existing structures would improve riparian areas, stream banks, and water quality from grazing damages. Riparian willow species would be planted in areas that would benefit, providing protecting banks and creating more diverse riparian habitat and improving water tables that increase habitat suitability.

Resource	Alternative 1	Alternatives 2 & 3
Water Quality & Quantity	No change from existing condition. Water quality and stream condition improvements on slow upward trend from past activities (grazing, roads, Wallow Fire) would not be accelerated. Degraded conditions on downward trends, where they exist, will not be impeded or reversed. No reforestation in high severity areas of the Wallow Fire would occur.	No changes to ADEQ's 303d designation. Water quality in critical aquatic habitat streams to be monitored. Stream buffer zones and BMPs provide protection from sediment to riparian and stream channels. Therefore, no negative effects to State's Outstanding Waters designated streams. Creates a greater vegetative grass component than Alt 1, thereby improving retention, storage, and filtering functions. AMZs and BMPs provide protection from sediment to riparian and stream channels. Riparian woody species would be planted in areas that would benefit from additional diversity improving water quality by protecting stream banks and reducing sediment, retaining soil moisture, and providing shade reducing stream temperatures. Additional exclosures and maintenance of existing structures would improve riparian areas, stream banks, and water quality from grazing damages. Instream channel restoration of banks, headcuts and habitat improvements would greatly improve water quality in the long-term. Reforestation in high severity areas of the Wallow Fire where natural regeneration is not occurring. This action would improve water quality and restoration of surface and groundwater runoff patterns and amounts. Opportunity to influence water quantity.
Seeps and Springs	No change from existing condition. No improvements to existing spring flow, water quality, and riparian and aquatic habitat through direct restoration activities and a potential for increased degradation.	Opportunity to improve developed spring function and efficiency, restore disused developed springs to a more natural state, and to restore natural, undeveloped springs impacted by management activities and/or unauthorized use. All of the above would be to increase, restore and maintain ecologic potential.
Old Streamgages	Dilapidated streamgages in the project area would continue to disintegrate and remain a safety / liability issue.	Dilapidated streamgages in the project area would either be obliterated or modified to eliminate hazards for the public and employees.
Roads	No change. Watershed function and condition wouldl remain in current state or potentially decline.	Potential for reduced road densities and improved road conditions within project area which should help improve overall watershed function and condition. Opportunity to improve stream crossings and thus improve water quality, riparian and aquatic habitat.
FRCC and Return to Stable Historic Vegetation Conditions	Understory fuels build up and tree density and cover increases, the likelihood of higher intensity, uncharacteristic wildfire increases as well as the potential for high soil burn severity. Much of the area has low forage production due to high concentrations of conifer needle litter layer.	Decreases in canopy closure & stand densities result in shift to herbaceous understory, moving toward FRCC '1'

Cumulative Effects

A signed decision is expected for the Forest's Travel Management Plan soon. The plan may reduce road density throughout the forest and the number of roads crossing drainages and riparian areas. These activities would be instrumental in improving aquatic and riparian habitat and water quality/quantity.

Both the Wallow West Prescribed Fire project as implemented and the proposed action, except for Travel Management, include fuels reduction through prescribed fire but only the Black River Project would implement mechanical and hand vegetative treatments. These coupled activities would maintain or potentially improve many of the WCF indicators. In addition, the Black River Project and Travel Management Plan include road improvements through obliteration of unauthorized travel courses and decommissioning of Forest Service system roads can also improve watershed condition. Implementation of the Travel Management Plan would likely reduce the density of roads while improving the location, and distribution of the Forest's roads, thus benefiting the roads and trails indicator.

Table 23. Summary of overall long-term cumulative effects on watershed condition indicator scores

Action	Effect on Indicators		
Past Activities and events (prior to 2020)	Watershed condition framework indicator ratings originally developed in 2010 incorporating past activities and events prior to 2010, ratings were updated in 2015 after Wallow Fire in 2011.		
Activities and events after 2020 and reasonably foreseeable	Maintenance or improvement of the following elements of the watershed condition framework: Water Quality and Quantity, Soils, Roads and Trails, Fire Regime and Wildfire, Forest Cover, Rangeland Vegetation, and Forest Health		
Proposed Action Activity	**Watershed Condition Indicator**	**Alternative 1 No Action**	**Alternative 2 & 3**
Forest vegetative treatments (thinning and prescribed burning)	Fire Regime and Wildfire Condition, Water Quality and Quantity, Riparian Vegetation, Forest Health, Forest Cover, Soil Condition	No Benefit or Potential Decline	Maintenance or Improvement
Grassland, savannah, and woodland (thinning and prescribed burning)	Water Quality and Quality, Riparian/Wetland Vegetation, Soil Condition, Rangeland Vegetation Condition, Fire Regime and Wildfire Condition	No Benefit or Potential Decline	Maintenance or Improvement
Riparian and Stream Treatments	Riparian/Wetland Vegetation, Aquatic Habitat, Water Quality and Quantity, Soil Condition, and Fire Regime	No Benefit or Potential Decline	Maintenance or Improvement
Unauthorized road obliteration and system road decommissioning	Road and Trail, Aquatic Habitat, Water Quality, Soil Condition	No Benefit or Potential Decline	Maintenance or Improvement

Ultimately, restoration thinning to more desired conditions would: a) reduce the susceptibility of ecosystems to intense, uncharacteristic wildfire behavior which in turns reduces the potential for high soil burn severity, b) creates canopy gaps and tree spatial arrangements that reduces competition between overstory and understory plant species for site resources and c) provide slash (coarse woody debris) which would add ground cover and potential long-term nutrient sources to the soil in areas where it may be lacking. No long-term cumulative effects from ground disturbance (compaction, topsoil displacement, etc.) from mechanical operations are anticipated to occur to a degree or spatial extent that would negatively affect current soil condition ratings and the existing trend for any TES map unit within the project area with the proper implementation of soil and watershed BMPs.

Satisfactory soil conditions in meadows would be maintained and impaired soil conditions in select meadows have the potential to be improved to an upward trend under the meadow restoration treatments included in the proposed action. The removal of encroaching upland tree species within and along the margins of meadows, prescribed fire, and native grass seeding where appropriate would all help improve soil and ecological conditions. Removal of tree encroachment in meadows would help reduce site competition for sunlight, water, and soil nutrient resources as well as restore the extent of the meadows to more desirable conditions. Halpern et al. (2012) found that tree encroachment removal on the margins of meadows can be effective in shifting the balance from forest to meadow plant species. Prescribed fire (post tree removal) would help increase the rate of decomposition and rejuvenate soil nutrient stocks, increasing potential soil fertility for more vigorous plant growth. Seeding with a native seed mix (tested and certified weed-free) in areas that may lack vegetative ground cover due to past ground disturbances such as heavy, concentrated OHV use or large animal trampling would help reestablish vegetative cover, as well as provide for a more desirable grass species composition. Barr et al. (2017) reported that including more native species and seeding at higher application rates than what is used in most seeding practices could lead to greater restoration success in grasslands.

Fuel reduction treatments in forested watersheds would probably have long-term detectable increase in water yields either on-site or downstream (Brewer, 2008; Bosch and Hewlet 1982; Troendle et al 2003, 2007). Prescriptions that cover most of the project area are likely to remove greater than 20 % of basal area that is needed to generate a detectable change in flow. Treatments for vegetation would produce uneven age stands with very small patches and groups, which allow more snow collection in openings, resulting in more potential on-site water storage and yield. The hydrologic effect would be that the area would provide longer periods of flow in intermittent streams within and downstream of the project area.

Prescribed fire activities as part of this project have the potential to benefit the water quality and quantity, aquatic habitat, riparian/wetland vegetation, soils, fire regime or wildfire indicator, forest cover, rangeland vegetation, and forest health with respect to attaining desirable vegetation structure and composition, fuel composition, and restoring natural fire regimes in the long-term. Upland satisfactory soil condition would remain stable and impaired soils have the potential for improvement. The proper timing and frequency of burns planned accordingly with vegetation type characteristics (type of vegetation, climate, veg. structure, moisture conditions, etc.), burn severity maintenance, adequate soil and watershed BMP implementation, and the proper temporal / spatial planning of burns as not to overlap previously burned areas still recovering are all important factors for reaching the desired condition. Recurring, low intensity prescribed fire is a key component in the maintenance of desirable ecological condition. As long as the prescribed fires are maintained regularly at low to low-moderate intensities, they have the potential to increase the rate of soil organic matter decomposition and incorporation in the long term.

Reforestation in high severity areas of the Wallow Fire would occur on approximately 10,767 acres in 4 different PNVT’s. This has the potential to contribute to improved water quality and to restoring spring flow and groundwater flow patterns to pre-fire conditions.

The rehabilitation methods employed during decommissioning/obliteration of forest roads or non-FS, user-created routes would ultimately help mitigate soil erosion impacts in these areas while also allowing natural recovery time to soils. Sosa-Perez and MacDonald found in a study in 2017 that small furrows created by road scarification, which is generally part of a road decommissioning process, virtually eliminated nearly all the road sediment by trapping it in the first two years after decommissioning. Vegetative ground cover re-establishment overtime would help increase infiltration rates, protect soil stability, and reduce overland flow and soil loss. In the long-term, this would improve overall watershed condition and function to more desirable conditions.

BMPs would be implemented to maintain the sediment filtering capacity of streamside buffer strips (Aquatic management Zones or AMZ's) to minimize sediment entering streams (see Appendix A, Map 7). Harvest/thinning operations that occur within the Aquatic Management Zones would slightly reduce the canopy cover in riparian areas and could cause a potential short-term warming effect on stream temperatures where thinning would be more aggressive. However, as most stream channels within the project area are ephemeral and/or dry during May, June, and much of July, stream temperatures would not be influenced substantially by overstory thinning. Prescribed fire treatments in the AMZs would likely have little potential to reduce canopy cover in riparian areas and would not result in further loss of shade.

Outstanding Arizona Waters streams within the Black River Project area occur within the Upper West Fork Black River subwatershed. The streams Stinky and Hay have been identified by the state of Arizona because of their importance as native fish habitat. Any proposed management activity would incorporate BMP's to assure that the values at risk are not substantially impacted negatively and that any negative impacts are negligible and short-term and positive in the long-term.

Instream channel restoration would treat perennial, intermittent, and ephemeral streams in order to reduce erosion, improve stream and watershed function, and restore habitat for native fish and aquatic species. The use of structures to help re-stabilize riparian/stream systems and reduce erosion / sediment delivery can go a long way to help mitigating some of the impacts from these types of disturbances and would aid in the recovery of long-term stream system health. For example, there is evidence that plug and pond techniques are an effective method for restoring many aspects of stream systems in the Southwestern United States (Ramstead et al., 2012). Restoration of a natural flow regime with the removal on non-functional structures can result in an eventual return of sediment transport to formerly impounded areas. As a result, riffle/pool sequences and gravel and cobble bars may reappear along with increases in biotic diversity overtime. Fish passage is generally another benefit of structure removal (Bednarek, 2001).

Resource protection measures (i.e., design features, Appendix B) are incorporated into treatments through design features, conservation measures for aquatic species, and best management practices for soils and water quality. A flexible toolbox approach (i.e., adaptive management) would be applied for restoration of streams and riparian areas across the project area. Prioritization would occur as part of implementation to provide flexibility. Assessment would be part of the flexible toolbox approach, to assess needs and possible restoration treatments.

Transportation

The Travel Analysis Report for the ASNF (United States Forest Service [USFS] 2008) describes the Travel Analysis Process (TAP). The TAP was developed to inform future project-level decisions related to motorized travel management. In accordance with the TAP, a project-specific TAP was developed to identify and recommend road changes (such as decommissioning, changing the road's classification, etc.) that are necessary in order to achieve the purpose of the project, as described above. The project-specific TAP involved a field survey of the existing roadway network, the correction of mapped route alignments based on field review and aerial photography, and an inter-disciplinary review and analysis process to modify the road network to accommodate the proposed action. The existing condition of operational maintenance level was updated during this project to accurately reflect current conditions.

Table 24 summarizes the mileage of existing roads and unauthorized routes associated with the proposed action. Mileages are based on the GIS roads layer dated 06/21/2016. As discussed in FSH 7709.59 (and in the Glossary of this Transportation Specialist Report-project record), ML1 refers to roadways that have been placed in storage between intermittent uses and are therefore closed to all motorized travel. For NFSRs that are open to motorized travel, the maintenance levels range from ML2 (open to high clearance vehicles) to ML5 (open to standard passenger cars and providing a high degree of user comfort and convenience).

Table 24. Existing road mileage

Existing Road or Route Designation	Miles
ML1, Basic Custodial Care (i.e., closed) *	319
ML2, Open to High Clearance Vehicles	158
ML3, Suitable for Passenger Cars	118.5
ML4, Moderate Degree of User Comfort	41
ML5, High Degree or User Comfort	23
Decommissioned System Routes	15
Total	674.5
Unauthorized Routes	29

*Does not include decommissioned routes, decommissioned routes still exist in the transportation atlas under Operational Level 1 and are not used in the road density calculations.

Alternative 1-No Action

Direct and Indirect Effects

Under Alternative 1, current road management practices would continue, and the existing road system within the project area would not be modified. Routine road maintenance activities would continue primarily on NFS roads, ML3 -5, with limited maintenance performed on NFS roads ML1 and ML2. No NFSRs or unauthorized routes would be decommissioned or obliterated. The drainage and erosion impacts associated with these routes would continue. Road traffic would remain and the current levels with no major impacts occurring from this alternative.

Alternative 2 (Proposed Action) and Alternative 3 (Preferred Alternative)

Direct and Indirect Effects

Under Alternative 2 and 3, the actions would contribute incrementally to temporary and localized increases in traffic, and to roadway wear and tear caused by increased traffic volumes, including trucks and other heavy vehicles. Unauthorized routes would be decommissioned, and unneeded routes would be removed or rerouted to deduce impacts to other resource areas addressing issue number 5 as described in Chapter 1. The transportation system would receive maintenance on routes that would not normally be planned for routine maintenance. See Table 25 and Appendix A-Maps, Map 3. Transportation, Existing and Proposed Changes for the summary of proposed changes. See Appendix C in Transportation Specialist Report (project record) for complete a list of proposed changes to the transportation system.

Table 25. Proposed action changes to transportation system.

Black River Project Roads*	Miles
National Forest System Roads (NFSR) in the project area (ML 2-5-open to public use)	340.5
NFSR ML1s within the project area	319
Unauthorized roads	29
Black River Treatment Road Access Needs and Proposed Changes	**Miles**
*Utilize existing ML 1s	290
Proposed changes	**Miles**
***Proposed new NFSRs roads for access	13
**Proposed temporary roads for access	Up to 2
Proposed ML 1s decommissioned (to prevent resource damage)	31
Proposed changes	**Miles**
Proposed unauthorized roads decommissioned (to prevent resource damage)	29

*After treatment these roads would be closed. **Temporary roads would be closed and rehabilitated after treatments.
***New NFSR would be accomplished by rerouting and decommissioning unneeded routes.

Cumulative Effects

Spatial and Temporal Context for Effects Analysis

The spatial boundaries for analyzing the cumulative effects to transportation are any area with impacts to transportation to the project area, because the transportation system is considered together as an entire network.

Past, Present, and Reasonably Foreseeable Activities

Both Alternatives 2 and 3 would contribute incrementally to temporary and localized increases in traffic, and to roadway wear and tear caused by increased traffic volumes, including trucks and other heavy vehicles. The cumulative analysis considers other past, present, and reasonably-foreseeable future projects in or near the project area that would take place concurrently with the proposed action and therefore may also contribute to these impacts, resulting cumulative effects. As discussed above, the proposed action's impacts to transportation and roads resources would be less than significant with the implementation of Best Management Practices. Given this consideration, and accounting for the temporary and localized nature of the proposed action's effects and proposed BMPs, the proposed/preferred action would not result in any cumulative impacts.

Past NEPA projects that have changed any alternations to the transportation atlas have been updated in the Natural Resources Management (NRM) data base and GIS and are reflected in the Alternative 1 existing condition, current NEPA projects are using the proposed alternatives and referring to the Travel Management Rule alternatives to ensure there are no conflicts between proposals. Future NEPA projects would be using the transportation system finalized in the TMR project as the starting point for any required transportation planning. If there are any proposed changes for the transportation system, they would be identified on a project by project basis.

Heritage Resources

Background

One hundred and two cultural resource inventories have been conducted in the Black River Restoration Project area over the last 25 years. Of those, 59 surveys totaling 28,440 acres, are valid under current, accepted standards (Table 26). However, the 2011 Wallow Fire dramatically changed much of that landscape and thus directly affected the existing conditions reported on to that point. As noted in the project description, the Black River Project "is located entirely within the Wallow Fire perimeter". Following that event, numerous large-scale survey efforts have taken place across that footprint. Since 2012, a total of 32,940 acres have been surveyed to current standard, covering roughly 33% of the total proposed project area. Two current to standard, large block surveys have been completed in support of the Wallow West Prescribed Fire project, 58,230 acres of which overlaps the Black River Project footprint. Both occurred to the north and west of the surveys noted above, and exhibit similar, though slightly lower, site density and distribution. The most recent survey is the first phase of Black River Project specific survey efforts. This survey was a large block survey conducted in the John's Canyon East area in the Southeast region of the Project area. No existing sites were known and only six new sites were discovered.

Table 26. Number/Percent of cultural surveys in Black River Project area within the past 25 years

Number/Percent of acres surveyed since 1993 (total number)	Number/Percent of surveys since 2001 (number to current standard)	Number/Percent of surveys since 2011 (number post Wallow Fire)
29,849/ 32% (102)	28,440/30% (59)	16,997/18% (24)

Using the most current available data, additional surveys would be designed and conducted prior to project implementation. To date, a total of 82 cultural resource sites are listed in the ASNFs records within the Project area (as listed in the current Heritage NRM database, the legacy INFRA database, and in paper files). Site type is divided evenly between Historic and Prehistoric. However, the sample size is so small, considering the overall size of the project area, that this is not a particularly descriptive statistic. Additionally, given the catastrophic nature of the Wallow Fire over much of the project area, many of those sites are likely to have experienced some manner of change in condition. As such, the majority of the known sites remain unevaluated for purposes of recommending eligibility status for the National Register of Historic Places (NRHP).

Project Design Features and Mitigation Measures

Resource protection measures for cultural resources are largely defined by major laws, regulations, policies, and the Forest Plan. Appendix J, Standard Consultation Protocol for Large-Scale Fuels Reduction, Vegetation Treatment, and Habitat Improvement Projects, of the Region 3 Programmatic Agreement (PA) guides the overall process and protection for cultural resources. Specifically, it defines the process for employing phased surveys to allow archaeologists to identify, document, and flag sites for avoidance prior to project implementation. The Forest Archeologist may approve additional site protection measures on a case by case basis.

The most employed protection measure is to mark and avoid all identified eligible, or treated as eligible, sites prior to and in the course of implementation. While this method, when appropriately implemented and followed, can afford protection from ground disturbing activities, it does not account for the buildup of fuels in or around a site. Such buildup can lead to adverse effects due to high intensity burns, examples of which include, but are not limited to rock spall, ceramic artifact spalling and clouding, obliteration of ancient thermal features, obliteration of post-contact Euro-American structures or features, or severe post-fire erosion.

To achieve desired levels of protection for a site where fuel loading is high, hand thinning would be performed in addition to avoidance during ground disturbing activities. Hand thinning to achieve fuel reduction on sites would greatly reduce the likelihood of high intensity burns inside site boundaries. The reduction of hazard fuels inside site boundaries would also ensure that no “islands” of timber or fuels are left behind to signal the location of a site.

Required Monitoring

Ensuring compliance with mitigation and protection measures as specified in Appendix B-Design Features, is essential to maintaining no adverse effects to cultural resources, traditional cultural properties, and traditional botanical resources and use areas. An ASNFs cultural resource specialist would monitor project activities throughout implementation. Monitoring stipulations would be further established throughout the phased Section 106 process and tailored to each implementation unit and activity type.

Table 27. Number of sites listed by NRHP eligibility status

Historic Sites	Prehistoric Sites	NRHP eligibility
1	0	Listed
6	10	Eligible
20	25	Unevaluated
8	0	Not Eligible

While identifying and documenting previously unknown sites is a primary focus of conducting additional survey in the proposed project area, re-inventorying, re-documenting, and evaluating the current status and potential NRHP eligibility of known sites is an important factor as well.

Regarding other areas of cultural resources concern; the Black River Project area includes one identified Traditional Cultural Property (TCP), that being Burro Mtn. in the northwest section of the proposed project area, and numerous springs are located throughout the project area, which are areas known generally to be of particular importance to tribes.

Alternative 1-No Action

Direct and Indirect Effects

No treatments would be implemented under this alternative measure. There would be, therefore, no direct effects to cultural resources.

While no activities with the potential to affect heritage resources would take place, the potential for dense vegetation and fuel build-up may adversely affect cultural resources. Dense stands of vegetation and timber may lead to uncharacteristically hot fires burning in or adjacent to sites. Fire spalling may affect rock art panels, lithic and ceramic artifacts, and masonry features. In addition, historic sites of a fire sensitive nature, such as cabins and other wood features, risk obliteration by fire if vegetation and timber are not thinned. Thinning would allow for adequate access and increased fire protection in the event of a wildfire. Post-fire erosion would cause additional irreparable damage to sites, particularly those with high levels of subsurface integrity. The high number of both system roads and unauthorized routes in the forest also threaten the integrity of sites. Access to sites is increased by the high number of roads. Data indicate that sites within 100 meters of a road have a higher likelihood of being affected by looting, vandalism, or having an overall “poor” site condition rating (Hedquist, Ellison, and Laurenzi 2014).

Alternative 2 (Proposed Action) and Alternative 3 (Preferred Alternative)

Direct and Indirect Effects

Given that all site identification, documentation, protection, and consultation measures are followed, the action alternatives for the Black River Restoration Project would ideally result in no adverse effects to cultural resources. The proposed treatments employed in conjunction with appropriate resource protection measures would likely benefit sites. In particular, hand thinning inside sites and closing roads that disturb, or are within 100 meters of, sites would reduce the cumulative effects of fuel buildup, engineering, and looting/vandalism disturbances.

Cumulative Effects

To determine cumulative effects of undertakings on archaeological heritage in the project area, a review of both alternatives presented in this specialist report is necessary. Direct and indirect effects on cultural resources must be analyzed to determine which alternative would result in no effect or beneficial effect to cultural resources. As 58,230 acres of the Black River Restoration Project overlap with the Wallow West Prescribed Fire Project, the cumulative effects of both projects would be considered.

Alternative 1-No Action

Projects completed in the past 25 years, present, and reasonably foreseeable future projects inform our understanding of cumulative effects. The past twenty-five years' worth of ground disturbing activities on the Black River Restoration Project landscape were mostly guided by mark and avoid mitigation. However, many past activities were carried out with a sample percentage of cultural resource inventory and not 100% survey coverage. An untold number of sites were potentially affected by past project activities in project areas where only sample surveys were performed.

Additionally, a potentially extreme level of hazard fuel buildup on cultural resource sites may exist if mark and avoid mitigation measures were employed without complementary hand-thinning of cultural resources. A buildup of hazard fuels can be detrimental to a site in the event of a wildland fire or even prescribed burn. No action would also result in the continued buildup of hazard fuels in and around cultural resources. Fire often simulates the growth of edible forest products. Humans throughout times have collected such forest products for consumption. Continuing suppression or delaying reintroduction of fire to the landscape can result in the decreased availability of edible or medicinal forest products that visitors or traditionally associated Native American groups can gather. This fuels buildup would be less of a concern in the 58,230 acres of the Black River Project that overlap with the Wallow West Prescribed Fire Project. In these overlapping areas, fuels buildup would be reduced as a result of the ongoing prescribed burning.

Alternative 2 (Proposed Action) and Alternative 3 (Preferred Alternative)

One hundred and two projects with related cultural resources events have occurred in the bounds of the Black River Restoration Project over the course of the last 25 years. There are no reasonably foreseeable actions in the Black River Project area known at this time. The previous 25 years' worth of heritage surveys in the Black River project boundary encompasses 32,940 acres of often overlapping inventory. The list of heritage clearance reports does not necessarily correspond with the individual Timber and Silviculture program projects. Additionally, many of the prior years' project areas were sample surveyed and not surveyed to 100-percent. Therefore, cumulative effects to cultural resources outside the sample transects are different than the cumulative effect for cultural resources that were identified and avoided by project activities as those resources outside of the sample transects may have experienced changes or impacts from past project activities that were not previously noted or considered..

While the Black River Restoration Project and the various treatments proposed do pose threats to cultural resources, following appropriate laws, policies, the R3 PA, the Forest Land Management Plan, and cultural resource protection and special treatment measures allows the ASNFs to carry out treatments in the project area with no adverse effects to cultural resources. In some cases, the effects would be beneficial.

Terrestrial Wildlife

There are 32 ESA-listed or USFS Region 3 Sensitive species or their suitable habitats present or likely to be present in the Black River Restoration Project or Action Area, as well as many migratory birds. Designated critical habitat is present for two of the terrestrial species considered here. Abundance of these species varies by species and spatially across the landscape, and they all have been impacted in the past from past management actions as well as natural phenomena such as drought, climate change, and wildfires.

Table 28. Federally listed species within Arizona and their status in relation to the Black River Project.

Species Name	Species Status	Critical Habitat in project area	Suitable Habitat Present	Suitable Habitat Occupied
Federally Listed Species				
Mexican Spotted Owl *Strix occidentalis lucida*	Threatened	Yes	Yes	Yes
Mexican Wolf *Canis lupus baileyi*	Endangered - experimental, non-essential	N/A	Yes	Yes
New Mexico meadow jumping mouse *Zapus hudsonius luteus*	Endangered	Yes	Yes	Yes
Southwestern willow flycatcher *Empidonax traillii extimus*	Endangered	No	Yes	No
Sensitive Species - Mammals				
Pale Townsends big-eared bat *Corynorhinus townsendii pallescens*	Sensitive	N/A	Yes	Assumed
Spotted bat *Euderma maculatum*	Sensitive	N/A	Yes	Assumed
White Mountains ground squirrel *Ictidomys tridecemlineatus monticola*	Sensitive	N/A	Yes	Assumed
Allen's lappet-browed bat *Idionycteris phyllotis*	Sensitive	N/A	Yes	Assumed

Species Name	Species Status	Critical Habitat in project area	Suitable Habitat Present	Suitable Habitat Occupied
Navajo Mogollon vole *Microtus mogollonensis navaho*	Sensitive	N/A	Yes	Assumed
Arizona montane vole *Microtus montanus arizonensis*	Sensitive	N/A	Yes	Assumed
White Mountains chipmunk *Neotamias minimus arizonensis*	Sensitive	N/A	Yes	Assumed
American water shrew *Sorex palustris*	Sensitive	N/A	Yes	Assumed
Sensitive Species - Birds				
Northern goshawk *Accipiter gentilis*	Sensitive	N/A	Yes	Yes
Gray catbird *Dumetella carolinensis*	Sensitive	N/A	Yes	Assumed
American peregrine falcon *Falco peregrinus anatum*	Sensitive	N/A	Yes	Assumed
Bald eagle *Haliaeetus leucocephalus*	Sensitive/Eagle Act species	N/A	Yes	Yes
Sensitive Species - Plants				
Goodings Onion *Allium gooddingii*	Sensitive	N/A	Yes	Assumed
Villous Groundcover Milkvetch *Astragalus humistratus var. crispulus*	Sensitive	N/A	Yes	Assumed
White Mountains paintbrush *Castilleja mogollonica*	Sensitive	N/A	Yes	Known locations
Gila Thistle *Cirsium gilense*	Sensitive	N/A	Yes	Assumed
Yellow Lady's-Slipper *Cypripedium parviflorum var. pubescens*	Sensitive	N/A	Yes	Assumed
Wislizeni gentian *Gentianella wislizeni*	Sensitive	N/A	Yes	Assumed

Species Name	Species Status	Critical Habitat in project area	Suitable Habitat Present	Suitable Habitat Occupied
Arizona alum root *Heuchera glomerulata*	Sensitive	N/A	Yes	Assumed
Mogollon Hawkweed *Hieracium brevipilum*	Sensitive	N/A	Yes	Assumed
Heartleaf Groundsel *Packera cardamine*	Sensitive	N/A	Yes	Assumed
Mogollon clover *Trifolium longipes ssp. nuerophyllum*	Sensitive	N/A	Yes	Assumed
Bebb's Willow *Salix bebbiana*	Sensitive	N/A	Yes	Known locations
Arizona Willow *Salix arizonica*	Sensitive	N/A	Yes	Known locations
Blumer's Dock *Rumex orthoneurus*	Sensitive	N/A	Yes	Assumed
Eagles				
Golden Eagle *Aquila chrysaetos*	Eagle Act Species	N/A	Yes	Assumed
Bald eagle *Haliaeetus leucocephalus*	Sensitive/Eagle Act species	N/A	Yes	Yes

Species information for ESA-listed Species

Mexican Spotted Owl

The Mexican spotted owl (MSO) was listed as a threatened species in March 1993, with critical habitat first established in 1995 and then revised in 2012. The Apache-Sitgreaves National Forests lie within the Upper Gila Mountain Ecological Management Unit, as defined in the 2012 Recovery Plan (USFWS 2012).

The MSO is a medium sized nocturnal predator, characterized by perch and pounce tactics to capture its prey, which primarily consists of small mammals such as mice, rats, and voles. Mixed conifer, lower-elevational spruce fir, ponderosa pine/gamble oak, riparian, and rocky canyon habitats on the Apache-Sitgreaves NF provide suitable habitat for these owls. Important habitat characteristics in these forest types for the owl consists of high canopy closure, high stem density, multi-layered canopies within the stand, numerous snags, and downed woody material. These characteristics provide cool, moist microclimate sites for nests and roosts, as well as an abundance of prey items for the owl.

Surveys were conducted in 2015, 2016, and 2017 within established MSO Protected activity centers (PAC), as well as across suitable habitat identified within the project area. 2 new PACs were established as a result of these efforts. In total, this brought up the number of PACs within the project to 13 PACS, Thus, a total of 19 known MSO breeding territories occur wholly or partially within the action area (project boundary and ½ mi buffer). The Forest Service establishes Protected Activity Centers (PACs) at the center of territories (i.e., nests) for management purposes. These PACs are scattered around the project area, with the majority occurring along the southern boundary of the project area.

Mexican wolf

The Mexican wolf was extirpated from the Southwest in the mid-20th century through a combination of habitat loss, hunting, and other predator control methods. A captive breeding program was established in the 1970's, and Mexican wolves were reintroduced on the Alpine Ranger District in 1998. This initial release of wolves was the genesis of a population of wild reproducing Mexican wolves, heavily managed by a collaboration of agencies termed the Interagency Field Team.

Mexican wolves are habitat generalists and utilize all vegetation types on the Apache Sitgreaves National Forests. Hunting in packs, wolves in Arizona prey primarily on elk and deer. Most packs use 150 to 250 square miles as a home range that they defend from other canines. Denning season occurs from roughly April through July, with a rendezvous site used for pack gathering after the pups leave the den. Pups start ranging with the adults around October. Dens of reintroduced wolves have been noted to be moved annually, though usually only a short distance.

Seven packs are known to occur in or near the project boundary and likely forage through the area regularly, which includes the Blue Stem, Maverick, Panther Creek, Bear Wallow, Diamond, and two new packs. Three of these packs (Maverick, Blue Stem, and Panther Creek) denned within the project boundary in 2016. The remaining four packs either denned outside the project area and foraged into the project area occasionally or are new pairs and have not established den locations and are known to also use the project area on occasion. As habitat generalists, Mexican wolves may utilize all PNVT categories within the project area, approximately 92,000 acres.

New Mexico meadow jumping mouse

The New Mexico meadow jumping mouse (NMMJM) is a small mammal that has highly specific habitat needs. The species occurs in riparian areas, along streams, creeks, and other water bodies. They require areas of moderate to high soil moisture with dense streamside vegetation with nearby flowing water and often associated with willows and alders. Other habitat characteristics include tall dense riparian herbaceous vegetation composed of sedges and forbs, as well as adjacent upland areas for hibernation and rearing of young. The mouse is a true hibernating species, only active during the summer months from June-October, after which the mouse retreats to upland areas and hibernates for 8-9 months of the year.

On the ASNFs, the NMMJM occurs in an elevational range between 7500 to 9500 feet on the Alpine and Springerville Ranger Districts (Morrison 1991). The ASNFs have the largest known population of NMMJM (USDI 2014). Within the project area, there are 10 identified occupied habitat polygons, where positive identification or captures of live NMMJM have been documented. Surveys have been ongoing on the A-S since 2015 in coordination with Northern Arizona University (NAU) and the AZGFD. Many of the perennial waters within the project boundary have been surveyed to some degree, however, we still do not have an entire picture of the complete NMMJM population distribution within the project or across the Forest. It is known that the main stem of the Black River, as well as both the East and West Fork of the Black River are occupied by NMMJM. Certain tributaries to the Black River have also been found to be occupied, including portions of Beaver Creek, Boggy Creek, Centerfire Creek, Home Creek, and lower Hannagan Creek. Critical habitat for this species occurs within the project on Boggy and Centerfire Creeks, and along the West and East Fork of the Black River.

Southwestern willow flycatcher

Southwestern willow flycatchers (SWFL) were listed in 1995 as an endangered species, with critical habitat first designated in November 2005 and finalized in 2013 (USFWS 2013).

This species is a small bird approximately 6 inches in size with a brownish to olive grey body. The flycatcher preys primarily on insects, which it captures in flight, sallying from a nearby perch. SWFL utilize riparian habitats in the southwestern United States and Mexico, preferring dense riparian stands composed of cottonwood/willow and tamarisk vegetation for nesting commonly associated with slower moving water or pools with saturated soils. Riparian habitat not suitable for nesting is used by the species for migration or foraging. This species nests in Mexico and the southwestern US, and winters in Central and South America. SWFL typically arrive on breeding grounds between early May and early June and depart for wintering grounds from mid-August to mid-September.

Southwestern willow flycatchers have not been documented in the project boundary. SWFL have been documented on the Alpine Ranger District and the nearby Springerville Ranger District. These locations, on Alpine at the San Francisco River and Nelson Reservoir, and on Springerville in Greer along the Little Colorado River, are from 9.5 mi, 17 mi, and 6 mi from the project boundary. Nesting within the project boundary has never been documented. Critical habitat for this species is not within the project boundary.

Sensitive Species

Northern goshawk

Northern goshawks (NOGO) are forest dwelling raptors that take a large variety of prey ranging from medium sized birds (such as Stellar's jays and robins) to mammals and rodents (such as rabbits, squirrels, and chipmunks). They are most commonly found nesting in ponderosa pine but also utilize mixed conifer forests. Nesting stands typically have intermediate canopy cover, while the stand itself is composed of mid to larger sized trees. Open areas adjacent to ponderosa stands are commonly used for foraging.

12 management units (known as Post-fledgling areas or PFAs) for Northern goshawks have been established in the project area.

Gray catbird

The gray catbird is a medium sized migratory bird that breeds from Canada through much of the United States. This bird winters in the southeastern US and the neo-tropics and arrives on its breeding grounds in late April to early June. In Arizona, this species likely arrives between April and May. Their diet is composed mainly of insects and fruit, foraging from treetops to the ground. Found primarily in riparian areas, at this elevation this species is found in dense willow and alder riparian corridors. It appears that physical structure rather than cover type is the dominant factor in habitat preference. The gray catbird is commonly associated with riparian areas with dense shrubby vegetation throughout ponderosa pine and pinyon-juniper forests.

Surveys for this species have not occurred within the project area. However, records exist of this species in nearby areas across the Apache side of the A-S National Forest. Nests were located in the Little Colorado River from near Greer to north of Springerville, and also locally along the upper San Francisco River just outside of Alpine. Habitat for this species is found in riparian areas in ponderosa pine, mixed conifer, and pinyon juniper forests, of which there are 132.64 miles along perennial streams in the project area.

American peregrine falcon

American peregrine falcon (*Falco peregrinus anatum*) occurs across Arizona. Essential habitat includes rock cliffs for nesting and a large foraging area, with nesting site cliffs having a mean height of 200 to 300 feet and is a permanent resident on the Apache-Sitgreaves National Forest. Peregrines are aerial specialists, preying mainly on birds found in wetlands, riparian areas, meadows, parklands, croplands, mountain valleys and lakes within a 10 to 20 mile radius from the nest site.

Surveys for this species have not been formally conducted inside the project area. The Arizona Game and Fish Department has typically monitored the known eyries on the Apache National Forest, and these are located in the Blue River, Black River, Little Colorado River, Chevelon Creek, and along the Mogollon Rim escarpment. During the 2017 field season, a possible eyrie was discovered along the Black River. A single adult was observed on two separate occasions in the same area. Cliffs that may be suitable for nesting exist along the Black River as well as the lower ends of Centerfire Creek, Wildcat Creek, and Reservation Creek. It is possible that if these cliffs are occupied, that Peregrines forage throughout the project area. If so, peregrines would be assumed to use the entire project area (66,000 acres) and would be analyzed as such.

Bald eagle, golden eagle

Bald and golden eagles are present in Arizona year-round. Some bald eagles are migratory and arrive in Arizona during the winter. These are both large raptors that feed on fish, small mammals, and carrion. Bald eagles are generally found along bodies of water during the nesting season but are found more dispersed during the winter as they forage for carrion. Golden eagles prefer wide open, remote areas. Nesting sites for bald eagles are most commonly found along bodies of water in large live or dead trees, whereas golden eagles commonly nest on cliff faces or hill tops but are occasionally found in trees or even telephone or electrical transmission poles.

There are no known nesting locations for either of these species within the project area. Bald eagles are found throughout the Black River drainage during the winter, as they forage for fish and game. Golden eagles are scarcer but are assumed to use the entirety of the project area for foraging habitat, and incidental sightings have been made of golden eagles within the project area. Cliff faces occur along the main stem of the Black River that may provide suitable nesting structures for golden eagles.

Pale Townsend's big-eared bat, Spotted bat, Allen's lappet-browed bat, Western red bat

These bats range across the state, and within the ASNFs and they utilize coniferous forests ranging from pinyon juniper, ponderosa pine, and mixed conifer forests. These bats are associated with caves, mines, cliff faces, or large tall trees or snags with suitable cracks and crevices. These bats are insectivorous, feeding upon insects, mainly soft bodied flying insects such as moths or beetles.

Surveys in conjunction with this project have not been conducted, however an NAU bat study was conducted in the project area in 2013, during which Allen's lappet-browed bats were detected within the Black River project area. The other 3 species were not detected during the study. Suitable foraging habitat for these species exists across the project area. Roosting habitat is limited for cave or mine dwelling species, as these features are not known to exist within the project. Cliff faces that may be suitable for spotted bats occur along the main stem of the Black River. Large snags or live trees that provide habitat for tree or cavity roosting bats are abundant across the project area.

Navajo Mogollon vole, Arizona montane vole, White mountains chipmunk, White mountains ground squirrel, American water shrew

These small mammals occur in mountain meadows and grasslands near or intermingled with coniferous forests (voles), subalpine meadows and spruce fir forests (chipmunk and ground squirrel), or high elevation riparian vegetation along swiftly moving streams (shrew). These species diets range from herbivorous to insectivorous and omnivorous. Most of them utilize underground burrows for nesting and protection, along with runways and herbaceous vegetation as cover when they forage. Intact, healthy meadows, forests, streams, and grasslands are important for sustaining these species.

Surveys for these species were not conducted for this project, however NAU recently (2012-2016) conducted a small mammal study within the project area. This study found that the voles were abundant in many sites and were the 1st and 3rd most commonly trapped rodents. Ground squirrels were trapped by the study and found to be positively associated with fire and elevation. A water shrew was also found in a separate study by NAU and others in or very near the project boundary on the Alpine and Springerville Districts in the late 90's and in 2014-2016.

Sensitive Plants

Mixed conifer and ponderosa pine species

Gooding's onion, villous groundcover milkvetch, Gila thistle, Wislizeni gentian, Mogollon hawkweed, heartleaf groundsel, yellow lady's slipper.

These sensitive species are found in a variety of conditions in mixed conifer and ponderosa pine forests, that range from drainage bottoms with heavy canopy cover, to mountain meadows, bare ground, disturbed areas, and open or partially shaded conifer stands. They range in elevation from 6,000 to 11,000 feet, with most falling between 7000 to 9000 feet.

Systemic surveys were not conducted for this project; however, surveys have been done in the past, with some populations being found, specifically there are known locations of Gooding's onions, Mogollon hawkweed, and heartleaf groundsel. No specific locations for the villous groundcover milkvetch, Gila thistle, Yellow's lady slipper, or Wislizeni gentian are known within the project area, although based on species information it is possible, they all exist in the project area within the mixed conifer PNVT.

Wetland/Cienega and Riparian species

Mogollon clover, Arizona willow, Bebb's willow, Blumer's dock, Arizona sneezeweed, Arizona alum root, White mountains paintbrush

These species are found in riparian habitats across the forest, such as in streams, rivers, wetlands, wet meadows, springs, and seeps. Available water and intact riparian systems are integral parts of the life cycles for these plants, although some, such as full grown Bebb's willows, are more tolerable of drier conditions. They range in elevation from 4000 – 11000 feet in elevation, with the majority of these plants falling within the range of 7000-9000 ft.

Most of these riparian species have had surveys conducted in the past, although none were conducted as part of the Black River Restoration Project. Locations have been identified through past studies for the Blumer's dock (found to be known in every major watershed), Bebb's willow and Arizona willow have been surveyed by a contractor in years past, with multiple locations known within the project, although some sites show some evidence of decline due to degraded riparian conditions and water table issues. The Mogollon clover and paintbrush were last surveyed for in the 90's, with populations known within the

project or nearby, and it is likely that populations exist in the project that are unknown. Arizona Sneezeweed and Arizona alum root have no known locations within the project boundary; however, historic populations of both species have been found near the project area. Arizona sneezeweed was located just west of Mt. Baldy on the Fort Apache Reservation.

Definitions

Effects to a species or its habitat from human activities can be direct, indirect, and cumulative. Factors that influence an effect can include proximity of an activity to a species or its habitat, geographic distribution of an activity, timing of an activity in relation to sensitive periods of a species' life history, nature of the effect, duration (short-, long-term, permanent), disturbance frequency, intensity, and severity (USDA Forest Service 2015b). Cumulative effects are those that result from past, present, and reasonably foreseeable future actions by federal, state, or local agencies or private individuals (40 CFR § 1508.7).

Alternative 1 – No Action

Federally Listed Species

For Mexican spotted owl and its critical habitat, the amount of mixed-conifer, large-tree biomass relative to small trees would not improve under the no-action alternative, and it would remain unchanged until active crown fire ignites in the area, which would cause a loss of most trees. Canopy cover would be reduced from present conditions relative to the action alternatives. However, stand-replacing wildfire may cause a complete loss of canopy across most Mexican spotted owl habitat in the long term. The number of snags and woody debris would remain relatively constant over the next 20 years, but much of that would be contributed by smaller trees given the large number of trees per acre relative to the action alternatives. A detailed analysis of the MSO habitat is available in the Silviculturist Specialist report (Project Record).

Sensitive Species

In general, taking no action would be less likely to maintain refugia and critical life cycle needs of Forest Service sensitive species (forest plan guideline) relative to the proposed action because vegetation across PNVTs, already departed from desired conditions, would generally move further away from desired conditions. As a result, the risk of uncharacteristic high-severity wildfire in the ponderosa pine and mixed conifer PNVTs would not be reduced and large habitat blocks, including nesting habitat (goshawk) or roosting habitat (bald eagle, bats), would be removed and eggs or non-mobile young would be destroyed. Habitat supporting prey species would not improve. Meadow encroachment would continue unless wildfire can burn within the montane/subalpine grassland PNVT. Temporary disturbance, displacement, or altered behavior of individuals would not occur from treatments but would likely end up being exponentially greater under larger, more frequent, higher-severity wildfire scenarios that remove large habitat blocks.

Bald Eagle and Golden Eagle

Short-term disturbance to golden eagle foraging behavior would not occur. The habitats used by golden eagle and their prey would not be improved by reducing tree encroachment and shrub cover and introducing characteristic wildfire that benefits prey species through nutrient cycling.

Migratory Birds

Under the no-action alternative, there would be no treatments and, therefore, no short-term disturbance impacts to migratory birds. However, the potential for habitat improvement toward desired conditions and reduction of the risk of uncharacteristic wildfire would not be realized. Fire can affect forest birds directly or indirectly, positively or negatively. Several factors determine how fire influences particular bird species including: fire extent and intensity; temporal scale at which effects are evaluated; and the particular life history of the species involved.

Fire can affect birds directly by causing mortality or reduced reproduction. Mortality due to fire is generally considered minor for adult birds because they can leave the affected area. However, mortality of nestlings or fledglings or reduced reproduction due to reductions in food supply is possible if fires occur during the breeding season.

Fires typically affect birds indirectly through habitat modification, changes in food supply, or changes in abundance of competitors and/or predators. The effects of fire on habitat structure, food resources, and floristic composition may be especially important because many birds respond strongly to these habitat features. The effect of fire on birds and their habitat varies with the extent and intensity of the fire. Large fires generally affect more habitat, and therefore, more birds than do small fires, and hot fires alter forest structure more than cool fires. A stand-replacing fire may result in many or most of the bird species present before the fire being replaced by new species. In contrast, cool understory prescribed fire may have little effect on species composition. How individual species respond to fire may depend on the size of the fire.

Fire effects also vary across temporal scales. Intense prescribed fire initially produce numerous snags for cavity-nesting birds and abundant food resources for timber drilling species such as woodpeckers. Over time those cavity and food sources dwindle.

Life history characteristics also influence the response of bird species to fire. Cavity-nesting birds, timber-drilling birds, granivores, and some flycatchers generally respond positively to prescribed fire in the short term because of increased nesting substrates and/or food supplies. Some species may even require intense fires for long-term population maintenance (Lewis's woodpecker). In contrast, foliage-gleaning insectivores generally respond negatively to fire due to decreased foraging substrate (Finch and Block 1997).

Some bird species could benefit from wildfire while others would be negatively impacted. However, based on data collected from past local wildfire, failure to reduce the risk of uncharacteristic wildfire across the project area is more likely to lead to detrimental large-scale habitat modification and changes in food supply for birds of conservation concern relative to the proposed action.

Alternative 2 (Proposed Action) and Alternative 3 (Preferred Alternative)

Direct and Indirect Effects to terrestrial species and their habitats

Mortalities, injuries, stress, and alteration of behavior would be the most likely direct effects to terrestrial wildlife and sensitive plants from use of mechanized equipment, foot traffic, prescribed fire, and instream or riparian restoration work, and increased road use. Direct effects result when the proposed activity occurs at the same time and location as the species, or in the case of critical habitat, its primary constituent elements. Terrestrial wildlife is generally mobile and able to move to refugia to escape direct effects. Mortalities and injuries are unlikely to occur through timing of operations during non-critical periods, or through buffers around sensitive areas, such as in the case of the Mexican spotted owl or the New Mexico meadow jumping mouse.

However, some adverse effects may occur on some species, such as the New Mexico meadow jumping mouse, through the implementation of aquatic restoration activities. These adverse impacts will be short term but provide for long term benefits by helping to recover flood plains and wet meadows. Avian species such as the Southwestern willow flycatcher do not occupy the project area, and only move through it during migratory periods and are not expected to have direct effects beyond some minimal disturbance from project actions.

Sensitive plants are immobile and are more likely to have direct effects from fire applications or mechanized removal of timber. Many of these species inhabit generally sensitive areas, such as wet meadows, seeps or springs, or riparian areas, and these areas are protected from most project actions, limiting disturbance.

Sensitive species are generally distributed across the project area, and may have some direct effects, such as disturbance and alteration of behavior, however, these are expected to be short term and would not affect the range-wide populations of any sensitive species, bald or golden eagles, or migratory birds.

Direct effects to critical habitat will occur, through the reduction of canopy cover and basal area of forested stands. These reductions will not remove trees and the stands will fall below thresholds identified in recovery plans. These effects will not adversely modify critical habitat but will help protect them from high severity fire and insect and disease outbreaks. The application of fire in some MSO habitats such as dry mixed conifer stands may reduce the number of snags available in the short term but will aid in long term stability of the habitat through the reduction of high severity fire danger.

Indirect effects are separated from a species or primary constituent elements of its critical habitat by time or space (or both). Expected indirect effects range from smoke settling, temporarily increased sedimentation, increased prevalence of disturbance-thriving or shade-intolerant vegetation, changes in food availability and increased predation. Beneficial indirect effects would also occur, including improved understory vegetation, cover, and food resources for ground dwelling species, leading to increased prey populations for carnivores and birds of prey such as eagles, goshawks, and spotted owls. Reduced or slowed erosion processes, raised water tables, and the capture of sedimentation runoff through the construction of check dams and other instream structures are expected, leading to more stable riparian systems. Long-term reduction of high severity fire danger would improve the persistence of forests, while thinning also allows more resources to individual trees as well as reducing disease and infection rates, speeding the attainment of large trees critical to many terrestrial wildlife species.

Indirect effects are expected to be short-term and minimal, as increased sediment is processed through the stream systems by natural processes such as spring runoff and monsoon. Vegetation is expected to rapidly regrow from natural sources or from scarification and seeding after Project activities are completed. Any indirect effects would likely be undetectable from current conditions.

Any activities undertaken must either maintain existing conditions or move existing conditions towards those desired (USDA Forest Service 2015a). Longer-term effects of the Proposed Action would be expected to restore a more natural fire regime and natural vegetation composition, improvements in watershed functioning, and improvements in riparian and aquatic habitats. These in turn would be expected to improve populations and habitats for ESA-listed and USFS Region 3 Sensitive Species, and additionally, other native and desirable nonnative species.

Table 29- Direct and Indirect effects summary for Black River Restoration Project

Category	Equipment/Methods	Physical Effects	Effects to Species and Habitats	Design features, BMPs, Conservation measures, and mitigations
Forest, Woodland, and Grassland Health Restoration	Mechanized equipment, hand thinning, prescribed fire	Increased erosion and sedimentation, vegetation alteration, altered hydrology, increased road use, introduction of nonnative species, smoke settling,	Decreased cover, temporary fluctuation of production of food and prey base, alteration of behavior, area avoidance, temporary loss but long-term increased understory community, loss of individual sensitive plants through application of fire, temporary disturbance of riparian systems with long-term stabilization	Designations of aquatic management zones, Timing restrictions, habitat and sensitive area buffers; adherence to recovery plans; restrictions on use of mechanized equipment in stream channels and riparian areas, restrictions on use by season, slope, and soil type, rehabilitation of skid trails using waterbars, slash, scarification, and seeding; pile and broadcast burn methods, use of low intensity, backing fire; small areas and limited time frame of stream and riparian treatments, cleaning and disinfection of equipment; minimizing removal of vegetation along roadsides to only what is needed for safety, leaving vegetation in ditches, performing maintenance as soon as it becomes necessary, maintaining an erosion-resistant surfacing such as grass or rock in ditches, compacting the graded roadway surface to keep a hard driving surface, avoiding unnecessary soil and vegetation disturbance; minimizing the number of stream crossings used
Stream habitat, Riparian, Wet Meadow, and Upland Soil Stabilization	Mechanized equipment, hand tools, riparian plantings, instream habitat improvements, headcut improvements, one-rock dams			
Increased use of ASNFs system roads (ML2-4)	Mechanized equipment, hand tools			
Road construction, and reconstruction, closure of existing ML1 roads and temporary roads	Mechanized equipment, hand tools			
Obliteration and decommissioning of roads	**Mechanized equipment, hand tools**			

Source and Nature of Effects

The most important effects of the action alternatives are expected to occur from mechanized vegetation treatments and consist primarily of ground disturbance and vegetation alteration. Mechanized vegetation treatments for the Project would occur over blocks of 2,000-4,000 ac and typically take up to two to four seasons to complete (Johnson 2018). Skid trails and landings would be needed to accomplish thinning activities. Multiple treatment blocks across the Project may be active at the same time. Treatments would be spread throughout the Project area during the term of the Project (15 years). Prescribed fire could potentially be implemented over the entire Project area, either as an exclusive treatment, or in combination with other vegetation treatments. Treatments of streams or riparian areas would occur in the same areas and at the same time as planned for mechanized vegetation treatments, if possible.

The ground-disturbing effects of mechanized vegetation treatments are influenced by multiple factors such as soil type, season of work, type of equipment, and how the equipment is used (Page-Dumroese et. al. 2010). Mechanical equipment could also be used for instream treatments, but these would involve a much smaller area and shorter period than mechanized vegetation treatments. Riparian and upland treatments such as tree plantings, instream treatments, one-rock dams, and headcut improvements would be less intense disturbances, over much smaller areas, and completed over a shorter time frame. Fish barrier and stream gauge removals would be one-time events and involve small areas.

Prescribed fire would be more extensive in an area than mechanized treatments and over a greater time period of implementation, but effects would be limited to short-term reductions in vegetation, coarse woody debris, loss and creation of some snags or live trees, and perhaps small, short-term increases in ash or products of combustion reaching stream courses, and minor short-term increases in water temperature. Prescribed fire could include mechanized (thinning) or hand preparation, building and rehabilitating control lines, broadcast burning, and pile burning. Burn unit size will be determined based on control features and possible effects to other resources. No more than ½ of a 6th code HUC should be burned in a three-year period to allow for the recovery of understory grasses and forbs (Simmons, 2017). Land managers will determine an appropriate size and spatial/temporal rotation for burning which recognizes the short-term fire effects and the recovery process. Proximity to recent fire activity will be considered when prioritizing prescribed fire operations. Some areas particularly Ponderosa pine forest and dry mixed conifer forest, would be higher priority for maintenance burning.

Increased use and maintenance of existing ASNFs roads and road crossings would occur to facilitate Project activities and could also result in increased sedimentation and vegetation alteration. Opening, use, and closing of ML1 roads would occur as needed, as well as a small number of additions, extensions, and relocations. Removal of unauthorized roads and decommissioning of ML1 roads would occur as needed to improve resource values. Any of these activities could result in increased amounts of fine sediments reaching streams and vegetation alteration.

Cumulative effects

Cumulative effects result from the incremental effects of the Proposed Action when added to other past, present, and reasonably foreseeable future actions. Acres for some ASNFs activities overlap the project area. Acres of wildfire suppression activities over the past 25 years include 11 wildfires totaling over half a million acres. Most of these acres were in the 2011 allow fire, one of the largest in Arizona history. All the acres in the previous fires were within the boundary of the Wallow fire.

Past Actions

Past ASNFs actions, particularly wildfire suppression, timber management, livestock grazing, and activities associated with private lands have contributed greatly to the existing conditions and departure from desired conditions within the project area. Past management activities in the project area have resulted in the following:

1) Fuel conditions that contribute to uncharacteristic fire intensity and fire behavior.

2) Changes in vegetation diversity, structural stages, and old growth components within the landscape, tree species composition, tree density levels, and the amount of available herbaceous vegetation present in riparian and upland areas.

3) Diminished soil productivity, which in turn determines future productivity of the vegetation.

4) Changed conditions of upland areas and degraded riparian and aquatic habitats.

5) Altered types and amounts of vegetative soil cover present and condition of soils that contribute to current levels of soil erosion, surface runoff, stream flow, stream turbidity, stream sedimentation, and water quantity and periodicity in wetland and riparian areas.

State, local, and private actions

Some livestock grazing on private land occurs in the project area, and there is some use of private wells and roads. Game populations, including elk and deer, are managed by the Arizona Game and Fish Department (AZGFD). Elk and deer can affect local riparian conditions by removing browse and trampling banks, both of which can result in erosion, contribute sediment to streams, and affect proper functioning of riparian areas.

The 2011 Wallow fire burned large sections of the boundary fence between the Fort Apache Indian Reservation and the ASNFs. Feral horses are common in the Centerfire Creek watershed. Their abundance is increasing, since they have no natural predators, and their distribution depends on the availability of adequate water and forage. Management responsibility lies with the State of Arizona. Effects of these animals are like those for elk or deer but are often more severe. Areas experiencing particularly severe effects from free-roaming horses (e.g. Wildcat Creek, Centerfire Creek, Boggy Creek).

Powerline corridors and associated roads required for access can increase the chance of wildfires occurring, and have resulted in invasive plant species becoming established, affecting adjacent areas and vegetation. Roads will require ongoing maintenance to provide for vehicular traffic throughout the Project area not associated with the Proposed Action. Maintenance activities will require some ground disturbance and vegetation removal that may result in stream sedimentation and some habitat alteration.

Determinations

Species found in the project area are assumed to be adapted to a frequent-fire regime typical of ponderosa pine, pinyon juniper, and mixed conifer forests in the southwestern United States. This includes low to moderate fire activity returning at intervals that vary based on the habitat type. Habitat effects that species have adapted with include smoke effects, and low severity fire habitat effects that include reduction of surface vegetation and dead and down fuels, as well as limited loss of trees and creation of snags. Effects from the 2011 Wallow fire are ongoing in many areas, but at diminishing intensity in most cases. Some areas of severe burn will have more long-term effects and take longer to return to a pre-Wallow fire condition.

Design criteria, best management practices, mitigations, and conservation measures directed at particular species or habitats are part of the Proposed Action and intended to minimize or reduce some effects of the

Proposed Action to resources. In particular, the use of timing restrictions, stream buffers, and the adherence to recovery plan guidance on vegetation alteration are expected to reduce negative direct, indirect, or cumulative effects to species or critical habitats. Project activities are spread out over time and space, reducing effects spatially and temporally. Direct effects would be extremely unlikely and discountable for most listed species but may occur for some species. Indirect effects should be insignificant or undetectable compared to background levels. Provisions in timber harvest contracts are intended to protect resource values.

If ESA-listed or USFS Region 3 Sensitive species are found in areas or in numbers not covered by existing analyses (see Black River Forest Restoration Terrestrial Wildlife Specialist Report and Biological Assessment documents), the Proposed Action may need to be modified to comply with the ASNFs Forest Plan (USFS 2015a) or the Forest Plan amended. For ESA-listed species, consultation will be initiated with the U. S. Fish and Wildlife Service. Determinations for various ESA-listed species and their habitats, and USFS Region 3 Sensitive Species are shown below in table 30.

Table 30. Wildlife species within the Black River Project and their determination.

Species Name	Species Determination	Critical Habitat Determination
Listed Species		
Mexican Spotted Owl	NLAA	LAA
Mexican Wolf *Canis lupus baileyi*	NLAA	N/A
New Mexico meadow jumping mouse	LAA	LAA
Southwestern willow flycatcher *Empidonax traillii extimus*	NLAA	N/A (None in project area)
Sensitive Species - Mammals		
Pale Townsends big-eared bat *Corynorhinus townsendii pallescens*	a	N/A
Spotted bat *Euderma maculatum*	a	N/A
White Mountains ground squirrel *Ictidomys tridecemlineatus monticola*	a	N/A
Allen's lappet-browed bat *Idionycteris phyllotis*	a	N/A
Western red bat *Lasiurus blossevilli*	a	N/A
Navajo Mogollon vole *Microtus mogollonensis navaho*	a	N/A
Arizona montane vole *Microtus montanus arizonensis*	a	N/A

Species Name	Species Determination	Critical Habitat Determination
White Mountains chipmunk *Neotamias minimus arizonensis*	a	N/A
American water shrew *Sorex palustris*	a	N/A
Sensitive Species - Birds		
Northern goshawk *Accipiter gentilis*	a	N/A
Gray catbird *Dumetella carolinensis*	a	N/A
American peregrine falcon *Falco peregrinus anatum*	a	N/A
Sensitive Species - Plants		
Goodings Onion *Allium gooddingii*	a	N/A
Villous Groundcover Milkvetch *Astragalus humistratus var. crispulus*	a	N/A
White Mountains paintbrush *Castilleja mogollonica*	a	N/A
Gila Thistle *Cirsium gilense*	a	N/A
Yellow Lady's-Slipper *Cypripedium parviflorum var. pubescens*	a	N/A
Wislizeni gentian *Gentianella wislizeni*	a	N/A
Arizona alum root *Heuchera glomerulata*	a	N/A
Mogollon Hawkweed *Hieracium brevipilum*	a	N/A
Heartleaf Groundsel *Packera cardamine*	a	N/A
Mogollon clover *Trifolium longipes ssp. nuerophyllum*	a	N/A
Bebb's Willow *Salix bebbiana*	a	N/A
Arizona Willow *Salix arizonica*	a	N/A
Blumer's Dock *Rumex orthoneurus*	a	N/A
Eagles		
Golden Eagle *Aquila chrysaetos*	a	N/A
Bald eagle *Haliaeetus leucocephalus*	a	N/A
Migratory Birds		
Migratory birds within project area	**a**	**N/A**

*NLAA=May Affect, Not Likely to Adversely Affect; NLAM=Will Not Destroy or Adversely Modify; NE=No Effect; N/A=Not Applicable
a= May Impact Individuals, but is Not Likely to Result in a Trend towards Federal Listing or Loss of Viability (USFS Region 3 Sensitive Species)

Aquatics and Fisheries

There are 11 ESA-listed or USFS Region 3 Sensitive aquatic species or their suitable habitats present or likely to be present in the Black River Restoration Project or Action Areas. Proposed or designated critical habitat is present for three aquatic species. Many of these species experienced sharp declines in abundance due to effects from the 2011 Wallow fire, but have since rebounded, although effects of drought, past habitat alterations, and nonnative species continue to affect abundance and distribution.

Table 31. ESA listed ad USFS R3 sensitive aquatic species and habitats in or potentially in the Black River Project area

Species Name	ESA/USFS Status	Critical Habitat in project area?	Suitable Habitat in project area?	Occur in project area?
Narrow-headed gartersnake (*Thamnophis rufipunctatus*)	Threatened	Proposed	Yes	Yes
Northern Mexican gartersnake (*Thamnophis eques megalops*)	Threatened	Proposed	Yes	No
Chiricahua leopard frog (*Lithobates chiricahuensis*)	Threatened	No	Yes	Yes
Apache trout (*Oncorhynchus apache*)	Threatened	N/A	Yes	Yes
Loach minnow (*Tiaroga cobitis*)	Endangered	Designated	Yes	Yes
Northern leopard frog (*Lithobates pipiens*)	Sensitive	N/A	No	No
Lowland leopard frog (*Lithobates yavapaiensis*)	Sensitive	N/A	No	No
“A stonefly” (*Capnia caryi*)	Sensitive	N/A	Yes	Unknown
“A caddisfly” (*Lepidostoma apache*)	Sensitive	N/A	Yes	Unknown
“A caddisfly” (*Lepidostoma knulli*)	Sensitive	N/A	Yes	Yes
“A caddisfly” (*Limnephilus granti*)	Sensitive	N/A	Yes	Unknown
Desert sucker (*Catostomus clarki*)	Sensitive	N/A	Yes	Yes
Sonora sucker (*Catostomus insignis*)	Sensitive	N/A	Yes	Yes
Roundtail chub (*Gila robusta*)	Sensitive	N/A	Yes	Yes

Species Information for ESA-listed Species

Narrow-headed gartersnake

The narrow-headed gartersnake was formerly widely distributed in the Southwestern states, but its range and abundance have been substantially reduced. Nonnative species such as the crayfish may be a factor in the decline of this species. The narrow-headed gartersnake is primarily aquatic, relying heavily on native fish for prey. Is often found in or near the stream, lying in ambush, or basking in cover on the bank during the active season (March-November). It may be found up to 600 feet or more from the stream brumating in cold weather. Within the Project area, the NHG is found primarily in the Wildcat Crossing area of the Black River but has also been detected in the East Fork Black River, West Fork Black River, and Reservation Creek. Abundance of this species appears to be decreasing. A single NHG was collected near Wildcat Crossing of the Black River in 2015, and 2 were collected in Reservation Creek in 2016. Sampling near Wildcat Crossing in 2017 yielded a detection of an adult female and another incidental detection; none were detected at a site in Centerfire Creek near the confluence of Boggy Creek. Proposed critical habitat is present along the Black River.

Northern Mexican gartersnake

No records of the northern Mexican gartersnake exist for the Apache-Sitgreaves National Forests. It is assumed to be present in the Black River and tributaries in the Action Area south of the Project boundary. Proposed critical habitat is present along the Black River.

Chiricahua leopard frog

The Chiricahua leopard frog was formerly widely distributed in the Southwestern states, but its range and abundance has been substantially reduced, and habitat destruction, nonnative species such as the Northern crayfish, and chytrid fungus are thought to be factors in the decline of this species. Perennial livestock tanks with adequate cover, water supply and quality, and adequate dispersal corridors close to existing populations may be key in recovering this species. Occupied habitat is present in the designated critical habitat area just outside of the northern boundary of the Project, and within dispersal distance. Translocations are planned at Fish Bench Tank just outside of the southern Project boundary and possibly other locations in the project area.

Loach minnow

The loach minnow is an extremely rare, small cyprinid species typically found in small streams with clean spawning substrates (small, flat rocks). It has not been detected in the Project area but has been found upstream in the East Fork Black River and tributaries. The most recent detection was a single individual in 2005. It is assumed to be present in the East Fork Black River in the project area. The Arizona Game and Fish Department plans to release loach minnow in the West Fork Black River area between crossings on Forest Service Roads 25 and 68 during the term of the Project, in the hope of establishing a viable population. Designated critical habitat in the project area is present in the lower 0.8 miles of the East Fork Black River before the confluence with the West Fork Black River.

Apache trout

The Apache trout is a small salmonid native to small- and medium-sized streams in the White Mountains of Arizona. Cool, clean water with adequate clean spawning gravel and quality pool habitat and cover, productive riffle areas, adequate abundance of macroinvertebrates, and absence of nonnative species are needed for this species to thrive. Several streams within the project area are either Apache trout recovery streams (West Fork Black River, Thompson Creek, Stinky Creek, Hayground Creek, Centerfire Creek metapopulation) or managed for the Apache trout (Home Creek, Hannagan Creek). The East Fork Black

River is managed as a put-and-take recreational fishery using hatchery production. Non-functioning fish barriers exist on several Apache trout streams in the project area. A new fish barrier was constructed on the West Fork Black River near the confluence with the East Fork Black River in 2016 in order to create a West Fork Black River metapopulation. Piscicide will likely be applied upstream in 2020 or later to eliminate nonnative trout. The timing of piscicide application will depend on adequate control of nonnative (brook) trout in the upper reaches of the West Fork Black River and Thompson Creek. Following piscicide treatment, pure strain Apache trout will be stocked. Removal of several of the existing fish barriers on the upper West Fork Black River, Stinky Creek, Hayground Creek, and Home Creek will likely occur during the term of the Project. Prioritization of fish barrier removals and subsequent stocking of Apache trout will be coordinated with AZGFD and will consider the AZGFD document '*Fish Barrier Removal Plan for the West Fork Black River Subwatershed, Arizona*' (AZGFD, 2014).

Effects of the Wallow Fire, drought, and presence of nonnative species have reduced the abundance of Apache trout in many streams in the Project area. In some cases, recent sampling has failed to detect any Apache trout. The species is most abundant in the West Fork Black River.

Species Information for USFS Region 3 Sensitive Species

"A stonefly" (1 species) and "A caddisfly" (3 species)

Very little is known of the life history of these four species of aquatic macroinvetebrates, including abundance and distribution. *Capnia caryi* (a winter stonefly) has been collected at one location on the ASNFs, but outside the project or action areas. Since water quality of streams supporting trout is generally good, it may be that this species is present in the project area, particularly the larger West and East forks of the Black River. *Lepidostoma knulli* was collected at two sites in or upstream of the Project area in June 1999, the East Fork Black River at Three Forks, and the West Fork Black River at the West Fork Campground. *Limnephilus granti* and *Lepidostoma apache* have been collected outside the Action Area. Since so little information exists for these species, and the project and action areas include many perennial streams and perennial springs, some with relatively good water quality and diverse habitats, it may be that all 4 species are present.

Desert sucker and Sonora sucker

The desert sucker and Sonora sucker are both relatively common in medium or larger perennial streams in the Project and Action areas, such as the West Fork Black River, East Fork Black River, and the Black River. As with many aquatic species in the Southwest, their abundance and distribution have been reduced.

These two species often coexist in the same streams, with the desert sucker usually more common. The desert sucker, Sonora sucker, Apache trout, and speckled dace are considered the native species complex for streams in the project area. Adult desert suckers are primarily herbivorous, moving up from pools at night to feed in riffles and runs. Young desert suckers feed on chironomid larvae. Spawning occurs in later winter and early spring in gravel depressions. Life history of the Sonora sucker is similar to the desert sucker, but food habits are more cosmopolitan, with macroinvertebrates important. Spawning occurs in gravel riffles with eggs deposited in the interstitial spaces.

Roundtail chub

The roundtail chub is a cyprinid that can reach a large enough size to be sought as a sport fish. Adults typically are found in deeper (6-7 feet) pools adjacent to riffles and runs. Spawning occurs over gravel after spring runoff concludes. It is most common in the Black River, but small numbers have also been found recently in the West Fork Black River, East Fork Black River, and smaller tributaries to the Black River. Abundance of the roundtail chub in the Black River near and below the Wildcat Point area, where it is most common, is likely influenced by distribution and abundance of the nonnative smallmouth bass.

Definitions

Effects to a species or its habitat from human activities can be direct, indirect, and cumulative. Factors that influence an effect can include proximity of an activity to a species or its habitat, geographic distribution of an activity, timing of an activity in relation to sensitive periods of a species' life history, nature of the effect, duration (short-term, long-term, permanent), disturbance frequency, intensity, and severity (USDA Forest Service 2015b). Cumulative effects are those that result from past, present, and reasonably foreseeable future actions by federal, state, or local agencies or private individuals (40 CFR § 1508.7).

Alternative 1 – No Action

Under the no-action alternative, there would be no treatments and, therefore, no short-term disturbance impacts to aquatic species. However, the potential for habitat improvement toward desired conditions and reduction of the risk of uncharacteristic wildfire would not be realized. Fire can affect aquatic species as runoff and sediment directly or indirectly affect the quality and temperature of the streams. The increased risk of uncharacteristic wildfire would potentially have long-term impacts for all aquatic species under no-action.

Alternative 2 (Proposed Action) and Alternative 3 (Preferred Alternative)

Mortalities, injuries, stress, and alteration of behavior would be the most likely direct results to fish species, reptiles, amphibians, and invertebrates from use of mechanized equipment, foot traffic, prescribed fire, and instream or riparian restoration work, and increased road use. Direct effects result when the proposed activity occurs at the same time and location as the species, or in the case of critical habitat, its primary constituent elements.

Aquatic species present are typically extremely low in abundance and limited in distribution. Some species, such as the narrow-headed gartersnake and Chiricahua leopard frog, are mobile and able to move to refugia. In the case of the northern Mexican gartersnake, it does not occur in the Project area, therefore only indirect effects may occur. The more abundant and more widely distributed species such as the desert sucker and Sonora sucker are generally in larger streams such as the West Fork Black River, East Fork Black River, and Black River, where any activities that might cause direct effects are unlikely to occur.

Indirect effects are separated from a species or primary constituent elements of its critical habitat by time or space. Ground disturbance and vegetation alterations are the most common effects of activities in the Proposed/Preferred Action. These disturbances and alterations typically result in increased fine sediments in streams and other water courses such as wetlands or livestock tanks. Short-term increases in embeddedness in stream substrates often occur and may persist for a longer period if sediment transport capacity of the stream is exceeded (Waters 1994, Henley and others 2000, Wood and Armitage 1997). Increased embeddedness often has a cascade effect that impairs feeding and reproduction of macroinvertebrates, and reduces their production, abundance, and distribution. Diminished macroinvertebrate abundance can affect fish and other organisms at higher trophic levels resulting in

decreases in abundance and distribution that may be short- or long-term. Sight-feeders may forage less efficiently when levels of suspended sediments are higher (i.e. turbidity). Spawning and recruitment of fish species present in the project area could be reduced since all depend on gravel with low to moderate levels of embeddedness. Reduced availability of fish prey could affect populations of narrow-headed gartersnake. Increased sedimentation in livestock tanks, springs, and other amphibian habitat and short-term vegetation alterations could affect feeding, reproduction, and abundance of the Chiricahua leopard frog (USFWS 2007).

Indirect effects are expected to be short-term and minimal, as increased sediment is processed through the stream systems by natural processes such as spring runoff and monsoon. Vegetation is expected to rapidly regrow from natural sources or from scarification and seeding after Project activities are completed. Any indirect effects would likely be undetectable from current conditions.

Any activities undertaken must either maintain existing conditions or move existing conditions towards those desired in the Forest Plan, see chapter 1 (USFS 2015a). Longer-term effects of the Proposed Action would be expected to restore a more natural fire regime and natural vegetation composition, improvements in watershed functioning, and improvements in riparian and aquatic habitats. These in turn would be expected to improve populations and habitats for ESA-listed and USFS Region 3 Sensitive Species, and additionally, other native and desirable nonnative species.

Table 32. Indirect effects summary for the Black River Project

Category	Equipment/Methods	Physical Effects	Effects to Species and Habitats	Design features, BMPs, Conservation measures, and mitigations
Forest, Woodland, and Grassland Health Restoration	Mechanized equipment, hand thinning, prescribed fire	Increased erosion and sedimentation, vegetation alteration, altered hydrology, pollution from petroleum products, increased road use, ash runoff, introduction of nonnative species	Filling in of pools, interstitial spaces, decreased riparian cover, reduced production of prey base (macroinvertebrates), reduced fish foraging, growth, survival, reproduction (egg survival)	Designations of aquatic management zones, restrictions on use of mechanized equipment in stream channels and riparian areas, spreading out of treatments in time and space, restrictions on use by season, slope, and soil type, rehabilitation of skid trails using waterbars, slash, scarification, and seeding; pile and broadcast burn methods, use of low intensity, backing fire; petroleum use and storage restrictions; small areas and limited time frame of stream and riparian treatments, isolation and temporary removal of species encountered in stream work; cleaning and disinfection of equipment; minimizing removal of vegetation along roadsides to only what is needed for safety, leaving vegetation in ditches, performing maintenance as soon as it becomes necessary, maintaining an erosion-resistant surfacing such as grass or rock in ditches, compacting the graded roadway surface to keep a hard driving surface, avoiding unnecessary soil and vegetation disturbance, and providing filter strips between drain outlets and streams; minimizing the number of stream crossings used
Stream habitat, Riparian, Wet Meadow, and Upland Soil Stabilization	Mechanized equipment, hand tools, riparian plantings, instream habitat improvements, headcut improvements, one-rock dams			
Increased use of ASNFs system roads (ML2-4)	Mechanized equipment, hand tools			
Road construction, and reconstruction, closure of existing ML1 roads and temporary roads	Mechanized equipment, hand tools			
Obliteration and decommissioning of roads	Mechanized equipment, hand tools			

Cumulative effects

Cumulative effects result from the incremental effects of the Proposed Action when added to other past, present, and reasonably foreseeable future actions. Acres for some past ASNFs activities overlap the project area. Acres of wildfire suppression activities over the past 25 years include 11 wildfires totaling over half a million acres. Most of these acres were in the 2011 Wallow fire, the largest in Arizona history. All acres in the previous fires were within the boundary of the Wallow fire.

Past Actions

Past ASNFs actions, particularly wildfire suppression, timber management, livestock grazing, and activities associated with private lands have contributed greatly to the existing conditions and departure from desired conditions within the project area.

Past management activities in the project area have resulted in the following:

1) Fuel conditions that contribute to uncharacteristic fire intensity and fire behavior.

2) Changes in vegetation diversity, structural stages, and old growth components within the landscape, tree species composition, tree density levels, and the amount of available herbaceous vegetation present in riparian and upland areas.

3) Diminished soil productivity, which in turn determines future productivity of the vegetation.

4) Changed conditions of upland areas and degraded riparian and aquatic habitats.

5) Altered types and amounts of vegetative soil cover present and condition of soils that contribute to current levels of soil erosion, surface runoff, stream flow, stream turbidity, stream sedimentation, and water quantity and periodicity in wetland and riparian areas.

State, local, and private actions

Some livestock grazing on private land occurs in the project area, and there is some use of private wells and roads. Elk and deer are managed by the Arizona Game and Fish Department (AZGFD). Elk and deer can affect local riparian conditions by removing browse and trampling banks, both of which can result in erosion, contribute sediment to streams, and affect proper functioning of riparian areas.

Game fish, including native species (e.g. Apache trout, roundtail chub) and nonnative (e.g. brown trout) are managed by AZGFD, and the regulation of their distribution and abundance may affect other native species. Piscicide treatment of the West Fork Black River is planned for 2020 or later above the new fish barrier to remove nonnative fish species, followed by stocking with native Apache trout. Chiricahua leopard frogs are also managed by AZGFD, and their abundance and distribution are augmented by reestablishment in areas where not currently present, as well as supplementation of populations that currently exist, and habitat improvements.

Powerline corridors and associated roads required for access can increase the chance of wildfires occurring, and have resulted in invasive plant species becoming established, affecting adjacent areas and vegetation. Roads will require ongoing maintenance to provide for vehicular traffic throughout the Project area not associated with the Proposed Action. Maintenance activities will require some ground disturbance and vegetation removal that may result in short term stream sedimentation and some habitat alteration.

Determinations

Species found in the Project area are assumed to be adapted to a frequent-fire regime typical of Ponderosa pine forests in the southwestern United States. This would include tolerance of low or moderate levels of fire at infrequent intervals. For relatively short periods of time, ash and sediment may reach stream courses, and vegetation removal may result in short-term increases in water temperature. Species are also assumed to be adapted to a spring runoff period and monsoon season of rainfall, with the attendant pulses of water and sediment that occur. Effects from the 2011 Wallow fire are ongoing in many areas, but at diminishing intensity in most cases. Some areas of severe burn will have more long-term effects and take longer to return to a pre-Wallow fire condition. Much of the Fish Creek watershed burned at severe intensity, and even though outside the Project area, will continue to affect conditions downstream in the Black River within the Project area. The ongoing effects of recovery from the Wallow fire will tend to obscure effects occurring from the Proposed Action in the Project or Action areas.

Design criteria, Best Management Practices (BMPs), mitigations, and conservation measures directed at species or habitats are part of the Proposed Action and intended to minimize or reduce some effects of the Proposed Action to resources (Appendix B-Design Features and Appendix C-Flexible Toolbox Approach for Aquatic and Watershed Restoration Activities). The use of Aquatic Management Zones of various sizes, with site specific restrictions on the types of activities, equipment, and seasons during which activities occur, is expected to reduce interactions with species and indirect effects such as sedimentation. Project activities are spread out over time and space, reducing effects spatially and temporally. Direct effects would be extremely unlikely and discountable, and indirect effects should be insignificant or undetectable compared to background levels. Provisions in timber harvest contracts are intended to protect resource values. Project activities must also comply with laws such as the Clean Water Act.

If ESA-listed or USFS Region 3 Sensitive species are found in areas or in numbers not covered by existing analyses (see Black River Forest Restoration Aquatics Specialist Report and Biological Assessment documents), the Proposed Action may need to be modified to comply with the ASNFs Forest Plan (USFS 2015a) or the Forest Plan amended. For ESA-listed species, re-consultation will be initiated with the U. S. Fish and Wildlife Service. Determinations are shown below in table 33.

Table 33. Effects determinations for ESA listed and USFS R3 sensitive aquatic species and habitats in or potentially in the Black River Project area.

Species Name	Species Determination	Critical Habitat Determination
Narrow-headed gartersnake	NLAA	NLAM (change to NLAA after designation)
Northern Mexican gartersnake	NLAA	NLAM (change to NLAA after designation)
Chiricahua leopard frog	NLAA	NE (None present)
Apache trout	NLAA	N/A (None designated/proposed)
Loach minnow	NLAA	NLAA
“A stonefly”	a	N/A
“A caddisfly”	a	N/A
“A caddisfly”	a	N/A
“A caddisfly”	a	N/A
Desert sucker	a	N/A
Sonora sucker	a	N/A
Roundtail chub	**a**	**N/A**

*NLAA=May Affect, Not Likely to Adversely Affect; NLAM=Will Not Destroy or Adversely Modify; NE=No Effect; N/A=Not Applicable a= May Impact Individuals, but is Not Likely to Result in a Trend Toward Federal Listing or Loss of Viability (USFS Region 3 Sensitive Species)

Chapter 4 - Agencies and Persons Consulted

The following Forest Service employees served on the interdisciplinary team to complete the analysis for this project.

Name	Title
Paul Hancock	Deputy Forest Supervisor, Responsible Official
Alissa Tanner	Alpine District Ranger
Rob Lever	Springerville District Ranger
Sheila Williams / Keith Fox / Orry Hatcher	NEPA Coordination
Loren LeSueur	Wildlife Biologist
Stephen Boe / Benjamin Cram	Fisheries Biologist
James Johnson	Silviculturist
Joel Saaranen	Timber Staff
Adam Simmons	Fuels Specialist
Chris Miller	Forest Engineer
John Rihs	Hydrologist
Eric Robertson	Forest Soil Scientist
Stephanie Welch/Aoife Kilmartin	District Archaeologist-Alpine
Barbara Romero	Recreation Specialist
Ron Mortensen	Range Staff
Mary Ellen Komnath	Geographic Information Systems Coordinator

The Forest Service consulted the following individuals, Federal, State, tribal, and local agencies during the development of this environmental assessment:

Federal, State, and Local Agencies:

Bureau of Land Management
Natural Resources Conservation Service
US Fish and Wildlife Service
US House of Representatives – Office of Tom O'Halleran
US Senate – Office of Jeff Flake
US Senate – Office of John McCain
Arizona Governor – Office of Doug Ducey
Arizona House of Representatives - Office of John Drew
Arizona House of Representatives – Office of Becky A. Nutt
Arizona House of Representatives – Office of Eric Descheenie
Arizona House of Representatives – Office of Winona Benally
Arizona House of Representatives – Office of Brenda Barton
Arizona House of Representatives – Office of Bob Thorpe
Arizona Senate – Office of Gail Griffin
Arizona Senate – Office of Jamescita Peshlakai
Arizona Senate – Office of Sylvia Allen

Arizona Department of Environmental Quality
Arizona Department of Transportation
Arizona Game and Fish Department
Arizona State Forestry
Arizona State Historical Preservation Office
Arizona State Land Department
Arizona State Parks
Northern Arizona University
Ecological Restoration Institute
University of Northern Arizona
Apache County
Greenlee County
Navajo County
Eastern Arizona Counties
Little Colorado River Plateau RC&D
Eagar/Springerville Chamber of Commerce
Alpine Fire Department
Eagar Fire Department
Nutrioso Fire Department
Alpine Alliance
Eagar Town Council

Tribes:

Pueblo of Acoma Tribe
Fort McDowell Yavapai Nation
Yavapai-Apache Nation
Yavapai-Prescott Indian Tribe
Hualapai Tribe
White Mountain Apache Tribe
San Carlos Apache Tribe
Tonto Apache
Hopi Tribe
Navajo Nation
Navajo Nation, Ramah Chapter
Pueblo of Zuni

Others:

Scoping list available upon request.

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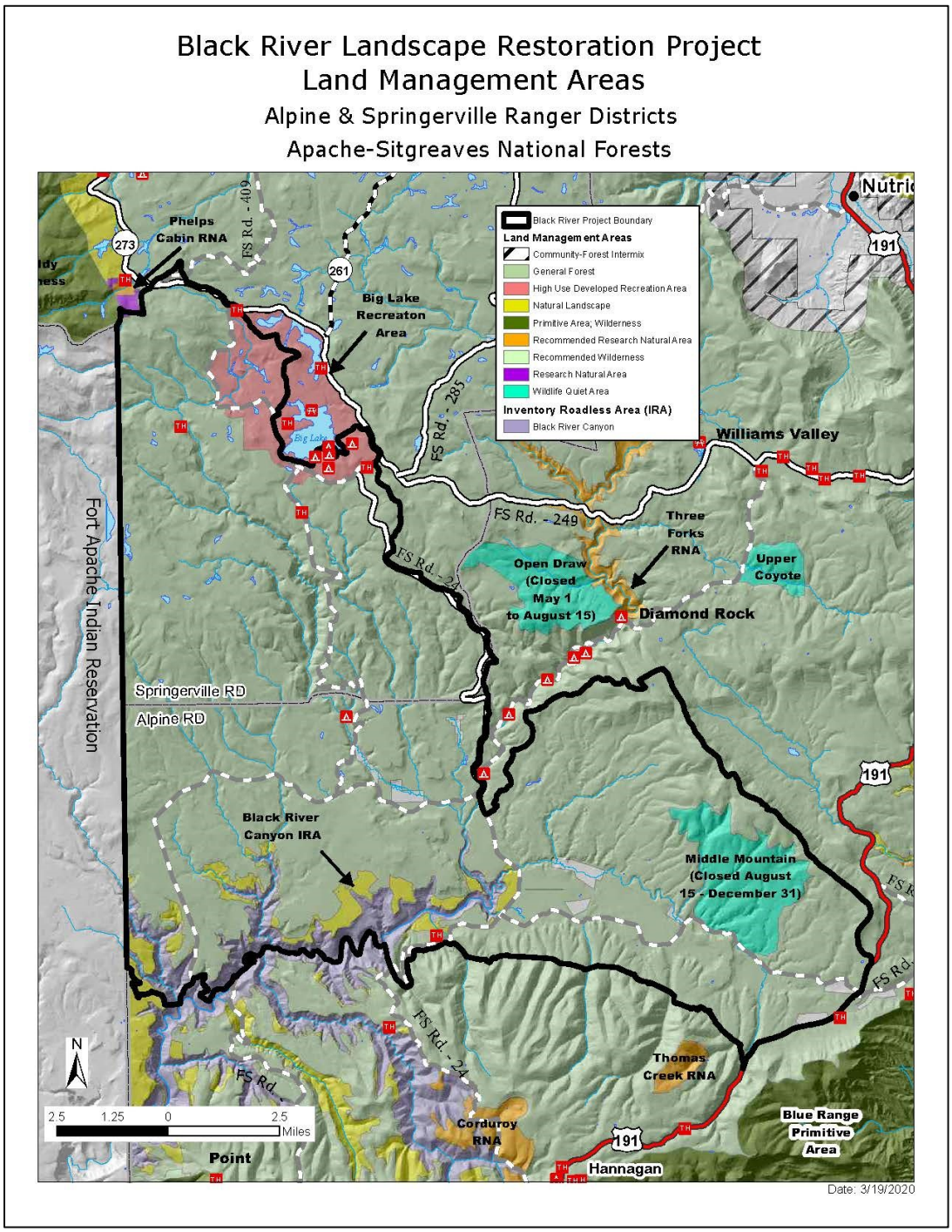
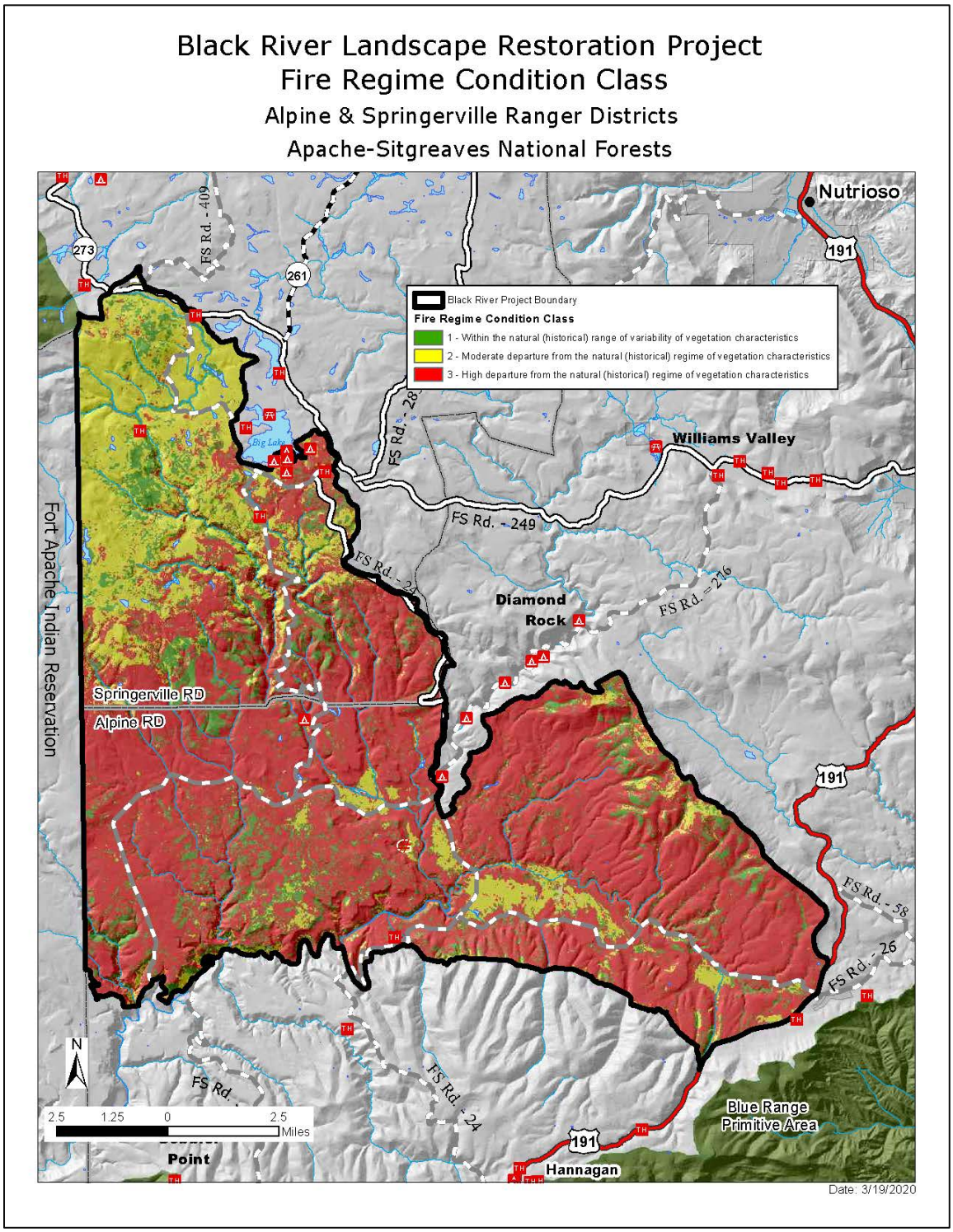
Appendix A-Maps

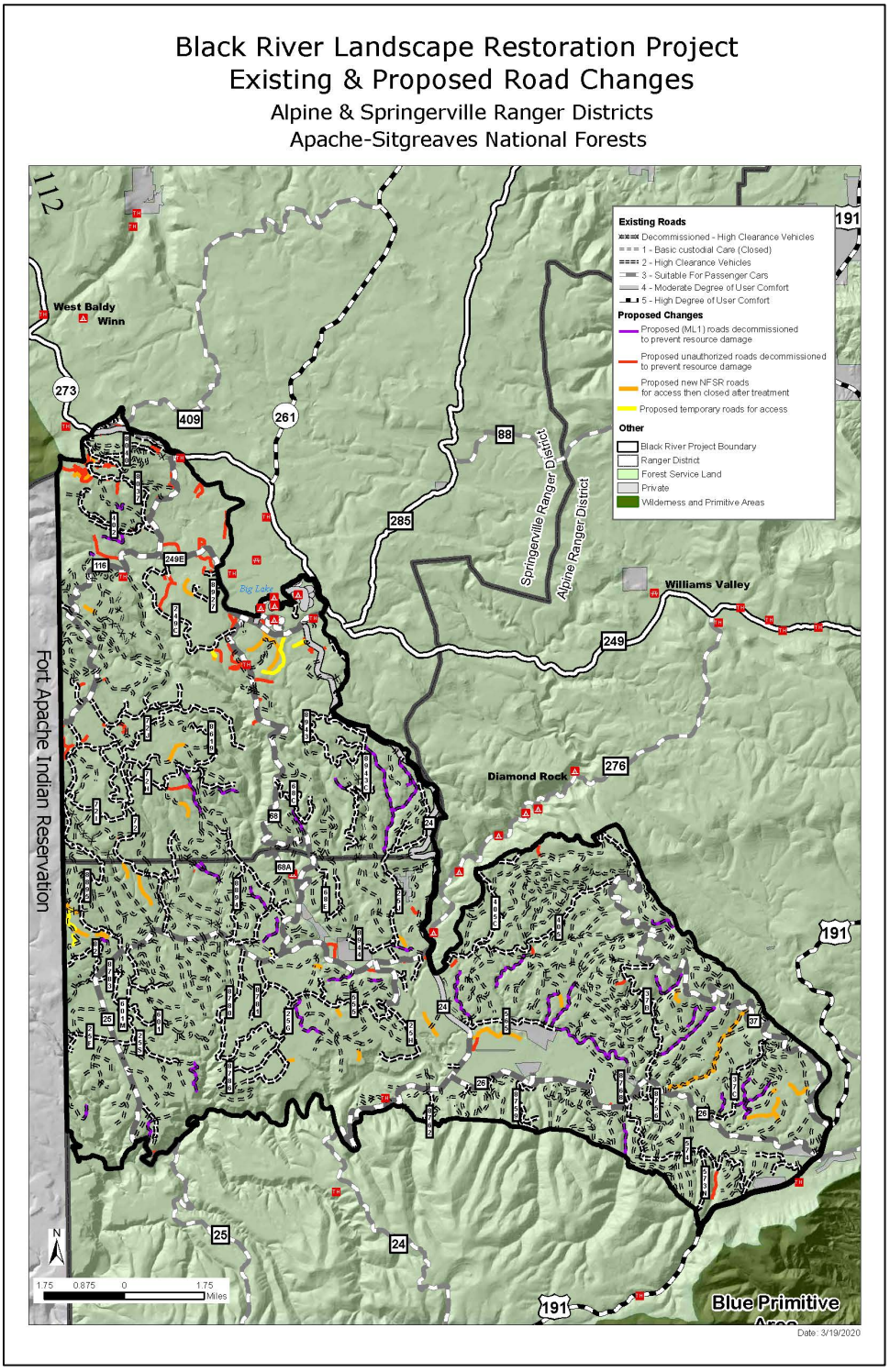
Map 1. Management Areas



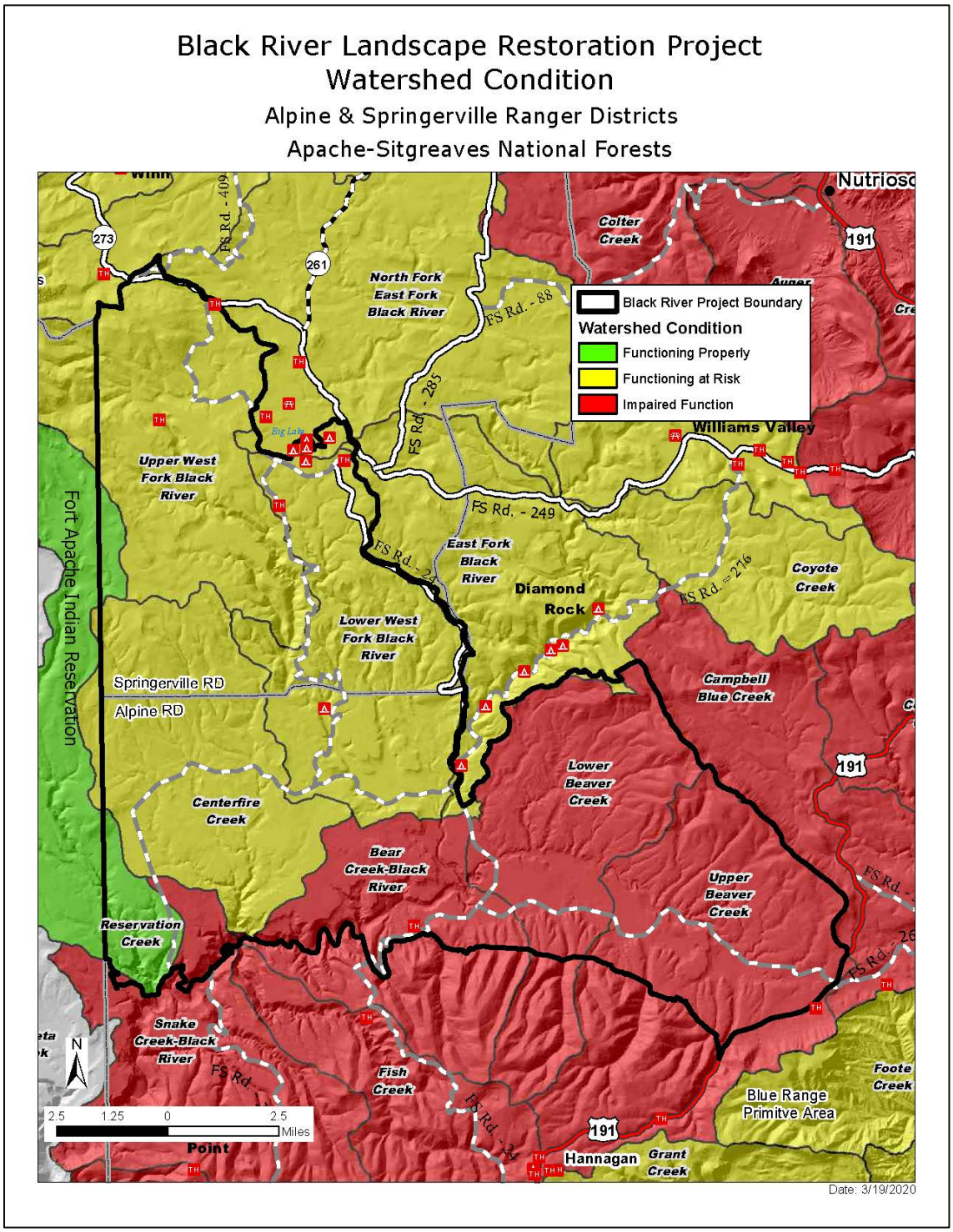
Map 2. Fire Regime Condition Class



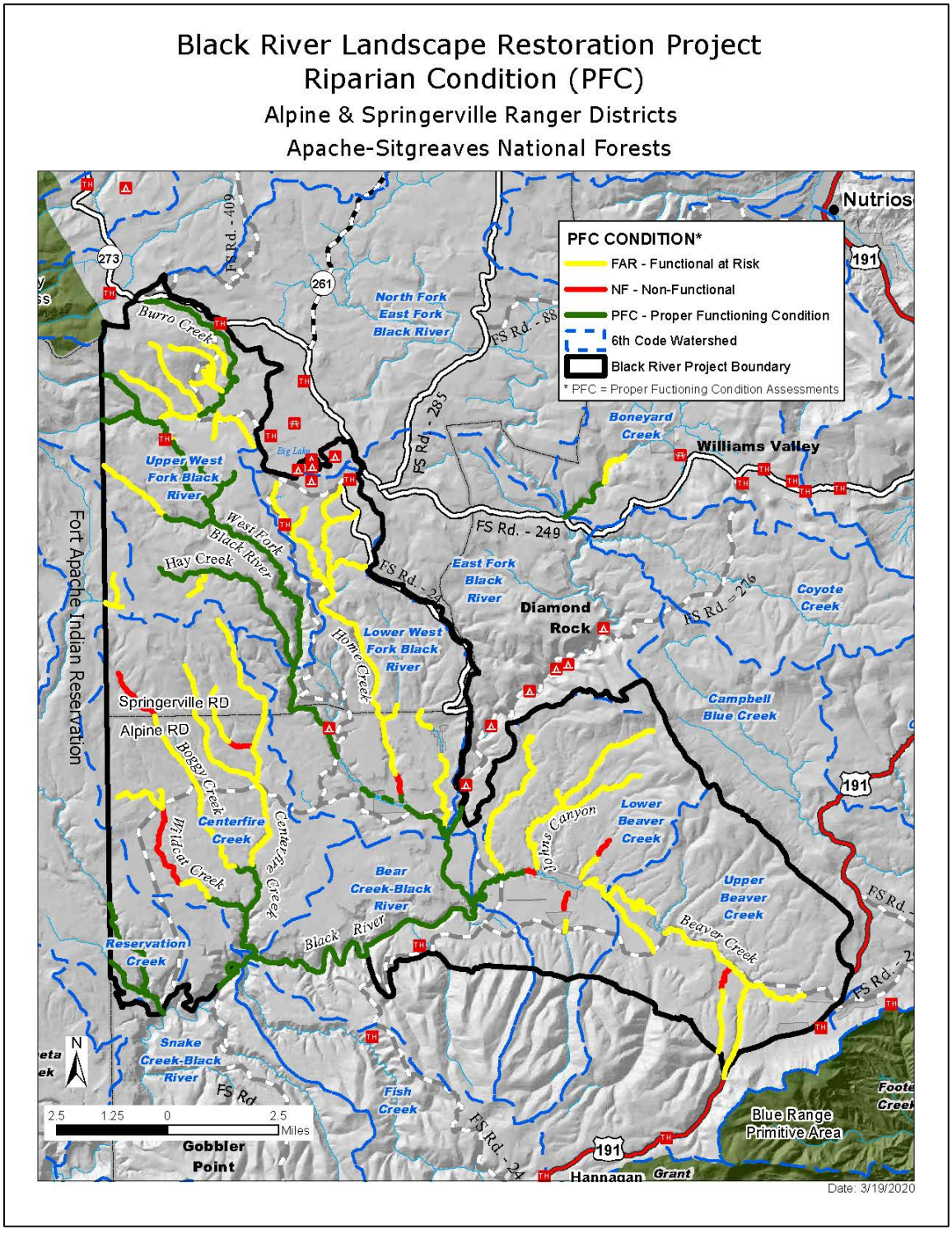
Map 3. Transportation, Existing and Proposed Changes



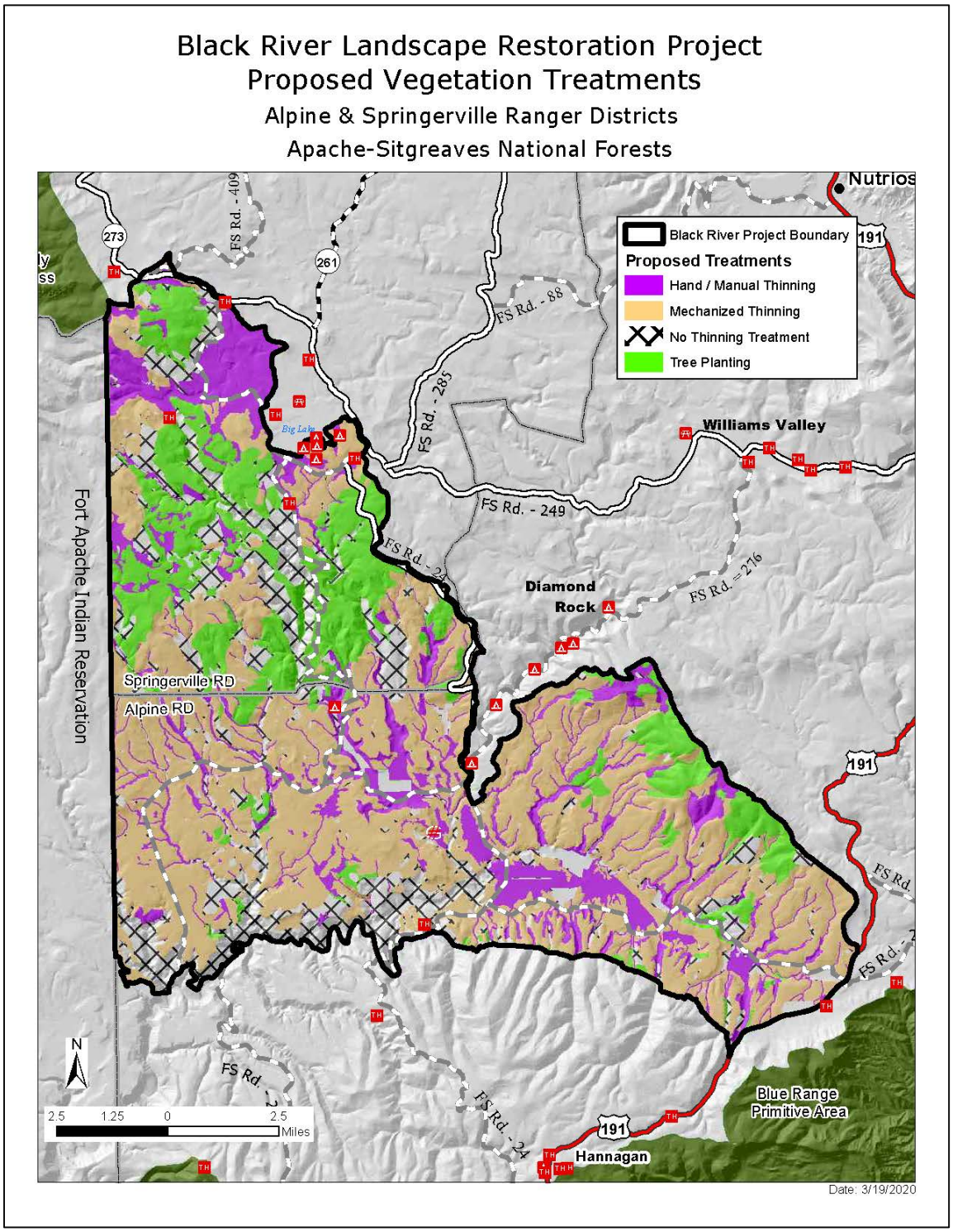
Map 4. Watershed Condition Classes



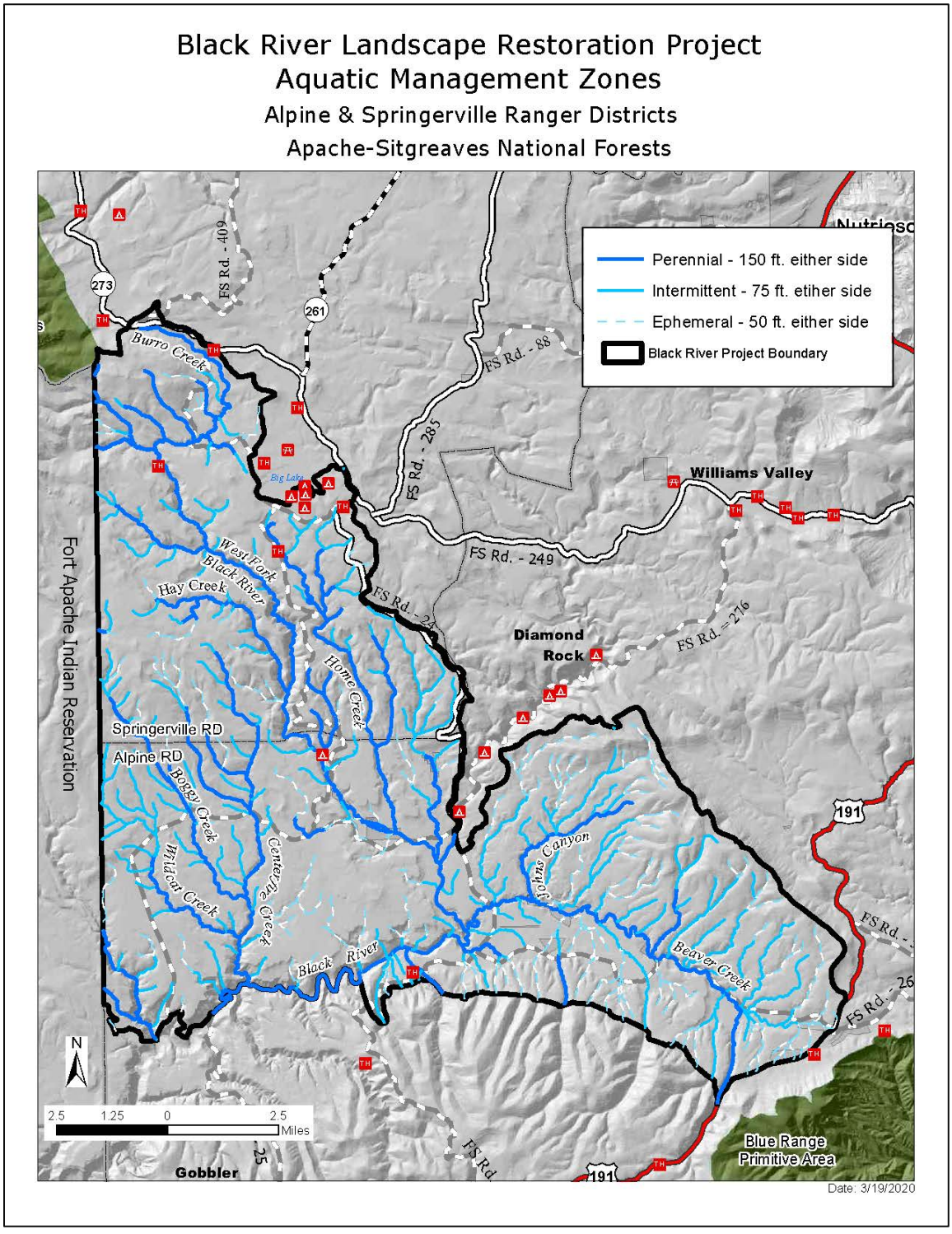
Map 5. Proper Functioning Condition Classes-Riparian Area



Map 6. Proposed Vegetation Treatments



Map 7. Aquatic Management Zones



Appendix B-Design Features

Applicable Actions	Main Resource Area(s)	Item	Design Criteria Description
• Project-wide management ⬩ Harvest Treatments	• Hydrology & Soils	Dry or Montane Meadow Protection	Meadows not to be treated would be marked as “protected areas” on the ground and treatment maps.
• Project-wide management ⬩ Harvest Treatments ⬩ Fireline Construction	• Hydrology & Soils	Slope Restrictions and Sensitive Soil Types	Mechanized equipment usage, including mechanized fireline construction, would be restricted to slope gradients of 25% or less on fragile or sensitive soil types (e.g., cinder cone or Datil soils) and 40% or less in all other areas. Areas to exclude mechanized equipment usage shall be marked with a “protected area” designation on sale contract maps and designed on the ground. Treatment for protected areas should receive manual thinning methods including contour felling of trees to help mitigate soil loss. Burning measures should aim to retain adequate coarse woody debris criteria post-burn especially on sensitive soils and steep slopes to help mitigate soil loss. Slash can be thinned, lopped (cut) and scattered, piled for burning, or retained for soil stabilization, wildlife values, or other resource benefits such as along skid trails in addition to water-barring for additional erosion control. Slash and/or chips can also be scattered on landings.
• Project-wide management ⬩ All actions around streams, wetlands, or other wet areas. ⬩ All instream and riparian actions	• Aquatics	Invasive Species	Any equipment or personnel used for activities in and around streams, natural or constructed waters, springs, or wetlands shall use appropriate decontamination procedures to prevent the spread of disease (e.g. chytrid fungus) and aquatic invasive species. When using imported (outside the project area) gravel for augmentation or other channel restoration purposes, it should be free of invasive species, non-native seeds, and aquatic diseases. If necessary, wash gravel prior to placement and allow it to dry completely for a minimum of 2 days to prevent spread of chytrid fungus.

Applicable Actions	Main Resource Area(s)	Item	Design Criteria Description
• Program-wide management ⬧ All actions around streams, wetlands, or other wet areas. ➢All instream and riparian actions	• Aquatics	ESA-listed species •Apache trout •Loach Minnow Other sensitive aquatic species	The width of Aquatic management zones (AMZs)—generally 50 to 300 feet—is determined at the project level based on stream attributes (e.g., class and type, channel condition, aspect, side slope steepness, erosion hazard of adjacent lands). The AMZ for waters with high resource value and quality would be at the greater width of this range. Management activities within AMZs are either modified or excluded to mitigate impacts to aquatic resources. AMZs would be established and mapped and described for vegetation or other restoration treatments, and contract documentation, based on stream designation and ESA species habitat needs. Otherwise restricted activities (e.g. mechanical treatments) may occur within aquatic management zones (AMZs) for ESA listed species if on-the-ground observations indicate minimal resource effects and if recommended by a hydrologist/soils/aquatics specialist and approved by a FS responsible official. AMZs of 300 ft. will be applied on either side of bankfull width of the 0.8 mi of the East Fork Black River (critical habitat for loach minnow) and West Fork Black River between FSR 25 and FSR 68 in the Project area AND Apache trout streams shown in the ASNFs GIS layer. In Apache trout and loach minnow AMZs: no vehicles or mechanical equipment allowed (except for instream habitat structure work); vegetation can only be removed mechanically if equipment can be placed outside the AMZ and remove vegetation without either equipment or cut trees touching the ground. Instream and riparian restoration activities would be scheduled to avoid effects to listed aquatic species. Work should occur during base-flow conditions, and on dry or frozen riparian soil conditions where possible. Mechanical removal of vegetation from AMZs should be done in a manner to minimize soil disturbance and removed vegetation would be placed outside the AMZ. Trees may be felled into the stream channel with biologist recommendation and FS responsible official approval.

Applicable Actions	Main Resource Area(s)	Item	Design Criteria Description
• Program-wide management ⬩ Mechanized and manual treatments-instream restoration	• Aquatics	ESA-listed species • Narrow-headed gartersnake (NGS) proposed critical habitat • Northern Mexican gartersnake (NMG) proposed critical habitat	Use manual thinning in techniques in AMZs; and pile slash outside AMZs. When work occurs in an AMZ with ESA species a Forest biologist should be on site during restoration treatments using heavy equipment. An AMZ of 600 ft. will be applied on either side of the mainstem Black River (occupied/proposed critical habitat for narrow-headed gartersnake and northern Mexican gartersnake) and Reservation Creek which shall be included in the contract, agreement, and project maps. Within these two AMZs, no vehicles or mechanical equipment allowed (except for instream habitat structure work); vegetation can only be removed mechanically if equipment can be placed outside the AMZ and remove vegetation without either equipment or cut trees touching the ground. Any narrow-headed and northern Mexican gartersnakes found would be relocated by biologists. Disturbance of rock/boulder piles and large woody debris in narrow-headed or northern Mexican gartersnake proposed critical habitat would be avoided during their brumation period (December-February).
• Program-wide management ➢Roads	• Aquatics	ESA-listed species • Narrow-headed gartersnake (NGS) proposed critical habitat • Northern Mexican gartersnake (NMG) proposed critical habitat	No temporary roads (e.g. skid trails) would be built in narrow-headed or northern Mexican gartersnake proposed critical habitat during their brumation period (December-February). Outside of this timing restriction temporary roads are allowed to be built.

Applicable Actions	Main Resource Area(s)	Item	Design Criteria Description
• Program-wide management ➢Instream and riparian restoration activities ➢Prescribed burning	• Aquatics	ESA-listed species • Narrow-headed gartersnake (NGS) proposed critical habitat • Northern Mexican gartersnake (NMG) proposed critical habitat	Burning within narrow-headed gartersnake occupied habitat or proposed critical habitat will occur during the surface active period (March –November) when gartersnakes are more likely within AMZs and not hibernating in wood piles, debris jams, etc. No pile burning (slash piles or large woody debris) will occur within NHG and NMG habitat up to and including the 600-foot AMZ.
• Program-wide management ➢Instream and riparian restoration activities ➢Mechanical equipment ➢Roads	• Aquatics	ESA-listed species • Chiricahua leopard (CL) frog occupied habitat • Narrow-headed gartersnake (NGS) proposed critical habitat • Northern Mexican gartersnake (NMG) proposed critical habitat	AMZs of 100 ft. will be designated around all potentially occupied CL frog locations (e.g., stock tanks, ponds, and springs). If Chiricahua leopard frog occupied/breeding sites are discovered during the course of the Project, a no-treatment buffer (no thinning, no direct ignition) ¼ mile distant from the site (i.e., tanks) or along a topographic break would be designated by a biologist. Mechanical equipment may be used to reach into the CL frog AMZ based on prescriptions determined by the silviculturist and biologist to meet restoration objectives for that habitat. Any earthen tanks, ponds, springs, etc. that are discovered to have populations of Chiricahua leopard frogs, narrow-headed or northern Mexican gartersnakes shall not be used as water sources for any activity. Structural erosion control measures (e.g. for roads) within occupied, potentially occupied or critical habitat, including associated AMZs, for the Chiricahua leopard frog, Narrow-headed, or Northern Mexican gartersnakes would exclude any woven mesh materials such as wattles that can entrap these animals. Structural erosion control measures not made of biodegradable material (e.g. silt fences) would be removed and material contoured in or removed within one year to prevent them from causing resource issues and decomposing on site.

Applicable Actions	Main Resource Area(s)	Item	Design Criteria Description
• Program-wide management ➢Drafting water for restoration activities	• Aquatics	ESA-listed species CL Frogs Other aquatic species	• All activities Avoid water withdrawals from streams bearing aquatic species whenever possible. No water withdrawals would be made from occupied or suitable habitats for the Chiricahua leopard frog, *except* perennial streams. If water withdrawals are required for restoration activities: any water withdrawals, equipment will be disinfected or dried completely to prevent the spread of aquatic diseases or aquatic invasive species, and pumping equipment will be screened to prevent entrapment or entrainment of ESA-listed, sensitive species or other native fish species. Pump intakes should have fish screens of 3/32 inch mesh or less and would have an intake flow of less than 1 cubic foot per second (cfs). Water drafting should take no more than 10% of the stream flow and would not dewater the channel to the point of isolating species and should be submerged at least 3 feet below surface level of the water

• Program-wide management ➢Instream restoration work	• Aquatics	Conservation measures for any perennial streams for fish, listed and sensitive species.	• Construction Zone If construction or activity is occurring within an AMZ for instream restoration, install block nets at up and downstream locations outside of the construction zone to exclude fish from entering the project area. Leave nets secured to the stream channel bed and banks until construction activities within the stream channel are complete. If block nets or traps remain in place for more than one day, monitor the nets or traps at least on a daily basis to ensure they are secured to the banks and free of organic accumulation and to minimize fish predation or inadvertent capture of other aquatic species in the trap. • Capture and release of species within construction zone Species trapped within the isolated work area would be captured and released at a safe release site, preferably upstream of the isolated reach, for fish in a pool or other area that provided cover and flow refuge. Collect fish in the best manner to minimize potential stranding and stress by seine or dip nets as the area is slowly dewatered; baited minnow traps placed overnight, or electrofishing may be considered if other options are ineffective. Fish should be handled with extreme care and kept in water the maximum extent possible during transfer procedures. A healthy environment for the stressed fish should be provided – large buckets (five-gallon minimum to prevent overcrowding) and minimal handling of fish. Place large fish in buckets separate from smaller prey-sized fish. Monitor water temperature in buckets and well-being of captured fish. If buckets are not being immediately transported, use aerators to maintain water quality. As rapidly as possible, but after fish have recovered, release fish. In cases where the stream is intermittent upstream, release fish in downstream areas that have adequate water to support fish and away from the influence of construction. Capture and release should be supervised by a fishery biologist experienced with work area isolation and safe handling of all fish. • Dewatering construction site When dewatering is necessary to protect species or critical habitat, divert flow around the construction site with a coffer dam (built with non-erosive materials), taking care to not dewater downstream channels during dewatering. Pass flow and fish downstream with a by-pass culvert or a water-proof lined diversion ditch. Diversion sandbags can be filled with material mined from the floodplain as long as such material is replaced at the end of project. Small amounts of instream material can be moved to help seal and secure diversion structures. If pumps are required to dewater, the intake should have a fish screen(s) as described above. Dissipate flow

Applicable Actions	Main Resource Area(s)	Item	Design Criteria Description
			energy at the bypass outflow to prevent damage to riparian vegetation or stream channel. If diversion allows for downstream fish passage, place diversion outlet in a location to promote safe reentry of fish into the stream channel, preferably into pool habitat with cover. Pump seepage water from the de-watered work area to a temporary storage and treatment site or into upland areas and allow water to filter through vegetation prior to reentering the stream channel. • Surface Water Withdrawals Surface water may be diverted to meet construction needs, but only if developed sources are unavailable or inadequate. If aquatic species are or may be present (e.g. fish, tadpoles, mollusks), diversions may not exceed 10% of the available flow and fish screen(s) would be installed, operated, and maintained. • Stream re-watering Upon project completing, slowly re-water the construction site to prevent loss of surface water downstream as the construction site streambed absorbs water and to prevent a sudden release of suspended sediment. Monitor downstream during re-watering to prevent stranding of aquatic organisms below the construction site. Avoid water withdrawals from streams bearing aquatic species whenever possible.

Applicable Actions	Main Resource Area(s)	Item	Design Criteria Description
•Program-wide management ➢Instream restoration work	• Aquatics	Conservation measures	• Implementation 1) Visually monitor during project implementation to ensure effects are not greater (amount, extent) than anticipated and to contact USFWS and Army Corp of Engineers representatives if problems arise. 2) Fix any problems that arise during project implementation. 3) If a biologist/hydrologist is not the Contracting Officer Representative, then COR's should regularly coordinate with biologist/hydrologist to ensure contractor is following all stipulations. • Post project 1) Post-project review should be conducted by the Forest Service after monsoon and spring high flows. 2) For each project, conduct a walk through/visual observation to determine if there are post-project affects that may not have met desired outcomes. For aquatic organism passage and revegetation projects, monitor for the following: 1) Aquatic Organism Passage Projects – Note and repair any problems with channel scour or bedload deposition, substrate, discontinuous flow, vegetation establishment, or invasive plant infestation. 2) Revegetation – For all vegetation treatment projects, including site restoration, monitor for and remove invasive plants until native plants become established. 3) In cases where remedial action is required, such actions are permitted without additional consultation if they use relevant design criteria and aquatic conservation measures and the effects of the action categories are not exceeded.

• Project-wide management ➢ Harvest Treatments ➢ Watershed / steam channel restoration	• Aquatics, hydrology, soils, vegetation	Stream channel, water quality protection	Perennial, intermittent, and well defined ephemeral stream channels and other water features such as lakes, ponds, and reservoirs are to be identified and properly labeled on contract and project maps as aquatic management zones (AMZs). AMZs shall be clearly identified, mapped, and designated. Crossing aquatic management zones (AMZs) would be at designated locations only and at right angles to channels. Designated road and skid trail stream crossings would be recommended by the watershed specialist and approved by the FS responsible official. There should be no skidding or road construction in or parallel to the AMZs, wetlands, or springs and their outflows. There should be no landings, log decks or burn piles placed within AMZs. These should be located upland and outside at least 100 feet from meadows, water, and riparian features. Place appropriate temporary sediment barriers around sites where potentially significant levels of erosion may enter the stream directly or through road ditches. Closed skid trails and roads should have adequate runoff and erosion control features (e.g. water bars and lead out ditches) which provide adequate filter distance between structure outlets and the channel and do not divert run-off into the stream channel. Any excess debris should be removed above the ordinary high water mark. There should be no removal of trees with root systems providing stream bank or channel stability. AMZs should be considered protected areas. However, otherwise restricted activities (e.g. mechanical treatments) may occur within AMZs if on-the-ground observations indicate minimal resource effects and if recommended by a hydrologist/soils/aquatics specialist and approved by the FS responsible official. Ground disturbing activities should be limited or restricted to when soils are dry or solidly frozen enough to prevent soil displacement such as rutting, pooling, erosion, pumping, displacement, etc. All equipment maintenance and fueling shall be conducted a minimum of 150 feet from any natural waterbody or wetlands, or if topographical restrictions exist, such as constricted valleys, place away from any natural water body or wetland to the maximum extent possible. Existing access roads and stream crossings would be used whenever possible, unless new construction would result in less habitat or resource disturbance and the old trail or crossing is retired.

Applicable Actions	Main Resource Area(s)	Item	Design Criteria Description
			Culverts, temporary bridges, low-water crossings, or log-fords would be required on all temporary roads and skid crossings on all streams that would have flowing water during the life of the temporary crossing. Temporary road and skid trail crossings would be removed when no longer needed. Any fill material would be removed and the channel and stream banks restored to pre-project condition. For stream restoration stockpile materials within the 100-year floodplain where appropriate and use erosion control methods to prevent materials from infiltrating the streams.
• Aquatic Restoration Treatments ➢Heavy equipment use for stream restoration	• Aquatics, hydrology, soils, vegetation	Aquatic restoration	Heavy equipment should be used from the top of the bank in aquatic restoration activities, unless instream use would result in less damage to the aquatic ecosystem as determined by a watershed specialist and/or biologist and approved by the FS responsible official. Restrict time in which heavy equipment is in stream channels, riparian areas, and wetlands to only that required to complete the work. Complete earthwork as quickly as possible and prior to monsoons.
• Aquatic Restoration Treatments ➢Accessibility to work areas ➢Heavy equipment use for stream restoration	• Aquatics, hydrology, soils, vegetation	Headcut and grade stabilization	Headcuts inaccessible by existing roads or on erosive soils can receive mechanized treatment if done under dry or frozen soil conditions. Restrict time in which heavy equipment is in stream channels, riparian areas, and wetlands to only that required to complete the work.

Applicable Actions	Main Resource Area(s)	Item	Design Criteria Description
• Project-wide management ➢Prescribed Fire	• Aquatics, hydrology, soils, vegetation, wildlife	Stream channel, water quality protection ESA Species	Aquatic management zones (AMZs) would be established and mapped and described on burn plans and other prescribed fire documentation, based on stream designation and ESA species habitat needs. No ignitions would occur within AMZs and aspen clones; fire should back down to riparian areas after ignition. AMZs will be burned after adjacent upland burn units to provide adequate herbaceous buffers. Treatment of AMZs will be implemented in stages, dispersed in time and space; only a portion of an AMZ should be burned within a given year. Fire prescriptions will be adaptively managed provided a patchy mosaic so that fire intensity is minimized and soil health and productivity are maintained. High soil burn severity should occur on <5% areal extent within an AMZ for each burn unit. Less than 5% mortality in the mature forest canopy along a streamside in each burn unit should occur. Treatments within WUI may take priority over other considerations within AMZs: however avoidance or lightest impacts to the AMZs should be considered when planning these treatments. Fire personnel should coordinate with the appropriate specialists to be aware of and address concerns (e.g., MSO PACs) with low altitude helicopter flights prior to implementation. Hand thinning may occur to remove trees and pruning may remove lower limbs where needed to meet objectives. Slash fuels and deadfall may be lopped and scattered or removed from the burn unit. Snags within 150 feet of control lines may be cut and moved or removed. Containment lines may be created as needed (not recommended within AMZs), and would be rehabilitated in accordance with Forest Service direction. If containment lines should be used within an AMZ, only raking, brushing (<3ft wide), leaf blower, or other techniques that cause minimal soil disturbance or erosion are to be used.

Applicable Actions	Main Resource Area(s)	Item	Design Criteria Description
• Project-wide management ➢ Erosion control measures and site restoration ➢ Roads	• Aquatics, hydrology, soils, vegetation	Aquatic restoration Post-restoration activity rehabilitation measures	All berms and depressions (e.g. ruts) created along the skid trail or temporary roads would be filled in and/or graded to restore the natural grade of the slope as much as possible. These should be left in a condition where erosion and sedimentation are reduced, and natural vegetation is able to re-establish itself. Water bar spacing should be approximately 130 feet for slopes 0-5% and 100 feet for slopes 6-10%. Any system roads to be left open to the public (ML 2+) would be left in standard condition. Skid trails, landings, temporary roads, paths, stream crossings, and staging and stockpile areas which are to be closed post-treatment would be scarified and restored with a certified weed-free mix of native, perennial grasses or sterile cereal grains that would be specified in the contract, or other measures used such as straw mulch or jute matting. Replant each area requiring revegetation prior to or at the beginning of the first growing season following the completion of work. When rehabilitating skid trails and temporary roads consider using methods such as creating barriers with slash, berms, down logs, rocks, etc. to prevent access to revegetated sites by ungulates or unauthorized persons. Scarification or ripping of landings should be conducted in a manner as not to mix the surface soil and subsoil to the point where subsoil becomes inverted and exposed at the surface. Place barriers—boulders, fences, gates, etc.—outside of the bankfull width and across traffic routes to prevent off-road vehicle access into and across streams. Provide site protection (e.g. hydromulch, erosion mat, spread slash, etc.) on newly disturbed soils in channel restoration and road crossing reconstruction sites as needed and where feasible.
• Project-wide management	• Aquatics, hydrology, soils, vegetation	Coarse woody debris, Slash management	Maintain a minimum of 5 tons/acre following timber and fuels treatments; higher amounts of coarse woody debris may be necessary following timber and fuels treatments based on slope, soils, etc. as recommended by hydrologists/soils specialists and approved by the FS responsible official. Implement standard protocols for slash to prevent beetle infestation as necessary including monitoring piles for beetle activity and requiring immediate removal should insect activity be discovered.

Applicable Actions	Main Resource Area(s)	Item	Design Criteria Description
• Project-wide management ⬩ Fence placement	• Aquatics, hydrology, soils, vegetation, wildlife	Ungulate exclosures	Fence placement should allow for lateral movement of a stream and to allow establishment of riparian plant species. To the extent possible, fences would be placed outside the channel migration zone. Minimize vegetation removal, especially potential large wood recruitment sources, when constructing fence lines. When using pressure treated lumber for fence posts, complete all cutting/drilling offsite (to the extent possible).

Applicable Actions	Main Resource Area(s)	Item	Design Criteria Description
• Project-wide management ⬩ Harvest treatments ⬩ Prescribed burns	• Wildlife	Den / Rendezvous site buffer for Mexican wolves Stream buffer for NMMJM Breeding Restriction for MSO Breeding Restriction for NOGO	If active raptor nests are found within the project area during project implementation, a buffer or timing restrictions, specific for the species, would be placed about the active nest during their breeding season. Consultation with the FS biologist would be required for all active raptor nests found in the project area. A no action buffer of 1 mile surrounding Mexican wolf den sites found in the project area to limit or eliminate disturbance to the wolves would be in place during April 1-July 31. If a rendezvous site is located within the project area, there would also be a 1 mi no action buffer around the rendezvous site from June 1 to Sept 30. A seasonal restriction during the active season (June 15-Oct 15) of the New Mexico Meadow Jumping Mouse (NMMJM) including critical habitat, 100m from any perennial stream would be in effect for all project activities. Exception to above seasonal restriction for NMMJM: minor hand treatments (ca. 5-15 trees per acre) may occur within the NMMJM buffer during the inactive season to remove encroaching conifers and improve herbaceous vegetation and increase diversity in NMMJM habitat. Broadcast burning within Mexican Spotted Owl (MSO) nest cores would only occur at low severity. Any fences or exclosures erected within PAC boundaries will be constructed of pipe rail fencing to reduce the risk of owl collisions and mortality. A seasonal restriction (Mar 1 – Aug 31) on project activities within 1/4mi nesting location or PACs would be in effect. Implement activities in surveyed occupied goshawk post fledging-family areas (PFAs) only outside of the breeding season (March 1 through September 30). In unsurveyed management units for MSO (PACs), NMMJM (i.e., Critical Habitat, Perennial Streams), and Goshawk (PFAs), the Forest Service would assume occupancy and seasonal restrictions would apply. Any exceptions to seasonal restrictions or buffer zones for any wildlife species would require a recommendation from a Forest Service biologist and approval from the FS responsible official.

Applicable Actions	Main Resource Area(s)	Item	Design Criteria Description
• Project-wide management ♦ Harvest Treatments	• Forest vegetation, wildlife	Old Trees, Large Trees, Snags, Recruitment snags, Special species	See Black River Old Tree Implementation Plan and Large Tree Implementation Plan in Appendix D.
• Project-wide management ➢Regeneration openings	• Forest vegetation, wildlife	Regeneration, openings	Prioritize regeneration openings to locations where severe dwarf mistletoe infection occurs and place group openings adjacent to a suitable seed source (healthy trees with no dwarf mistletoe infection). Follow the contour of the land in placement of regeneration openings so openings are irregular in shape and randomly distributed across the landscape as is more natural. Any small scattered meadows not captured in the riparian PNVT mapping due to their small size (< 10 acre inclusions) but found in the field would have any encroaching post-settlement trees removed and their boundaries reestablished.
• Project-wide management ➢ Invasive Plant Mitigation/ Avoidance Ground disturbing Actions	• Vegetation-noxious / invasive weeds	Mechanized treatments	Contractor's equipment should be cleaned of soil and/or vegetative matter and inspected and approved by Forest Service personnel before beginning operations. In areas within the project where noxious/invasive weeds are identified equipment should be cleaned of soil and/or vegetative matter and inspected and approved by Forest Service personnel, before moving to another project treatment area. If contractor desires to clean off-road equipment on National Forest land, such as at the end of a project or prior to moving to or through an area that is free of invasive species of concern, contractor should obtain prior approval from Contracting Officer or Timber Sale Administrator (TSA) as to the location for such cleaning and measures for controlling impacts (e.g., burn pit, unused gravel pit, or other forest service approved location).

Applicable Actions	Main Resource Area(s)	Item	Design Criteria Description
• Project-wide management	• Range Management-Understory Vegetation	Grazing Schedule Coordination, Range infrastructure	Coordinate adjustments to the annual grazing schedule early with thinning and prescribed burning, which may require rest or deferment of pastures with substantial ground disturbance. All existing structural range improvements (fences, gates, spring developments) should be protected from harvest and burning activities. Any damage would be repaired to Forest Service standards by the responsible party prior to livestock turnout. Fence right of ways (6 feet either side of fence), trails, other developments and access to them should be cleared of slash produced by logging or post sale activities. AMZs treated with prescribed fire would be evaluated following treatments to ensure there is adequate ground cover for grazing.
• Big Lake Recreation area ♦ Log Haul	• Recreation	Noise, disturbance to public	No logging activity in the Big Lake Recreation Area (boundary as defined by special forest order 01-401 exhibit 06-01) is allowed during the holiday weekends of Memorial Day, Independence Day, and Labor Day. A holiday weekend for Labor Day and Memorial Day is defined as the Thursday prior to the holiday and Tuesday immediately following the holiday. The holiday weekend for Independence Day is defined as the two days before Independence Day and two days following Independence Day.

Applicable Actions	Main Resource Area(s)	Item	Design Criteria Description
• Project-wide management ⬩ Harvest Treatments ⬩ Prescribed Burning	• Recreation	Recreation infrastructure	Minimize damage to infrastructure (recreation sites and trailheads) from tree felling operations. Felled trees should be skidded to designated landings outside of developed sites and slash should be removed from trails, road corridors, and maintained areas within developed recreation sites and scattered outside the developed site. Coordinate closure of heavily used trailheads, campgrounds, and travel corridors with District recreation staffs to minimize impacts to the public. The district would provide information to the recreating public on the purpose and duration of the closure as well as on alternative recreation opportunities in the vicinity. All trees marked within the recreation area should be 'cut tree' marked, to maintain visual quality within the recreation area. Recreation areas should be left in good conditions post activity i.e. by disposing of slash and excess material, rehabilitating landings and skid trails to their natural profile, removing berms or soil piles, and rehabilitating burn piles to a natural state. All trails would be protected and maintained to their present standard. Crossing trails with equipment and other operations may be allowed at pre-approved locations, identified by the FS responsible official. Temporary special order closures may be implemented during thinning and tree removal located adjacent to trails. Design treatment to provide screening between camp sites and to provide some sun, screening, and shade trees at and between camp sites.
• Project-wide management ⬩ Road Management Use, and Maintenance	• Heritage, Cultural Resources	NRHP Unevaluated and Eligible sites, tribal resources	The *Protocol for Protecting Historic Properties within Forest System Roads for Projects within the Four Forest Restoration Initiative Area* and Programmatic Agreement will be followed. For historic roads and associated features, maintenance activities on historic roads and features will be negotiated with the SHPO based on a segment or feature's contribution, or lack thereof, to the overall eligibility of the historic property. Unauthorized routes going through NRHP unevaluated and eligible sites shall be closed. Appropriate measures (i.e., barriers) will be employed to discourage use of unauthorized routes going through NRHP eligible and archaeological sites.

Applicable Actions	Main Resource Area(s)	Item	Design Criteria Description
• Project-wide management ⬩ Spring Restoration	• Heritage, Cultural Resources	Tribal resources: heritage sites, Traditional Cultural Properties, and Sacred Sites	Springs identified as a tribal resource would follow agreed parameters for treatments between the tribes and forest heritage specialists, with coordination with hydrologists, biologists, silviculturists, and other specialists and approved by the FS responsible official.
• Project-wide management ⬩ Aspen Restoration ⬩ Grassland and Meadow Restoration	• Heritage, Cultural Resources	NRHP Eligible sites, unevaluated sites, tribal resources	Mature aspen stands would be thoroughly investigated for historic dendroglyphs (bark carvings) prior to implementation and protected (based on subsequent evaluation).

• Project-wide management
  ♦ Harvest Treatments
  ♦ Prescribed burns
	• Heritage, Cultural Resources	NRHP Unevaluated and Eligible sites, tribal resources (including traditional plant collection areas, TCPs, or other sacred areas) Unanticipated discoveries	All National Register eligible or unevaluated site boundaries would be marked to ensure mechanical and burn activities avoid cultural resources. All sites considered unevaluated or eligible for the National Register of Historic Places will be avoided by mechanized equipment and inspected post-implementation by a heritage specialist.
			If appropriate, manual (i.e., hand) thinning, may be allowed within site boundaries with the following conditions:
			• Cutting is accomplished using hand tools only
			• Large diameter trees are felled away from all features
			• Thinned material is hand carried outside site boundary; logs, trees, or thinned materials shall not be dragged across or within site boundaries
			• No use of vehicles or mechanized equipment within site boundaries
			• No staging of equipment or vehicles within site boundaries
			• No slash piles inside site boundaries
			• Tribes may be invited to participate in manual thinning of project area in and around heritage sites.
			Protect sites considered eligible or unevaluated for the National Register by following the protection measures in the Programmatic Agreement and negotiated measures in each phase's NHPA consultation documentation.
			Should additional sites be discovered during project implementation, all work in that locale would be halted and the FS archaeologist would be notified immediately. Work would not resume in that area until a FS archaeologist has notified the FS responsible official that work can proceed.
			For prescribed fire coordinate with FS archeologist to determine site specific protection measures prior to implementation. This would include the protection of fire-sensitive sites and the possible burning of non-fire sensitive sites.
			Protect fire sensitive sites (i.e., historic sites built with flammable materials; rock art; prehistoric sites with flammable architectural elements or features, or built with soft or porous volcanic tuff; culturally modified trees (e.g., aspen art), certain TCPs identified by tribes or in consultation with SHPO/THPOs) by removing heavy fuels by hand, or by preventing combustion of heavy fuels that cannot be removed.

Applicable Actions	Main Resource Area(s)	Item	Design Criteria Description
			• Measures to protect fire-sensitive sites include: • Exclude from project area • Hand line • Black line • Wet line • Foam retardant • Structural fire shelter • Remove heavy fuels from site by hand • Prevent in-situ heavy fuels that cannot be removed from ignition (e.g., flush-cut & bury stumps) • Implement same protective measures for future maintenance burns • Selective protection for other, less fire-sensitive sites include: • Allow burning over sites without fire sensitive features or materials • No slash piles within site boundaries • No ignition points within site boundaries • No staging of equipment within site boundaries • Allow construction of safety zones and additional lines in 100% surveyed areas, with archaeological monitoring to assure recorded sites are avoided
• Inventoried Roadless Areas (IRAs) ⬩ Harvest Treatments ⬩ Prescribed Fire ⬩ Roads	• Special Designations	Maintain roadless characteristics	No logging activities would occur in IRAs, but thinning activities for forest health purposes may occur. Prescribed fire shall adhere to methodologies for maintaining roadless characteristics. No new roads or road upgrades are allowed in IRAs.
• Eligible Wild, Scenic, and Recreation Rivers	• Special Designations	Maintain eligibility	AMZs (1/4 mile from river corridor on either side) shall be designated for the eligible and suitable wild and scenic, and recreational river segments in the project area. Only activities to be allowed are those that would enhance eligibility. Eligible and suitable wild river segments are unsuitable for tree cutting (see Forest Plan, Table 8, p. 136-137) unless to enhance the primitive recreational experience (e.g., clearing trails).

Appendix C-Flexible Toolbox Approach for Aquatic and Watershed Restoration Activities

Table 34. Considerations for prioritizing where and when treatments are implemented.

Priority	Consideration	Rationale
Primary	Watershed Condition Framework	Areas/activities within existing Watershed Restoration Action Plans can increase opportunities to maintain watershed condition or move into a higher condition class.
Primary	Vegetation restoration activities within the area.	Incorporating aquatic and watershed restoration activities in an area with other restoration treatments whenever possible to improve efficiencies.
Primary	Partner Interest	Projects that already have partners or interested partners, particularly if funding is available.
Primary	Presence of federally listed or candidate species	Presence of these species and habitats and the potential for improving abundance/distribution and their habitat conditions could prioritize a site over one without.
Secondary	Wet meadows, cienegas, and other similar habitats.	Maintaining or improving water supply, hydrology, soils, and temperature regime in these areas could have substantial downstream benefits.
Secondary	Location in watershed (higher/lower)	Improvements in conditions of the upper regions of watersheds could result in downstream benefits and have a larger range of beneficial effects than further downstream.
Secondary	Issues that are new, easily treated, or could quickly spread.	Less existing environmental degradation; restoration treatments are more cost effective and efficient, reducing or preventing future degradation. New infestations of noxious weeds or aquatic invasive plants are easier to treat early.
Secondary	Force account, contracted, and partner implementation	Each has variable financial or oversight costs. Prioritization may depend upon which category a project occurs in when weighed against workload, capacity, and financial considerations.
Secondary	Process versus form-based projects	Form-based projects enhance habitat, but do not restore the processes that create habitat, and may require more maintenance than those that restore processes. Projects that restore processes may have higher priority.

Table 35. General groupings of restoration treatments and tools available.

Resource Area	Existing Condition	Aquatic/Watershed Resource Issues and Concerns	See Tools For:
Springs	Outflow, springbox, or piping alterations.	Reduced surface flows, reduced channel function, altered channel form, reduced soil function, and reduced habitat for aquatic, wetland, and riparian obligate plants and animals.	Improving spring outflows.
Springs	Developed spring is splitting flow from a failing springbox, diversion, or piping.	Diversion of flow above the water right is dewatering the outflow impacting channel function / condition, soil function, and associated wetlands.	Improving spring outflows.
Springs	Channeling or degraded outflow channels.	Reduced surface and subsurface flows for channel and riparian maintenance, reduced soil function, reducing and/or eliminating habitat for aquatic, wetland, and riparian obligate plants and animals.	Improving spring outflows, improving form and function of stream channels and floodplains.
Springs, Wetlands, Meadows	Invasive or noxious plants present.	Native plants being replaced, habitat degraded, loss or decline of native species. Departure from desired species composition.	Improving native riparian or aquatic vegetation.
Springs, Meadows	Recreation or livestock grazing present.	Excessive use resulting in loss or decline of native wetland, riparian, and aquatic plant species, reduction or loss of habitat. Impacts to channel form and function. Soil compaction and subsequent accelerated soil erosion leading to a degradation of proper soil function.	Improving native riparian or aquatic vegetation.
Springs, Wetlands, Meadows	Encroachment of upland plant species.	Loss or decline of native wetland, riparian, and aquatic plant species, reduction or loss of habitat, lowered water table. Departure from desired species composition.	Improving native riparian or aquatic vegetation.
Springs, Wetlands, Meadows	User-created roads or trails present, poorly located system roads, excessive herbivory.	Loss or decline of native wetland, riparian, and aquatic plant species, reduction or loss of habitat. Impacts to channel form and function, excessive sediment input. Soil compaction and subsequent accelerated soil erosion leading to a degradation of proper soil function.	Improving road or trail interactions, improving native riparian or aquatic vegetation.
Wetlands, Meadows	Incision, slumping, other factors draining wetlands.	Reduced surface and subsurface flows, Impacts to channel form and function, excessive sediment input. Reduction or loss of wetland, riparian, and aquatic plant species. Reduction or loss of habitat. Impacts to proper soil function.	Improving form and function of stream channels and floodplains.

Resource Area	Existing Condition	Aquatic/Watershed Resource Issues and Concerns	See Tools For:
Roads	Poor location of system roads, presence of unauthorized roads.	Soil compaction and subsequent accelerated soil erosion leading to a degradation of proper soil function and decreased site productivity. Confinement of stream channel, degradation of wetlands, channel widening, altered. Impacts to channel form and function, excessive sediment input.	Improving road or trail interactions with stream courses, springs or other wetlands; improving form and function of stream channels and floodplains. .
Roads	Frequent maintenance.	Inadequate energy dissipation, soil erosion and sedimentation.	Improving road or trail interactions with stream courses, springs or other wetlands; improving form and function of stream channels and floodplains.
Road Crossings	Channel incision, scour, channel widening, excessive sedimentation, Altered streamflow spacially long-term aggradation/degradation of stream channel.	Reduced primary and secondary production, degraded habitat, including increased stream temperatures. Reduced form / function of stream channels and soil function at crossings.	Improving road or trail interactions with stream courses, springs or other wetlands; improving form and function of stream channels and floodplains.
Road Crossings	Poorly functioning culverts altering flow distribution impacting channel form and function.	Passage of organisms, gene flow, distribution, access to refuge habitats. Increased soil erosion and sedimentation.	Improving road or trail interactions with stream courses, springs or other wetlands; improving form and function of stream channels and floodplains.
Streams (Channels, Floodplains, Riparian)	Inadequate amount and distribution of coarse woody debris .Lacking in habitat complexity,	Lack of expected complement of native species, low abundance of species, reduced distribution, population resilience. Excessive flow velocities and bank protection impacting channel form and function. Impacts to streambed and streambank soil stability.	Improving form and function of stream channels and floodplains.
Streams (Channels, Floodplains, Riparian)	Channel incised, disconnected from floodplain, laterally unstable, historic channels abandoned.	Reduction in aquatic habitat, excessive soil erosion / sedimentation, lack of groundwater recharge, lack or riparian vegetation, increased stream temperatures, lack of ability to dissipate energy from high flows.	Improving form and function of stream channels and floodplains.
Streams (Channels, Floodplains, Riparian)	Channel confinement or straightening.	Altered hydrology, excessive soil erosion / sedimentation, loss or reduction in aquatic habitat.	Improving form and function of stream channels and floodplains.

Resource Area	Existing Condition	Aquatic/Watershed Resource Issues and Concerns	See Tools For:
Streams (Channels, Floodplains, Riparian)	Excessive aggradation from inadequate sediment transport.	Channel widening, deepening, increased water temperatures, loss of instream habitat.	Improving form and function of stream channels and floodplains.
Streams (Channels, Floodplains, Riparian)	Altered streamflow quantity and/or streamflow spatial and temporal distribution patterns resulting in decreased/increased high water events, sinuosity.	Increased scouring, increased soil erosion / sedimentation, loss of instream habitat for aquatic life, increased water temperatures, loss of channel connection to floodplain.	Improving form and function of stream channels and floodplains.
Streams (Channels, Floodplains, Riparian)	Increased suspended and deposited sedimentation.	Loss of primary and secondary productivity, reduced abundance of fish and other consumers, increased numbers of disturbance-tolerant species, loss of instream habitat.	Improving form and function of stream channels and floodplains.
Streams (Channels, Floodplains, Riparian)	Inadequate abundance and distribution of obligate- and facultative riparian vegetation.	Reduced nutrients and food items for secondary production, consumers such as fish, amphibians, and reptiles, loss of bank shading and cover, increased water temperatures, diminished bank stability, reduced dissipation of high flow energy, reduced water table. Reduction of desirable soil function and site productivity.	Improving form and function of stream channels and floodplains.

Table 36. Potential tools to facilitate aquatic restoration in the Black River Project.

Tools for	Method(s)	Reference(s)
Improving spring outflows	Removal of spring developments.	Abele 2011; Stevens et al. 2016
Improving spring outflows	Eliminate split flows.	Abele 2011; Stevens et al. 2016
Improving spring outflows	Remove or improve spring boxes.	Abele 2011; Stevens et al. 2016
Improving native riparian or aquatic vegetation	Removing tree(s), tree canopy, or shrub encroachment of upland species with hand thinning, mechanical thinning or prescribed fire.	Hunter et al. 2007

Tools for	Method(s)	Reference(s)
Improving native riparian or aquatic vegetation	Manage noxious or invasive plants using herbicides as described in forest weed management plans.	Herbicide treatments only per Decision Notice & Finding of No Significant Impact ENVIRONMENTAL ASSESSMENT FOR THE A-SNFs INTEGRATED FOREST-WIDE NOXIOUS OR INVASIVE WEED MANAGEMENT PROGRAM (2008)
Improving native riparian or aquatic vegetation	Plant native aquatic or riparian plant species by hand or mechanically, including seeding of native, perennial herbaceous species where appropriate.	Hall et al. 2011; Hoag 2007; Eubanks and Meadows 2002
Improving native riparian or aquatic vegetation	Protect and promote existing native aquatic or riparian plant species. Site protection or fencing, which could be for seasonal restrictions, temporary restrictions, or year-round. Install fencing, jack straw, remove/relocate roads or trails, create defined trails for recreation management using manual or mechanical tools.	Hall et al. 2011; Hoag 2007; Eubanks and Meadows 2002; Bentrup and Hoag 1998; Dreesen and Fenchel 2007
Improving native riparian or aquatic vegetation	Prescribed burning.	Hunter et al. 2007; Smith and Prichard 1992
Improving road or trail interactions with stream courses, springs or other wetlands.	Obliterate ML1 and ML2 roads after treatment if and where applicable by: restoring natural contours, lightly scarify, and properly rehabilitate site with native vegetation using mechanical roads treatments.	Weaver et al. 2015; USFS 2002a, 2002b; ASNFs roads manual
Improving road or trail interactions with stream courses, springs or other wetlands.	Close and restore unauthorized roads, trails, and dispersed camping areas using mechanical roads treatments including but not limited to: restoring natural contours, light scarification, and proper site rehabilitation with native vegetation.	Weaver et al. 2015; USFS 2002a, 2002b; ASNFs roads manual
Improving road or trail interactions with stream courses, springs or other wetlands.	Install waterbars or drainage and blocking entrances on unauthorized roads or trails using mechanical roads treatments.	Weaver et al. 2015; USFS 2002a, 2002b; ASNFs roads manual
Improving road or trail crossing interactions with stream courses, springs or other wetlands.	Remove culverts, reestablish road drainage, remove unstable fill, pull back shoulders, and scatter slash using mechanical roads treatments.	Weaver et al. 2015; USFS 2002a, 2002b; ASNFs roads manual
Improving road or trail interactions with stream courses, springs or other wetlands.	Relocate ML1 and ML2 roads needed for mechanical offerings that are causing resource damage to springs, wetlands or streams using mechanical roads treatments.	Weaver et al. 2015; USFS 2002a, 2002b; ASNFs roads manual
Improving road or trail interactions with stream courses, springs or other wetlands.	Armor downstream culvert outlets using mechanical roads treatments.	Weaver et al. 2015

Tools for	Method(s)	Reference(s)
Improving road or trail interactions with stream courses, springs or other wetlands.	Upsizing culverts using mechanical roads treatments.	Weaver et al. 2015
Improving road or trail interactions with stream courses, springs or other wetlands.	Installing or adding culverts or culvert arrays using mechanical roads treatments.	Weaver et al. 2015
Improving road or trail interactions with stream courses, springs or other wetlands.	Maintaining Aquatic Organism Passage where it exists if road work needed. – Install bridge, replace culvert, or remove crossing using mechanical roads treatments.	Weaver et al. 2015; USFS 2008; AZGFD 2016
Improving road or trail interactions with stream courses, springs or other wetlands.	Install hardened low water crossings or fords (rock, concrete slab, concrete planks, concrete blocks, geocell fords, and vented fords on existing ML1 and ML2 roads needed for mechanical offerings using mechanical roads treatments.	Weaver et al. 2015
Improving road or trail interactions with stream courses, springs or other wetlands.	Install and replace bridges on ML1 and ML2 roads needed for mechanical offerings using mechanical roads treatments.	Weaver et al. 2015
Improving road or trail interactions with stream courses, springs or other wetlands.	Restore downstream channels affected by road crossings using mechanical roads treatments.	Yochum 2015; BOR 2015
Improving road or trail interactions with stream courses, springs or other wetlands.	Developing footpath(s) on existing trails to prevent further soil erosion using hand or mechanical treatments.	
Improving form and function of stream channels and floodplains.	Provide for large woody debris, log structures, log jams by yarding trees. Tree falling, transport and placement of trees and root wads from somewhere else, yarding over trees, helicopter wood, mechanical installation.	Slaney and Zaldokas 1997; Yochum 2017; Cramer 2012
Improving form and function of stream channels and floodplains.	Hand girdling trees to provide for future large woody debris stream input.	
Improving form and function of stream channels and floodplains.	Weirs and Beaver Dam Analogs (BDAs) installed by hand or mechanical methods.	Pollock et al. 2017; Malcolm 2013
Improving form and function of stream channels and floodplains.	Wicker, log and rock wires, vanes, or baffles, brush bundles and root wads using various methods and installed by hand or mechanically.	Zeedyk and Clothier 2014; Yochum 2017; Cramer 2012; Donat 1995
Improving form and function of stream channels and floodplains.	Boulder and log deflectors using mechanized installation.	Slaney and Zaldokas 1997; Yochum 2017; Cramer 2012; BOR 2015

Tools for	Method(s)	Reference(s)
Improving form and function of stream channels and floodplains.	Restoring meanders or adding stream length by induced meandering, recontouring the channel, plug and pond, other similar methods mechanically.	Zeedyk and Clothier 2014; Yochum 2017; Cramer 2012; Donat 1995; Ramsted et al. 2015
Improving form and function of stream channels and floodplains.	Channel reconstruction or realignment using mechanical treatments.	Cramer 2012; BOR 2015
Improving form and function of stream channels and floodplains.	Flood plain creation, widening, or laying back incised stream banks using mechanical treatments.	Cramer 2012; BOR 2015
Improving form and function of stream channels and floodplains.	Zuni bowls, one rock dams or other similar methods using mechanical or hand treatments.	Zeedyk and Clothier 2014; Ramstead et al. 2015
Improving form and function of stream channels and floodplains.	Reconnection of historic side channels that should be functioning using mechanical treatments.	USFS 2002b; Cramer 2012
Improving form and function of stream channels and floodplains.	Maintenance of existing structures using manual or mechanical treatments.	Cramer 2012

Appendix D: Black River Project Old and Large Tree Implementation Plan

Introduction

The Black River Old and Large Tree Implementation Plan is specific to the Black River Restoration Project. It is important to note that the Black River Old and Large Tree Implementation Plan differs in some ways from the previous 4FRI plans to reflect conditions specific to Black River project area. The Black River Old and Large Tree Implementation Plan is designed to reflect the intent to focus restoration treatments on small-diameter tree thinning, to retain large trees whenever possible, and to more specifically design treatments so that large trees will be retained unless they must be cut to meet the purpose and need of the Black River Project and the overarching desired conditions of the Forest Plan.

One purpose of the Black River Project is to:

> *Restore forest structure, composition, density, and landscape patterns to create uneven-aged landscapes more resilient to disturbances so natural ecological processes may return to their characteristic roles within the ecosystem and fire to its more natural function (historic frequency, intensity, and extent).*

Therefore, each ponderosa stand will be managed towards a sustainable structure of young, mid-aged, and old forest structures at the fine scale. This also means that each stand will correspondingly have a sustainable composition (by area occupied, not trees per acre) of small, medium and large-sized trees. These trees will be grouped in natural spatial patterns that include intermixes of tree groups and interspaces.

Black River Old Tree Implementation plan

The Black River Project defines two categories of old trees:

1. Pre-settlement Tree defined as those trees established prior to 1870.
2. Post-settlement trees that are older than 150-years of age at the time implementation occurs within a stand[3].

The advantages of using a two-tiered system to identify old trees is that it assures that pre-settlement trees are retained and future trees over 150 years are retained as they mature on the landscape. Pre-Settlement (Old) trees and post-settlement trees reaching 150 years old at time of stand entry would be retained, with few exceptions, regardless of their diameter, within the Black River Restoration Project analysis area. Exceptions would be made for threats to human health and safety and would include hazard trees as defined by Forest Service Manual and Forest service Handbook Direction (currently FSM 2332.1, FM 2332.11, and FSH 7709.59). A hazard tree is defined as a tree that has both a structural defect that increases the chance of a tree or its parts to fail and a target (people, buildings, cars, etc.) would be hit when the tree fails. Some examples of removing old trees for hazards include:

[3] Establishment age is determined at breast height (4.5 feet above ground) and a locally derived addition to age is added to then set seeding establishment.

- Old trees growing on the side of an existing curve in a road - Logging equipment may require a wider turning radius. The options are to relocate the road or cut the old tree and widen the curve to accommodate the larger turning radius. Relocating the road will result in a larger area of the forest being permanently disturbed, versus cutting the old tree and widening the curves radius.

- Hazard trees on a landing or skid trail – If an old tree is determined as hazard near a landing or skid trail the sale administrator may designate the tree for removal to provided safety for the mechanized thinning operations. If possible, landings and/or skid trails should be located where there are no old trees nearby.

- Old trees near powerlines, recreation facilities, and other infrastructure – If an old tree is determined to be a hazard and is within striking range of facilities or infrastructure then the old tree may be designated for removal. Fence line hazard trees typically would not be situations where old tree would be removed.

Old Tree Descriptions and Illustrations

The task of identifying old trees in the Black River Project requires an understanding of the characteristics used to determine age patterns. In determining what is an old tree the obvious and best way to determine the age of a tree directly with an increment borer. Accurate aging of every tree is not practical or cost effective and can damage tree boles and introduce disease. However, when implementing large landscape projects visual descriptions given to timber markers and contractors are a more efficient method of age determination. Figure 7, Figure 8,

Figure 9 and table 39 show and describe various age indicators in ponderosa pine. Each of these indicators should be identified in silviculture prescriptions and project implementers must be trained in how to identify various ages correctly. Careful attention should be given to trees in transition from large or mid-aged to old tree conditions.

In examining Figure 7, it is important to understand the transition from “blackjack” ponderosa pine to “yellow” ponderosa pine. The top left photo shows a post-settlement tree that is just beginning to transition to older bark characteristics, but it is relatively young. The other photos show ponderosa pine trees that were established prior to 1870. However, it should be noted that site specific differences may change visual indicators in bark for various ages, so project specific guidelines should be developed using site specific data.

There is a very strong correlation between bark plate width and age (Figure 3). Site specific variations can cause outliers to bark width, so other factors, such as tree form and branch form and diameter, should be considered as well, but bark width can be useful to help make an old tree determination.

Figure 6. Photos of ponderosa pine bark characteristics for trees at different ages.

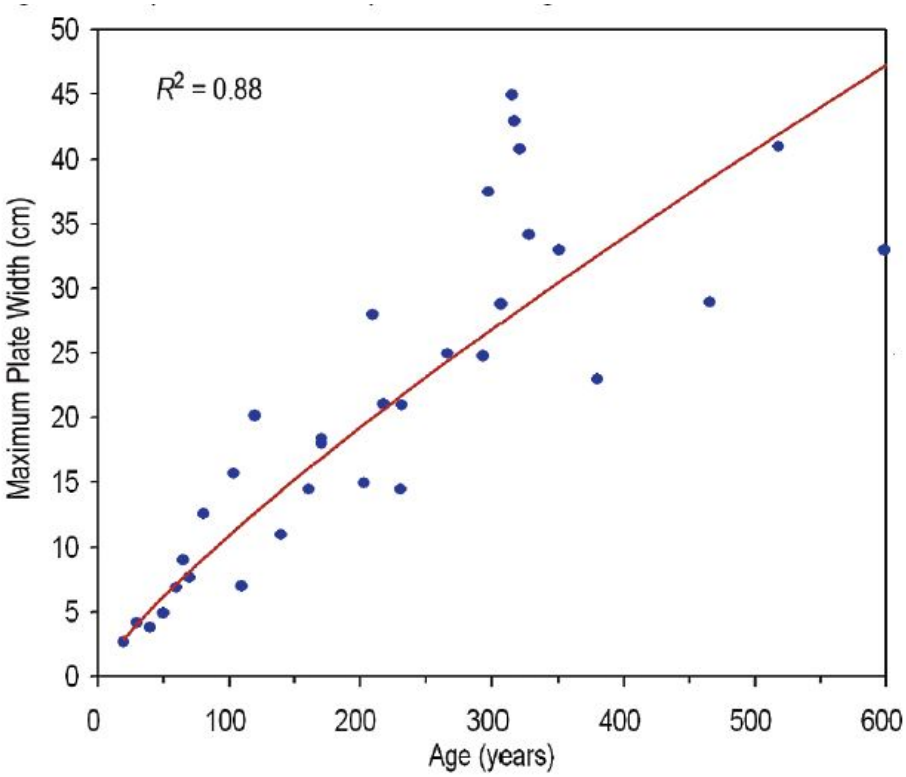
Note: Trees on individual sites may differ in appearance based on site specific attributes. Photo taken from Van Pelt 2008.

Within the Black River Restoration Project, no trees suspected of being 150 years old will be increment bored to establish age. Physical characteristics will be used to efficiently classify old trees. Old trees are defined in the ASNFs Forest Plan as represented by Keens' Class 4 (Forest Plan page 161 & 240). For the Black River Project old trees will be determined by the following characteristics and tree form shown in Figure 7:

- Age –Established prior to 1870 or 150 years of age.
- D.B.H. – Site dependent.
- Tops – ranging from pyramidal or rounded (occasionally pointed) to flat (making no further height growth).
- Branching – ranging from upturned in upper third of the crown, horizontal in the middle third, and drooping in the lower third of the crown to mostly large,

drooping, gnarled, or crooked. Branch whorls range from incomplete and indistinct except at the top to completely indistinct and incomplete.

Figure 7. Ponderosa Pine Bark Plate Width as a predictor of tree age (Van Pelt 2008)



Keen (1943) Age Class 4: Overmature; making no further height growth; diameter growth very slow; bark light yellow, uniform for entire bole (except in extreme top), with wide, long and smooth plates and often shallow fissures; tops usually flat or occasionally rounded or irregular; branches large, heavy, and often gnarled or crooked and mostly drooping except in extreme top.

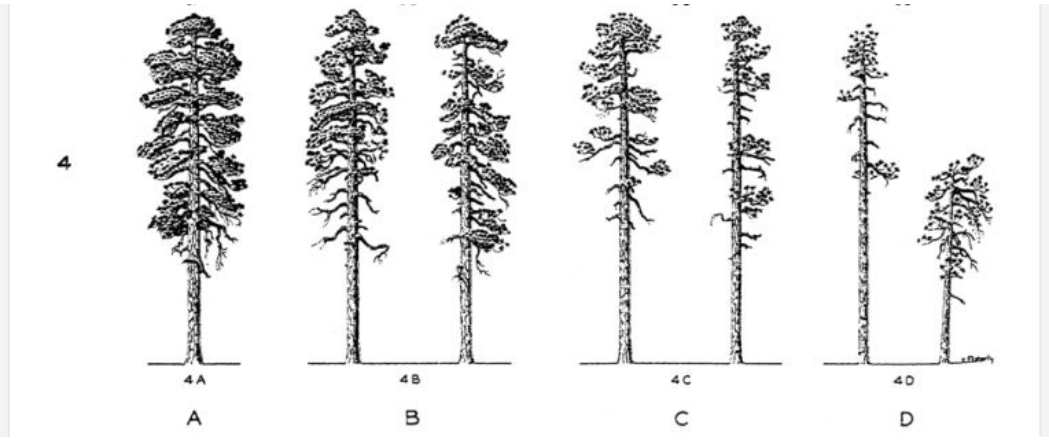


Figure 8. Keen's Tree Classification for Ponderosa Pine class 4 (Keen 1943)

Table 37. Age class descriptions and characteristics of trees for the Apache-Sitgreaves National Forests.

Age Class	Relative Tree Age	Typical DBH (Inches)	Characteristics					
			Crown	Branches	Ponderosa Pine Bark	Southwestern White Pine Bark	Douglas Fir Bark	White Fir Bark
1	0-75 Years	<12	Pointed	Upturned whorls distinct	Dark gray to black, deeply furrowed with narrow ridges between fissures	Light to gray, smooth to slight furrow	Light gray, smooth	Light gray, smooth
2	75-150 Years	<24	Pointed or slightly rounding, never flat	Upturned whorls distinct	Black to dark reddish brown with ridges or narrow plates between fissures	Dark gray or brown and deeply furrowed into narrow, irregular ridges	Gray to reddish brown, furrowed, slight orange between furrows	Gray, furrowed, lighter gray between furrows. Ridges forming a base, frost cracks
3	150-225 Years	<36	Usually pyramidal or rounded, occasionally pointed	Upturned in upper 1/3 of crown, those in the middle horizontal and dripping in lower 1/3 of crown	reddish brown, shading to black in the top with moderately large plates between fissures	Dark gray to reddish brown furrowed with narrow, irregular ridges	reddish brown to dark brown with deep furrows	Medium gray furrowed, think ridges, frost cracks
4	225+ Years	36+	Usually flat and making no further height growth	Mostly large drooping, gnarled or crooked; whorls indistinct and incomplete	Reddish brown to yellow, the plates are usually very wide , long, and smooth	Gray to reddish brown furrowed, with narrow, irregular, scaly ridges	Thick bark dark brown to black with deep furrows	Reddish brown to yellow, the plates are usually very wide, long and smooth

* Trees greater than 18 inches in diameter, may or may not be old on good growing sites where trees have been free to grow and achieve large diameter at a relatively young age. See Keens tree class for additional information on indicators of tree maturity (Keen 1943, Thompson 1940, Dunning 1928). Trees may or may not be old on good growing sites where trees have been free to grow and achieve large diameters at a relatively young age.

Old Trees of Other Species

Specific identification of old trees other than ponderosa pine in the Black River Project will not be done for thinning treatments since these species occur in and help define Mexican Spotted Owl (MSO) recovery habitat (USDI 2012). Species such as Douglas-fir, southwestern white pine, Engelmann spruce, blue spruce, corkbark fir, and white fir generally occur in a species mix identified as mixed conifer under the MSO recovery plan4. The MSO recovery plan guidance suggests tree diameter restrictions during implementation to protect the oldest trees of these species. In the circumstance, where isolated large trees of other species occur outside MSO recovery habitat, prescriptive constraints will be implemented to protect these old trees.

Black River Large Tree Implementation Plan

This large tree implementation plan is designed to inform implementation of forest restoration projects focused on restoring characteristic forest structure, composition, and function for frequent fire forests in the USFS Southwestern Region. The plan's ecological objectives are consistent with development or maintenance of the desired conditions found in the Apache-Sitgreaves forest plan as well as the enacting language of the Collaborative Forest Landscape Restoration Program "maximizing the retention of large trees, as appropriate for the forest type, to the extent that the trees promote fire-resilient stands." (Omnibus Public Land Management Act of 2009).

This implementation plan is only applicable when no other overriding restrictions occur. For example, within specific sites identified as Threatened and Endangered species habitat, treatments would be driven by habitat needs in consultation with the USDI Fish and Wildlife Service. This implementation plan is only applicable for project areas planned for uneven-aged forest restoration treatments in frequent fire forest types (ponderosa pine and dry mixed conifer forests). It is not applicable for mesic, infrequent fire forest types (wet mixed conifer or spruce fir forests) or project areas where even-aged forest management practices (e.g. shelterwood, seed tree, clear cutting, coppice) are proposed to address site specific forest management issues.

For the purpose of this document, large post-settlement trees as defined by the socio-political process, are those that are 20-inch DBH or larger. Groups of trees greater than or equal to 20-inch DBH represent the largest and (sometimes) oldest trees. These size classes best correspond with the successional stage classification system that was developed to address the forest dynamics of southwestern ponderosa pine.

This plan may not include every instance where large post-settlement trees may be removed. There may be additional areas and/or circumstances where large post-settlement trees need to be removed in order to achieve restoration objectives. During implementation (prescription development), if there is a condition where forest plan desired conditions conflict with the exception condition categories listed below, no large trees would be felled until an interdisciplinary team reviews and makes recommendations to the deciding official. The deciding official would decide whether the action is consistent with the analysis and the decision made. The exception categories for falling large trees are listed below.

1. Seeps and Springs

Seeps are locations where surface-emergent groundwater causes ephemeral or perennial moist soil or bedrock. Standing or running water is infrequent or absent. Vegetation and other biological diversity are adapted to mesic habitat with moist, adequate soil moisture. Springs are small areas where surface-emergent groundwater causes ephemeral or perennial standing or running water and wet or moist soils.

[4] ASNFs Forest Plan defines two mixed conifer types as Dry and Wet Mixed Conifer. The 2012 MSO Recovery Plan on describes these two habitats as "Mixed Conifer".

Seeps and springs exhibit unique, often isolated biophysical conditions that can sustain unique, mesic-adapted biological diversity, and can facilitate endemism and speciation. Springs also provide water and other habitat to terrestrial wildlife.

Removal of trees that have encroached upon seeps and springs may constitute a relatively small part of an overall seep and spring restoration effort, when compared to fully addressing root causes of overall degradation. Thinning alone, without addressing other sources of degradation, may be unlikely to fully restore seeps and springs (Thompson et al. 2002). However, it is a necessary step leading to the restoration of these ecologically important areas.

Ecological Objectives

- The biophysical conditions in seeps and springs upon which terrestrial, mesic-adapted, and aquatic native biological diversity depend are conserved and restored.
- The integrity of the spring's unique biophysical attributes is not compromised by tree rooting and shading.
- Mesic habitats associated with a seep or spring are not encroached upon by conifers.
- If treatment occurs, an equivalent number of large replacement trees remain where there is evidence that pre-settlement trees have grown in similar root and crown proximity to a particular seep or spring in the past.

2. Riparian

Riparian areas occur along ephemeral or perennial streams or are located downgradient of seeps or springs. These areas exhibit riparian vegetation, mesic soils, and/or aquatic environments. Riparian areas exhibit unique biophysical conditions that can sustain unique, mesic-adapted, or aquatic biological diversity. Riparian areas and the streams, springs, and seeps connected to them often harbor imperiled species that can be sources of endemism. Riparian areas also provide water and other habitat to terrestrial and aquatic wildlife. In the absence of frequent fires and in the presence of other competing factors, large post-settlement trees may have become established and grown within riparian areas to the point that they compromise available soil moisture or light that support the unique biophysical conditions that are associated with the riparian areas. Conifer trees encroaching into riparian zones of any size may need to be removed to retain or improve riparian vegetation (both woody and herbaceous) and condition.

Ecological Objectives

- The biophysical conditions in riparian habitat upon which terrestrial and aquatic native biological diversity depends are conserved and restored.
- The use of soil and water best management practices (BMPs) minimize the impacts of removing trees within riparian areas.
- Removal of trees constitutes a relatively small part of an overall riparian area restoration effort, when compared to the fundamental causes of overall degradation. Riparian areas are fully restored by using an array of tools that address all sources of degradation.
- Available soil moisture or light that support that area's unique biophysical conditions is not compromised by growing (rooted) trees.
- If treatment occurs, an equivalent number of large replacement trees remain where there is evidence that pre-settlement trees have grown in similar root and crown proximity to a seep or spring in the past.
- Post-treatment snags and logs that include large trees are available onsite.

3. Wet Meadows

Wet meadows may be referred to as riparian meadows, montane (or high elevation) riparian meadows, sedge meadows, fens, or simply as wet meadows (Cooper, David J.; Merritt, David M. 2012). Wet meadows are usually located in valleys or swales, but may occasionally be found in isolated depressions, such as along the fringes of ponds and lakes with no outlets. Where wet meadows have not been excessively altered, sedges (*Carex* spp.), rushes (*Juncus* spp.), and spikerush (*Eleocharis* spp.) are common species (Patton and Judd 1970, Hendrickson and Minckley 1984, Muldavin et al. 2000). Willow (*Salix* spp) and alder (*Alnus* spp) often occur in or adjacent to these meadows (Long 2000, Long 2002, Maschinski 2001, Medina and Steed 2002). High elevation wet meadows frequently occur along a gradient that includes aquatic vegetation at the lower end and mesic meadows, dry meadows, and ponderosa pine or mixed conifer forest at the upper end. These vegetation gradients are closely associated with differences in flooding, depth to water table, and soil characteristics (Judd 1972, Castelli et al. 2000, Dwire et al. 2006). While relatively rare, wet meadows are believed to be of disproportionate value because of their use by wildlife and the range of other ecosystem services they provide. Wet meadows perform many of the same ecosystem functions associated with other wetland types, such as water quality improvement, reduction of flood peaks, and carbon sequestration.

Due to hydrologic changes, large post-settlement trees may have established and grown within wet meadows such that they compromise available soil moisture or light creating unique biophysical conditions, whereby removal can assist in the recovery of wet meadows.

Ecological Objectives

- The biophysical conditions of wet meadows upon which terrestrial native biological diversity depend are conserved and restored.
- Wet meadow function is not impaired by growing (rooted) trees.
- If treatment occurs, an equivalent number of large replacement trees remain where there is evidence that pre-settlement trees have grown in similar root and crown proximity to a seep or spring in the past.
- Removal of large trees constitutes a relatively small part of an overall riparian area restoration effort, when compared to the fundamental causes of overall degradation. Wet meadows are fully restored by using an array of tools that address all sources of degradation.

4. Encroached Grasslands

Encroached grasslands are herbaceous ecosystems that have disparate to no evidence of pine trees growing prior to settlement. A key indicator of grasslands is the presence of mollisol soils. Mollisol soils are typically deeper with higher rates of accumulation and decomposition of soil organic matter relative to soils in the surrounding landscape. In addition to their association with mollic soils, grasslands in this region are maintained by a combination of climate, fire, wind desiccation, and, to a lesser extent, by animal herbivory (Finch 2004).

Plant diversity is particularly important in grassland ecosystems. Grassland plots with greater species diversity have been found to be more resistant to drought and to recover more quickly than less diverse plots (Tilman and Downing 1994). This resilience will become even more important in a warming climate. Conifer tree removal, restoration of fire, and appropriate livestock numbers are all necessary to restore structure and function of native grasslands.

Ecological Objectives

- Grasslands are enhanced, maintained, and function with potential natural vegetation (as defined by vegetative mapping units).
- Grasslands function with a natural fire regime.
- Existing grasslands are not encroached upon by conifers.
- If treatment occurs, an equivalent number of large replacement trees remain where there is evidence that pre-settlement trees have grown in similar root and crown proximity to a seep or spring in the past.

5. Aspen Forest and Woodland

Quaking aspen occurs within ponderosa pine forests, Mixed-Conifer with Frequent Fire and Mixed-Conifer with Aspen. It is ecologically important due to the high concentration of biodiversity that depends on aspen for habitat (Tew 1970, DeByle 1985, Finch and Reynolds 1987, Griffis-Kyle and Beier 2003). In addition, stable aspen stands serve as an indicator of ecological integrity (Di Orio et al. 2005). Aspen is currently declining at an alarming rate in some areas (Fairweather et al. 2008).

The lack of fire as a natural disturbance regime in southwestern frequent fire forests since European settlement has caused much of the aspen dominated lands to cede to conifers. Other factors contributing to gradual aspen decline over the past 140 years include reduced regeneration from browsing ungulates (Pearson 1914, Larson 1959, Martin 1965, Jones 1975, Shepperd and Fairweather 1994, Martin 2007).

Ecological Objectives

- Aspen forests and woodlands are conserved and restored to their appropriate fire regime.
- Aspen is effectively being regenerated or maintained, and regeneration, saplings, and juvenile trees are protected from browsing.
- There is decreased competition from conifers. Post-settlement conifer tree numbers do not exceed residual targets that have been identified using pre- settlement conifer tree evidences, site visitations, and collected data.
- Removal of large trees constitutes a relatively small part of the aspen restoration effort, when compared to the fundamental causes of overall degradation. Aspen forests and woodlands are fully restored by using an array of tools that address all sources of degradation.

6. Ponderosa Pine/ Oak Forest (Pine-Oak) and Douglas-Fir/ Oak Forest Associations

A number of forest types exist in the southwestern United States that could be described as pine-oak. Ponderosa pine forests and Douglas-fir forests are often interspersed with oak (*Quercus species*) trees of various mixtures.

In southwestern frequent fire forests, oak species have several growth forms distinguished by stem sizes and the density and spacing of stems within clumps. These include shrubby thickets of small stems, clumps of intermediate-sized stems, and large, mature trees that are influenced by age, disturbance history, and site conditions (Kruse 1992, Rosenstock 1998, Abella and Springer 2008, Abella 2008a). Oak species provide high quality wildlife habitat in its various growth forms and is a desirable component of ponderosa pine forests (Neff et al. 1979, Kruse 1992, Bernardos et al. 2004). Different growth forms provide important habitat for a large number and variety of wildlife species (Neff et al. 1979, Kruse 1992). These include hiding cover in a landscape with limited woody shrub cover, cavity substrate for birds and bats, roost potential for bats, nest sites for birds, and bark characteristics used by invertebrates.

Whether as saplings, shrubby thickets, or larger sized trees, oak adds a high value for wildlife in ponderosa pine forests.

Oak enhances soils (Klemmedson 1987), wildlife habitat (Kruse 1992, Rosenstock 1998, USDI 1995, Bernardos et al. 2004), and understory community composition (Abella and Springer 2008). Large oak trees (> 12" DRC) are particularly valuable since they typically provide more natural cavities and pockets of decay that allow excavation and use by cavity nesters than conifers.

Oak densities appear to have increased in many areas with fire exclusion, especially in the small and medium diameter stems (<8-inch DBH, Abella and Fulé (2008)).

Conifer competition with oak has been identified as an issue in slowing oak growth, particularly for older oaks (Onkonburi 1999). Thinning of competing pine trees may promote large oaks with vigorous crowns and enhanced acorn production (Abella 2008b) and may increase oak seedling establishment (Ffolliott and Gottfried 1991).

Ecological Objectives

All Oak Species

- Small oak trees develop into larger size classes.
- Fire treatments retain small and shrubby oak in numbers and distribution.
- All growth forms of oak are present.
- Larger and older oak trees are created, enhanced and maintained.
- Large post-settlement trees are not restricting oak development.
- Frequent low-severity surface fire occurs in ponderosa pine- oak forests.
- Brushy thicket, pole, and dispersed clump growth forms of oak are present and maintained by allowing natural self-thinning, thinning dense clumps, and/or burning.
- Oak growth forms are managed during restoration treatments to develop or maintain desired quantities and structural stages to provide for sustainability over time. Desired composition and densities of oak are variable based upon local soils, plant associations, historical conditions, and management objectives.
- Within 30 feet of oak 10- inch DRC or larger, post-settlement conifer trees up to 18-inch DBH (that do not have interlocking crowns with oak) are not restricting oak development.

In MSO Recovery Habitat

- Within MSO habitat and designated critical habitat, the recovery plan for the MSO improves key habitat components and primary biological factors, which includes oak.

7. Within-Stand Openings (Regeneration Gaps and Forest Interspaces)

Within-stand openings are small openings (generally 0.05 to 1.0 acres) that were occupied by grasses and wildflowers before settlement (Pearson 1942, White 1985, Covington and Sackett 1992, Sánchez Meador et al. 2009). For the purposes of this strategy, within-stand openings are equivalent to interspaces. The within-stand opening management approach described below is distinct from, and should not be considered as guidance relating to regeneration groups.

Pre-settlement openings can be identified by the lack of stumps, stump holes, or other evidence of pre-settlement tree occupancy (Covington et al. 1997). Current openings include fine-scaled canopy gaps. It is not necessary to have desired within-stand openings and groups located in the same location that they were in before settlement (the site fidelity assumption). Trees might be retained in areas that were

openings before settlement, and openings might be established in areas which had previously supported pre-settlement trees.

Within-stand openings appear to have been self-perpetuating before overgrazing and fire exclusion (Pearson 1942, Sánchez Meador et al. 2009). Fully occupied by the roots of grasses and wildflowers as well as those of neighboring groups of trees, these openings had low water and nutrient availability because of intense root competition (Kaye et al. 1999). Heavy surface fuel loads insured that tree seedlings were killed by frequent surface fires, reinforcing the competitive exclusion of tree seedlings (Fulé et al. 1997).

These natural openings appear to have been very important for some species of butterflies, birds, and mammals (Waltz and Covington 2004). Often the largest post-settlement trees, typically a single tree, became established in these natural within-stand openings as soon as herbaceous vegetation was removed. Contemporary within-stand openings or areas dominated by smaller post-settlement trees should be the starting point for restoring more natural within-stand heterogeneity.

Ecological Objectives

- The pattern of openings within stands that provide natural spatial heterogeneity for biological diversity are conserved, created, or enhanced.
- Openings break up fuel continuity to reduce the probability of torching and crowning and restore natural heterogeneity within stands.
- Openings promote snowpack accumulation and retention which benefits groundwater recharge and watershed processes at the fine (1 to 10 acres) scale.
- The presence of large trees do not prevent the reestablishment of sufficient within-stand openings to emulate natural vegetation patterns based on current stand conditions, pre-settlement evidences, desired conditions, or other restoration objectives.
- Groups of trees typically range in size from 0.1 acre to 1 acre. Canopy gaps and interspaces between tree groups or individuals are based on site productivity and soil type and may range from 10 percent on highly productive sites to as high as 90 percent on those soil types that have an open reference condition.
- Establish gaps for forest regeneration to develop or maintain sustainable uneven-aged forest structure. Suitable openings for successful natural regeneration in frequent fire forest types range in size from 0.25 to 1 acre, based on local soils and plant associations, and informed by historic reference conditions.

8. Heavily Stocked Stands (with High Basal Area) Generated by a Preponderance of Large, Young Trees

In some areas, the increase in post-settlement trees has been so rapid that current stand structure is characterized by high density and high basal area in large, young trees. These stands or groups of stands exhibit continuous canopy which promotes uncharacteristically severe fire effects under severe fire weather conditions. At the fine scale, the management approach would apply on a case-by-case basis. The removal of large trees may be necessary to meet site-specific ecological objectives as listed below. For example, the removal of large trees may be necessary to reduce the potential for uncharacteristic crown fire, especially to limit spread into communities or important habitats that include MSO and/or goshawk nest stands.

In stands where pre-settlement evidences, restoration objectives, community protection, or other ecological restoration objectives indicate much lower tree density and basal area would be desirable, large post-settlement conifers may need to be removed to achieve post-treatment conditions consistent with a desired trajectory towards more resilient forest density and uneven-aged structure, and composition. Where evidence indicates higher tree density and basal area would have occurred pre-settlement, or other ecological restoration or management objectives desired higher forest density, only a few large conifers may need to be removed. Many of these areas would support crown fire and, thus, require structural modification to reduce crown fire potential and restore understory vegetation that supports surface fire. Based upon Forest plans, it is desired to develop or maintain forest structure and spatial patterns similar to historic conditions (functional restoration[5]). Frequent low-severity fire forests in the Southwest historically ranged in density from 20-100 square feet of basal area (ponderosa pine forests), and up to 125 square feet of basal area (dry mixed conifer forests) at the mid (stand) scale. Spatial patterns are highly variable, ranging from aggregated (with distinct tree groups and grass/forb/shrub interspaces) to randomly distributed tree patterns in a grass/forb/shrub matrix. Aggregated tree patterns are characteristic of forests and savannas growing on heavy, fine-textured soil types, most often of basaltic origin, and also those forests growing on more xeric sites. Random tree patterns are characteristic on lighter, coarse-textured soil types of variable origins, and forests growing on more mesic sites. Forest density and spatial patterns are regulated by tree regeneration dynamics and frequent fire occurrence. Regeneration tends to establish episodically and in limited "safe site" locations on heavy textured soils, resulting in aggregated (grouped) tree patterns that are subsequently thinned by fire. On coarse-textured soils, regeneration tends to establish rapidly and profusely in open forest conditions, but overall densities are regulated by fire, resulting in a relatively more closed forest condition with random tree patterns. Both types of spatial patterns are characteristically uneven-aged in structure at the stand scale; with even-or multi-aged groups occurring in aggregated tree patterns, and random distribution of tree ages throughout forests patterned with random tree patterns (Reynolds et al. 2013). Forest plan desired conditions describe that these forests will be dominated by uneven-aged structural conditions at the mid (stand) scale, with representation of young, mid-aged, and old trees to assure sustainability of desired conditions over time.

Ecological Objectives

- Natural heterogeneity of forest, savanna, and grasslands occurs at the landscape scale and within stands. Sub-stand scale tree patterns are similar to historic conditions, informed by ecological site conditions and historic evidence of tree patterns. Typically, tree spatial patterns will be managed with a functional (not strict sense) restoration approach.
- Uneven-aged forest structure (grouped or random tree patterns) is restored by retaining deficit structural stages to develop more balanced uneven-aged stands in the shortest timeframe possible.
- Decreased shading and interception from the canopy, decreased needle litter and duff, and surface fire restore and maintain a mosaic of natural vegetative communities.

[5] Restoration, functional. Restoration of abiotic and biotic processes in degraded ecosystems. Functional restoration focuses on the underlying processes that may be degraded, regardless of the structural condition of the ecosystem. Functionally restored ecosystem may have a different structure and composition than the historical reference condition. As contrasted with ecological restoration that tends to seek historical reference condition, the functional restoration focuses on the dynamic processes that drive structural and compositional patterns. Functional restoration is the manipulation of interactions among process, structure, and composition in a degraded ecosystem to improve its operations. Functional restoration aims to restore functions and improve structures with a long-term goal of restoring interactions between function and structure. It may be, however, that a functionally restored system will look quite different than the reference condition in terms of structure and composition and these disparities cannot be easily corrected because some threshold of degradation has been crossed or the environmental drivers, such as climate, that influenced structural and (especially) compositional development have changed. (FSM 2020; FSH 1909.12)

- Decreased shading and interception from the canopy fuels allow the growth of continuous herbaceous surface fuels to carry surface fire.
- Reduced horizontal and vertical canopy fuels reduce the potential for crown fire.
- Fire may be used with other methods to maintain forest structure over time.
- Regeneration openings and interspaces contribute to the ecological objective of natural heterogeneity of historical forest structure, age class diversity, and open space.

Project areas that are appropriate for restoration to aggregated tree and interspace patterns will primarily be managed with *group selection cutting methods* to create, restore or maintain this pattern and develop or maintain uneven-aged structure. Where the project area is dominated by coarse-textured soils that characteristically support uneven-aged forest structure with random tree distribution, *single tree selection cutting methods* will primarily be used on these sites to create, restore or maintain characteristic structure and spatial patterns. The objective of these treatments is to manage forest structure to maintain or develop mixtures of young, mid-aged, and old structural stages in either predominate spatial pattern, and within the desired forest density ranges. At the fine scale, each stand would be evaluated to determine the specific prescription to move towards uneven-aged structural distribution, by removing young, large trees in groups where they are excess (to favor deficit age/size classes), or by thinning to reduce stand density within cohorts of the same age/size class.

Appendix E: Mechanized Treatments and Flexible Toolbox Approach for Vegetation Restoration

The Black River Restoration Project uses a modified / limited flexible toolbox approach for mechanized vegetation treatments. For each forested stand within the Black River Restoration Project, specific silviculture treatments were assigned by a certified silviculturist using a combination of field reconnaissance and data from stand exams and nearest neighbor imputations. While these assigned treatments are generally accurate and unlikely to be changed during project implementation, there will be situations during detailed silviculture prescription development where the assigned prescription from the modeling will need to change based on actual existing conditions differences from modeled stand data to what is observed during implementation. The flexible toolbox essentially outlines how the project silviculturist will modify prescriptions from what was initially modeled to what is prescribed and certified during implementation. Any changes will be tracked, and limits will be placed upon increases in treatment intensities.

General Treatment Descriptions

The vegetation treatments are determined based on the potential natural vegetation type (PNVT), as described in the Forest Plan. PNVTs are course-scale groupings of ecosystem types that share similar geography, soils, vegetation, and historic ecosystem disturbances, such as fire, drought, and grazing by native species. PNVTs represent the vegetation type and characteristics that would occur when natural disturbance regimes and biological processes prevail. These PNVTs typically contain diverse vegetation structure, varying successional states, and species composition and densities that provide quality habitat for native and desirable nonnative plant and animal species throughout their life cycle and at multiple spatial scales. Landscapes provide for the full range of ecosystem diversity at multiple scales.

The proposed action would move the project area toward the desired condition of uneven-aged stand conditions, as outlined in the Forest Plan. The goal would be to distribute tree groups to attain high heterogeneity within stands. Groups of underrepresented diameter classes would be retained throughout the stands in order to develop an uneven aged structure. Large oaks are underrepresented in the landscape and would be retained whenever possible. Areas would be treated with periodic low severity prescribed burns when and where feasible.

Vegetation treatments would be done to reduce fuel loads in and around cultural resources to provide for the sustainability of archaeological sites, historic properties, traditional cultural properties, sacred sites, and forest resources and areas associated with traditional cultural practices to ensure future opportunities for engagement in traditional uses and research. Within these PNVTs, the vegetation treatments are refined by habitat type for Northern goshawk and Mexican spotted owls as well as unique ecosystem types, as described in the following sections.

Treatments within Northern Goshawk Habitat

Both the Northern goshawk post fledgling area (PFA) and nest areas would be treated following Forest Plan direction by increasing the basal area by 10 to 20 percent in mid-aged to old tree groups. The proposed action would ensure denser canopy conditions in nest areas. Northern goshawk nest areas have forest conditions that are multi-aged and dominated by large trees with relatively denser canopies than the surrounding forest. Timing restrictions would be implemented from March 1st through September 30th to minimize human presence during the nesting season.

Treatments within Mexican Spotted Owl Habitat

All Mexican spotted owl (MSO) habitat would be treated according to the direction provided in the revised Mexican Spotted Owl Recovery Plan (USFWS 2012). Treatments would vary by protected activity center (PAC), recovery habitat managed as nesting / roosting, and recovery habitat managed as foraging / non-breeding habitat as outlined using the conditions-based management approach described below.

MSO PACs

PACs are intended to sustain and enhance areas that are presently, recently, or historically occupied by breeding Mexican spotted owls. Each PAC has a 100-acre no treatment area around the known nest site (Low intensity prescribed fire is allowed). Outside the 100-acre no treatment area, trees may be thinned and/or light prescribed burns may be used to treat fuels and mitigate fuel hazards where feasible. Each PAC to be treated would have an upper diameter limit of trees that may be thinned with the maximum cap being 16.0" DBH in order to emphasize obtaining 50% or greater of the stand basal area being from 16.0" DBH trees; all trees above the prescribed limit would be retained. The cap would be prescribed on an individual stand basis and may be lower than 16.0" DBH based on individual stand conditions and objectives. The proposed action would utilize irregular tree spacing to create canopy gaps (0.1 – 1 acre) to move toward or facilitate stand conditions that may be more conducive to low severity prescribed fire treatment. Retain and recruit coarse woody debris and snags, generally within three to five years after prescribed fire operations. Groups of oaks would be protected, where feasible, from fire impacts either through burn prescriptions or other techniques. Timing restrictions will be implemented from March 1st through August 31st unless non-breeding is confirmed that year per accepted protocol outlined in the MSO Recovery Plan Appendix D.

Within the Black River Project, limited thinning treatments are planned within five of the thirteen PACs within the project area under alternatives 2 and 3. PACs with planned treatments include: Campbell Blue, Firebox, Reservation Tank, Wildcat, and Burro. The remaining eight PACs either have no treatment planned or have tree planting in areas burned during the Wallow Fire and include: Bear Creek, Deer Creek, Hannagan Creek, Home Creek, Lost Bear, McKibbins, Side Canyon, and West Fork. Alternative 2 thins approximately 22.4% of the total PACs, while alternative 3 thins approximately 13.8% of the PACs. Table 38 shows a summary of the treatments within Black River Project PACs.

Table 38. All MSO PACs Treatments within the Black River Project under alternatives 2 and 3

Treatment	Alt 2	Alt3
Mechanized thinning & Burn	277	265
Hand Thinning & Burn	658	315
Rx Burn Only	718	721
Site Prep and Tree Planting	269	262
No Treatment	2,255	2,614
Total Acres	4,177	4,177

Treatment rational for implementing thinning and burning within the PACs is based on field verification and recommendations from an interdisciplinary team. The location of these PACs would prevent much of the surrounding landscape from burning successfully as fire would likely move into the PAC during adjacent prescribed fire operations. The thinning treatments within the PACs are adjacent to other timber

treatments outside of the PACs and would help to provide needed protection for the MSO PAC core area. The fire regime of most of the PACs is suitable for frequent fire and sufficient holding features exist within and around the PACs to enable application of prescribed fire, along with hand thinning, to keep fire to low severity effects. The Burro PAC is in wet mixed conifer and spruce-fir habitat and any thinning and prescribed fire treatments will be strategically placed using jackpot burning. All burning will be reviewed by biologist and fuel management specialists.

Treatments within the PACs are planned to compliment adjacent treatments outside of PACs. Treatment densities will range from 120 ft² of basal area per acre to over 200 ft² based upon for forest type. For ponderosa pine and dry mixed conifer PACs, treatments will be towards the lower end of the range to reduce fire effects is these Fire Regime I - frequent fire ecosystems. For wet mixed conifer and spruce-fir PACs, treatments will be towards the higher end of the range as the fire regime ranges from III to V and is typically mixed severity to stand replacing in nature.

MSO Recovery Nesting / Roosting Habitat

Within MSO recovery nesting/roosting habitat and stands designated to be managed towards nesting / roosting habitat, the stands would be managed using a conditions-based management approach following the MSO recovery plan guidelines (USFWS 2012). Treatment of these stands may include thinning trees and/or light prescribed burns to treat fuels and mitigate fuel hazards where feasible. Irregular tree spacing would be utilized to create canopy gaps and create stand conditions that may be more conducive to low severity prescribed fire treatment. This approach allows for treatments to reduce fire risks, lessen insect or disease problems, maintain seral species, or meet other ecosystem objectives. Ten percent or greater of the ponderosa pine/Gambel oak recovery habitat would be managed for replacement nest/roost habitat, along with 25 percent or greater of the mixed conifer recovery habitat, with the goal of obtaining greater than the minimum acreages where suitable. The following guidelines will be followed when treating MSO recovery nesting / roosting habitat:

- Emphasize attainment of nest/roost conditions as quickly as reasonably possible.
- Retain large trees.
- Strive for spatial heterogeneity.
- Manage for species diversity.
- Retain key owl habitat elements (large trees, snags, large logs, hardwoods, etc.).
- Emphasize large hardwoods, where appropriate

Conditions-Based Management Approach for MSO Recovery Nesting / Roosting Habitat- A conditions-based management approach will be used to determine treatment and treatment intensity within MSO Recovery Nesting / Roosting Habitat. This approach allows for treatments to reduce fire risks, lessen insect or disease problems, maintain seral species, or meet other ecosystem objectives. The following situations and conditions will be used:

- **No Treatment -** Designated Stands that do not currently meet minimum nesting / roosting thresholds, no treatment will be prescribed in order to continue moving the stand towards the minimum threshold levels.
- **Minimum Threshold Prescribed** – Treatments that would lower the MSO recovery nesting / roosting habitat to the minimum thresholds would occur under the following stand situations.
    - High basal area stand, with an active insect or disease outbreak which is causing mortality within the stand. The prescription would focus on targeting recent

mortality, active infested trees, and small diameter trees to improve overall forest health and maintain the stand attributes at or above threshold levels. The rational for this treatment is that if left along with insect or disease outbreak would likely worsen and possibly move the stand below thresholds levels. Large trees over 18.0" DBH would not be targeted for removal.

- High basal area stand that is dominated by small diameter trees in frequent fire ecosystems (Ponderosa Pine and Dry Mixed Conifer). The prescription would focus on thinning small trees to increase the vigor and growth of remaining trees to maintain a healthy stand condition and reduce the risk of uncharacteristic fire. Small trees would be targeted for removal. This would move these stands as close to the ASNF desired conditions as possible while maintaining minimum nesting / roosting conditions. Large trees over 18.0" DBH would not be targeted for removal.
- Stands within a WUI area – Stands within a WUI would be prescribed the minimum thresholds levels in order to improve public safety and reduce impacts to private property and nearby infrastructure. Large trees over 18.0" DBH would not be targeted for removal.

- **Above Minimum Threshold Prescribed** – Treatments that would maintain higher than the minimum nesting / roosting thresholds would occur under the following stand situations.
  - Wet Mixed Conifer Stands – Basal Areas would range up to from 120 ft^2 to 180 ft^2 based on the Forest Plan desired conditions for wet mixed conifer PNVTs. Large trees over 18.0" DBH would not be targeted for removal.

MSO Recovery Foraging / Non-Breeding Habitat

Within MSO Recovery habitat that is foraging, non-nesting / roosting the treatments will follow the desired conditions outline in the Forest Plan and the following guidance from the MSO recovery plan:

- Emphasize Large Hardwoods: Within pine-oak and other forest types where hardwoods are a component of owl habitat, emphasis should be placed on management that retains, and promotes the growth of additional, large hardwoods.
- Retain Large Trees: Retain all 24" + DBH trees.
- Retain Key Owl Habitat Elements: Retain most hardwoods, large snags (18.0" + DBH), large downed logs (18.0"+ at any point), trees (18.0"+ DBH) are retained.

Grassland and Meadow Restoration

Meadow and grassland restoration would include reducing and/or eliminating tree encroachment and applying prescribed fire. This would promote and re-establish the historic meadow edge as defined by current forest structure of young trees encroaching around the edge. Pre-settlement trees (trees greater than 150 years old) would be retained; trees not meeting pre-settlement characteristics may be removed using limited mechanical or hand treatment options. Where evidence of pre-settlement trees exist, it may be desirable to leave post-settlement replacement trees if they occur. Where oak occur, they would not be cut.

Within pronghorn movement corridors, the encroaching conifers and small diameter snags would be removed. Within the project area, movement corridors have been identified from the open grasslands

around Big Lake South to PS Ranch, and then east to Sprucedale grasslands. If additional movement corridors within the grassland and meadow restoration treatment areas are identified, they would receive similar treatment.

Aspen Restoration

Within portions of ponderosa pine stands, aspen remnants would be regenerated by removing all post settlement conifers within a half to one chain (66 feet) of the aspen clone. Some removal of aspen within the clone as well as ground disturbing activity or burning may occur to stimulate suckering. Each clone would be evaluated to determine if fencing or other barriers are needed to reduce ungulate browsing of regenerating aspen.

Reforestation in severely burned stands (All PNVTs)

Planting treatments are planned in all stands that were severely burned in the Wallow fire. Species mixes appropriate for each specific PNVT will be planted depending on available seed inventory. All planting will be done with native seed from seed collected locally within the proper seed zone and elevation band for the species being planted. Site prep using mastication, thinning of dead trees and burning may occur prior to planting.

Specific Thinning Treatments

The proposed vegetation treatments include uneven aged (UEA) group selection (GS), intermediate thinning (IT), stand improvement (SI), even-aged (EA) treatments, overstory removal (OR), slash treatments, and hazard tree removal. These treatments are defined and summarized in Table 40. Table 39 shows a summary of treatments that are planned and that were modeled for the Black River Restoration Project. Table 40 provides a general description of each of the treatments under both alternatives.

Table 39. Summary of treatments by alternative within the Black River Project

Treatment Type	Alternative 2	Alternative 3
Hand / Manual Thinning	14,808	14,466
Mechanized	44,794	44,782
None	14,546	14,786
Rx Fire Only	718	721
Tree Planting	16,738	16,732

Table 40. Black River Restoration Project Vegetation treatment summary descriptions.

Stratum	Vegetation	Slash
Ponderosa Pine (General Forest and Forage) All Slopes Ponderosa Pine and Pine/Gambel Oak Ground based mechanical and manual tree thinning methods and RX burning Boles or slash may be removed or utilized Pine, Pine/Gambel Oak	**General** - Move stands toward the desired conditions, as outlined in the Apache-Sitgreaves (2015) LRMP, of uneven-aged stand conditions. Strive to distribute tree groups to attain high heterogeneity within stands. Groups of under-represented diameter classes would be retained throughout to develop an uneven-aged structure. Consider large oaks as underrepresented in the landscape and should be retained. Large oaks >5" drc/dbh may be considered as residual trees in the target group. Areas should be treated with periodic low severity prescribed burns when and where feasible. **UEA GS – Group Selection** Thin tree groups to an average of 20-80 square feet of basal area and establish non-forested openings adjacent to groups. Actual results will vary depending on current stand conditions. Tree groups are typically less than 1-acre and average ½ -acre. Mid- to old-aged tree groups consist of approximately 2 to 40 trees with interlocking canopies. Interspaces typically range from 10 percent in more productive sites to 70 percent in the less productive sites. Crown spacing between groups would average from 25' to 125' depending on treatment intensity. Priority location for non-forested openings is in currently non-stocked areas and in areas that lack pre-settlement evidence. Regeneration openings up to four acres may be created to recruit a new age class depending on current stand structure. Regeneration openings would average from .3 to .8 acres and would be occupy 10 to 20 percent of the area. Priority location for regeneration openings is within moderate to severe dwarf mistletoe infection centers if margins or residual overstory (within 66 feet) is free of dwarf mistletoe or has low DMR (DMR<3). **ST – Single Tree Selection** Mechanical and fire treatments that leaves fewer tree groups and more randomly spaced trees. Designed to increase or maintain age class diversity and reduce understory brush and shrub response, creating small openings less than or equal to ¼-acre in size where seedlings and saplings are underrepresented, and brush cover is greater than 40%. Maintains higher basal area where brush competition is expected to be strong to suppress woody understory response. **IT – Intermediate Thin** Thin stands that are low to moderately infected with dwarf mistletoe to improve growth and vigor. Thin tree groups to an average of 60-80 square feet of basal area. Retain the best growing dominant and co-dominant trees with the least amount of mistletoe in the lower crown where possible. Establish non-forested openings between residual tree groups. Crown spacing between groups would average from 25' to 80' depending on treatment intensity. Priority location for	Project created slash may be mechanically treated, removed, lopped and scattered, piled, burned or retained for soil stabilization or other resource benefits. Existing ground fuels may also be treated by relocation or removal to reduce fire hazard if quantities are above Land Management Plan guidelines. Manage for 3-10 tons of CWD per acre after treatment. Bark beetle prevention measures may be implemented as necessary. Snags or Hazard Trees within a distance of twice their height from private land boundaries, along key fire control roads, developed recreation areas, and some designated trails may be felled. In all other areas conifer snags >18" dbh will be retained at 1 to 2 per acre (at the landscape level), except in cases of human health and safety.

Stratum	Vegetation	Slash
	non-forested openings is in currently non-stocked areas and in areas that lack pre-settlement evidence. **SI – Stand Improvement** Thin young, even age stands dominated by trees <8.5" dbh to improve growth and vigor. Thin tree groups to an average SDI 90-115 in pine and pine/Gambel oak, 81-102 in Pine/Evergreen Oak, and 120-150 in Dry Mixed Conifer (frequent fire) (20-25% of max SDI). Establish non-forested openings between residual tree groups. Crown spacing between groups would average from 25' to 80' depending on treatment intensity. Priority location for non-forested openings is in currently non-stocked areas and in areas that lack pre-settlement evidence. **OR – Overstory Removal** In stands where there is heavy dwarf mistletoe infection (>80%) remove scattered overstory trees severely infected with dwarf mistletoe that are over-topping young stands of pine with little or no DM infection. Retain as many old and/or large trees as possible with low levels of infection. Old Tree Implementation plan would adhered to. Consider re-delineation of stand boundaries if infection is localized to best mitigate infection.	
Dry Mixed Conifer Forest Dry Mixed Conifer	**General** - Move stands toward the desired conditions, as outlined in the Apache-Sitgreaves (2015) LRMP, of uneven-aged stand conditions. Strive to distribute tree groups to attain high heterogeneity within stands. Groups of under-represented diameter classes would be retained throughout to develop an uneven-aged structure. Consider large oaks as unrepresented in the landscape and should be retained. Large oaks >5" drc/dbh may be considered as residual trees in the target group. Areas may also be treated with periodic low severity prescribed burns when and where feasible. **UEA GS** – Thin tree groups to an average of 30-100 square feet of basal area and establish non-forested openings adjacent to groups. Actual results will vary depending on current stand conditions. Tree groups are typically less than 1-acre and average ½ -acre. Mid- to old-aged tree groups consist of approximately 2 to 40 trees with interlocking canopies. Interspaces typically range from 10 percent in more productive sites to 70 percent in the less productive sites. Crown spacing between groups would average from 25' to 125' depending on treatment intensity. Priority location for non-forested openings is in currently non-stocked areas and in areas that lack pre-settlement evidence. Regeneration openings up to four acres may be created to recruit a new age class depending on current stand structure. Regeneration openings would average from .3 to .8 acres and would be occupy 10 to 20 percent of the area. Priority location for regeneration openings is within moderate to severe	Project created slash may be mechanically treated, removed, lopped and scattered, piled, burned or retained for soil stabilization or other resource benefits. Existing ground fuels may also be treated by relocation or removal to reduce fire hazard if quantities are above Land Management Plan guidelines. Manage for 5-15 tons of CWD per acre after treatment. Bark beetle prevention measures may be implemented as necessary. Snags or Hazard Trees within a distance of twice their height from private land boundaries, along key fire control roads,

Stratum	Vegetation	Slash
	dwarf mistletoe infection centers if margins or residual overstory (within 66 feet) is free of dwarf mistletoe or has low DMR (DMR<2). **ST – Single Tree Selection** Mechanical and fire treatments that leaves fewer tree groups and more randomly spaced trees. Designed to increase or maintain age class diversity and reduce understory brush and shrub response, creating small openings less than or equal to ¼-acre in size where seedlings and saplings are underrepresented, and brush cover is greater than 40%. Maintains higher basal area where brush competition is expected to be strong to suppress woody understory response. **IT** – Thin stands that are moderately to heavily infected with dwarf mistletoe to improve growth and vigor. Thin tree groups to an average of 70-90 square feet of basal area. Retain the best growing dominant and co-dominant trees with the least amount of mistletoe. Establish non-forested openings between residual tree groups. Crown spacing between groups would average from 25' to 80' depending on treatment intensity. Priority location for non-forested openings is in currently non-stocked areas and in areas that lack pre-settlement evidence. **SI** - Thin young, even age stands dominated by trees <8.5" dbh to improve growth and vigor. Thin tree groups to an average SDI 90-115 in pine and pine/Gambel oak, 81-102 in Pine/Evergreen Oak, and 120-150 in Dry Mixed Conifer (frequent fire) (20-25% of max SDI). Establish non-forested openings between residual tree groups. Crown spacing between groups would average from 25' to 80' depending on treatment intensity. Priority location for non-forested openings is in currently non-stocked areas and in areas that lack pre-settlement evidence.	developed recreation areas, and some designated trails may be felled. In all other areas conifer snags >18" dbh will be retained at 3 per acre (at the landscape level), except in cases of human health and safety.
Ponderosa Pine (Post Fledgling Area – PFA) All Slopes All Forest Types Ground based mechanical and Manual tree thinning methods and RX burning	Same as Ponderosa Pine General Forest and Forage areas with the following exceptions: **General –** Northern goshawk post-fledging family areas (PFAs) may contain 10 to 20 percent higher basal area in mid-aged to old tree groups than northern goshawk foraging areas and the surrounding forest. **UEA –** Thin tree groups and establish non-forested openings adjacent to groups to an average of 10-20% higher square feet of basal area than General Forest. Crown spacing between groups would average from 25' to 70' depending on treatment intensity.	Same as Ponderosa Pine (General Forest and Forage) areas

<table>
<tr><th>Stratum</th><th>Vegetation</th><th>Slash</th></tr>
<tr><td>Boles or slash may be removed or utilized</td><td></td><td></td></tr>
<tr><td>Ponderosa Pine (NOGO Nest Area)</td><td>General – UEA
Thin tree groups and establish non-forested openings adjacent to groups to an average of 10-20% higher square feet of basal area than General Forest.

Northern goshawk nest areas have forest conditions that are multi-aged and dominated by large trees with relatively denser canopies than the surrounding forest.

Crown spacing between groups would average from 25’ to 70’ depending on treatment intensity.</td><td>Same as Ponderosa pine (Post Fledgling Area – PFA)</td></tr>
<tr><td>MSO PACs

All Slopes

Ponderosa pine/Gambel oak, Dry Mixed Conifer, and Ponderosa pine/Evergreen Oak (Madrean Pine-Oak)

Ground based mechanical tree thinning methods and/or hand thinning and/or RX burning

Boles or slash may be removed or utilized</td><td>Ponderosa pine sites designated as MSO PACs are protected habitat with specific requirements for treatment. Each PAC has 100-acre no treatment area around the known nest site.

Outside the 100-acre no treatment area, trees may be thinned and/or light prescribed burns may be used to treat fuels and mitigate fuel hazards where feasible. Each PAC to be treated will have an upper diameter limit of trees that may be thinned (Typically 16.0” DBH or less). All trees above that limit will be retained. Utilize irregular tree spacing to create canopy gaps to move toward or facilitate stand conditions that may be more conducive to low intensity prescribed fire treatment. Areas may be treated with periodic low intensity prescribed burns where and when feasible. Within existing old growth stands, old growth attributes would be retained. CWD, snags, groups of oaks would be protected from fire impacts either through burn prescriptions or other techniques.
<table>
<tr><th>Treatment in PACs</th><th>Alt 2</th><th>Alt3</th></tr>
<tr><td>Mechanized thinning and Rx Burn</td><td>277</td><td>265</td></tr>
<tr><td>Hand Thinning and Rx Burn</td><td>658</td><td>315</td></tr>
<tr><td>Rx Burn Only</td><td>718</td><td>721</td></tr>
</table></td><td>Project created slash may be hand piled, lopped and scattered, burned or retained for soil stabilization or other resource benefits. Manage for 5-10 tons of CWD per acre on southerly aspects, 10-15 tons of CWD per acre on northerly aspects and substantive amounts of down logs greater than 12” at midpoint after treatment.</td></tr>
</table>

<table>
<tr><th>Stratum</th><th>Vegetation</th><th>Slash</th></tr>
<tr><td></td><td>
<table>
<tr><td>Site Prep and Tree Planting</td><td>269</td><td>262</td></tr>
<tr><td>No Treatment</td><td>2,255</td><td>2,614</td></tr>
<tr><td>Total Acres</td><td>4,177</td><td>4,177</td></tr>
</table>
</td><td></td></tr>
<tr><td>MSO Recovery Habitat
All Slopes

Ponderosa pine/Gambel oak, Dry Mixed Conifer, and Ponderosa pine/Evergreen Oak (Madrean Pine-Oak), Wet Mixed Conifer, and Spruce fir.

Ground based mechanical and manual tree thinning methods and RX burning

Boles or slash may be removed or utilized</td><td>Ponderosa Pine/Gambel Oak
Manage 10% of Ponderosa Pine/Gambel oak Recovery Habitat as replacement for Nest/Roost. Manage to attain Nest/Roost on this 10% in the shortest timeframe. Thin Ponderosa Pine/Gambel oak to a threshold BA of 110 using a combination of small group cuts and/or thinning. Try to distribute BA so that 30% is in trees <18” dbh and 30% is in trees >18” dbh. Openings .1 up to 2.5 acres. No trees 24 inches dbh or larger would be removed.

Mixed Conifer
Manage 25% of the Mixed Conifer Recovery Habitat as replacement for Nest/Roost. Manage to attain Nest/Roost on this 25% in the shortest timeframe. Thin Dry Mixed Conifer to a threshold BA of 120 using a combination of small group cuts and/or thinning. Try to distribute BA so that 30% is in trees <18” dbh and 30% is in trees >18” dbh. Openings up to 2.5 acres may be considered where necessary. No trees 24 inches dbh or larger would be removed.

Recovery Habitat Not Managed for Nest/Roost
Once the 10% or 25% Nest/Roost thresholds have been identified or attained then stands that do not meet Nest/Roost conditions and are not designated for development of such can be managed to meet other resource objectives (USFWS, 2012).

Ponderosa Pine/Gambel Oak
General - Move stands toward the desired conditions, as outlined in the Apache-Sitgreaves (2015) LRMP, of uneven-aged stand conditions. Strive to distribute tree groups to attain high heterogeneity within stands. Groups of under-represented diameter classes would be retained throughout to develop an uneven-aged structure. Consider large oaks as underrepresented in the landscape and should be retained. Large oaks >5” drc/dbh may be considered as residual trees in the target group. Areas should be treated with periodic low severity prescribed burns when and where feasible.

Dry Mixed Conifer
General - Move stands toward the desired conditions, as outlined in the Apache-Sitgreaves (2015) LRMP of uneven-aged stand conditions. Strive to distribute tree groups to attain high heterogeneity within stands. Groups of under-represented diameter</td><td>Project created slash may be mechanically treated, removed, lopped and scattered, piled, burned or retained for soil stabilization or other resource benefits. Existing ground fuels may also be treated by relocation or removal to reduce fire hazard if quantities are above Forest Plan guidelines. Manage for 5-10 tons of CWD per acre and substantive amounts of down logs greater than 12” at midpoint after treatment. Bark beetle prevention measures may be implemented as necessary. Snags or Hazard Trees within a distance of twice their height from private land boundaries or along key fire control roads may be felled. In all other areas conifer snags >12” dbh will be retained except in cases of human health and safety.</td></tr>
</table>

Stratum	Vegetation	Slash
	classes would be retained throughout to develop an uneven-aged structure. Consider large oaks as unrepresented in the landscape and should be retained. Large oaks >5" drc/dbh may be considered as residual trees in the target group. Areas may also be treated with periodic low severity prescribed burns when and where feasible. **Wet Mix Conifer** General - General - Move stands toward the desired conditions, as outlined in the Apache-Sitgreaves (2015) LRMP of uneven-aged stand conditions. Strive to create a mosaic of structural stages and seral states ranging from young to old trees. The landscape arrangement is an assemblage of variably-sized and aged groups and patches of trees and other vegetation associations similar to reference conditions.	
MSO Nest/Roost All Slopes Ponderosa pine/Gambel oak, Dry Mixed Conifer, and Ponderosa pine/Evergreen Oak (Madrean Pine-Oak) Boles or slash may be removed or utilized	Maintain stands to meet and exceed threshold conditions or move them towards target conditions. Refer to Table C.3 in 2012 MSO Recovery Plan. Treatments will be designed based on a conditions-based management approach to maintain at least 110 BA (pine/oak) or 120 BA (Mixed Conifer) but often much higher based on the specific conditions of the individual stand. There is a minimum requirement of 12 trees per acre >18" DBH. In most cases higher than the minimum will be prescribed with treatments designed to move smaller tree towards past the minimum. Treatment of these stands may include thinning trees and/or light prescribed burns to treat fuels and mitigate fuel hazards where feasible. Utilize irregular tree spacing to create canopy gaps to move toward or facilitate stand conditions that may be more conducive to low intensity prescribed fire treatment. Within existing old growth stands, old growth attributes would be retained. CWD larger than 12" at midpoint, snags, and groups of oaks would be protected from fire impacts either through burn prescriptions or other techniques. **Ponderosa Pine/Gambel Oak** Manage 10% or greater of Ponderosa Pine/Gambel oak Recovery Habitat as replacement for Nest/Roost. Manage to attain Nest/Roost on these area in the shortest timeframe. Thin Ponderosa Pine/Gambel oak to a threshold BA of 110 or greater using a combination of small group cuts and/or thinning. Try to distribute BA so that 30% is in trees <18" DBH and 30% is in trees >18" DBH. Openings .1 up to 2.5 acres. No trees 24 inches DBH or larger would be removed. **Dry Mixed Conifer** Manage 25% or greater of the Mixed Conifer Recovery Habitat as replacement for Nest/Roost. Manage to attain Nest/Roost on this	Project created slash may be hand piled, lopped and scattered, burned or retained for soil stabilization or other resource benefits. Manage for 5-10 tons of CWD per acre on southerly aspects, 10-15 tons of CWD per acre on northerly aspects and substantive amounts of down logs greater than 12" at midpoint after treatment.

Stratum	Vegetation	Slash
	Pine-oak | 10 | >30 | >30 | 25.3 (110) | 30 (12) [1] % of area pertains to the percent of the planning area, subregion, and/or region in the specified forest type that should be managed for threshold conditions. [2] BAs in m^2/ha (ft^2/acre), and include all trees >1 inch dbh (i.e., any species). We emphasize that values shown are **minimums**, not targets. [3] Trees > 46 cm (18 inches) dbh. Density is tree/ha (trees/acre). Again, values shown are minimums rather than targets. We encourage retention of large trees. [4] Pine-oak forest type: ≥10% of the stand BA or 4.6 m^2/ha (20 ft^2/ac) of BA consist of Gambel oak ≥ 13 cm (5 in) drc. [5] Pine-oak recommendations apply only to the Mount Taylor and/or Zuni Mountains regions within the CP EMU. **Wet Mix Conifer** General - General - Move stands toward the desired conditions, as outlined in the Apache-Sitgreaves (2015) LRMP of uneven-aged stand conditions. Strive to create a mosaic of structural stages and seral states ranging from young to old trees. The landscape arrangement is an assemblage of variably-sized and aged groups and patches of trees and other vegetation associations similar to reference conditions. **Spruce-Fir** General - General - Move stands toward the desired conditions, as outlined in the Apache-Sitgreaves (2015) LRMP of uneven-aged stand conditions. A mosaic of primarily even-aged groups and patches, which vary in size, species composition, and age should be created.	
Burn Only Ponderosa pine/Gambel oak, Dry Mixed Conifer, and Wet Mixed Conifer) All Slopes	Areas may be treated with periodic prescribed burns where and when feasible. Within existing old growth stands, old growth attributes would be retained. Snags and groups of oaks would be protected from fire impacts either through burn prescriptions or other techniques. Limited treatment of pre-existing fuels may be used to prepare firelines, reinforce control lines or disrupt pockets of fuel concentrations for the protection of identified resources or improve control features. Apsen clones would be protected through not igniting within the clone.	Any slash created in conducting this treatment may be piled or lopped and scattered. Fuel concentrations should be scattered to alleviate the threat to control. Manage CWD tons per acre after treatment at levels that are appropriate for the stratum it falls within.
Meadow Restoration (All) Meadow Restoration Hand thinning	Promote and reestablish the historic meadow edge as defined by the current forest structure of young trees encroaching around the edge. Large trees with long-lived characteristics will be retained; trees not meeting long-lived characteristics may be removed using limited mechanical or hand treatment options. Where evidence of large trees exist, it may be desirable to leave replacement trees if they occur. Where oak occur, they will not be cut. Areas may also be treated with	Boles and created slash may be removed or lopped and scattered, or piled and burned, or utilized for soil stabilization. Bark beetle prevention measures will be

Stratum	Vegetation	Slash
	periodic low intensity prescribed burns where and when feasible.	implemented as necessary.
Aspen (All) Aspen Boles or slash may be removed or utilized	Inclusions of aspen remnants within portions of ponderosa pine stands would be regenerated by removing all post settlement conifers from within ½ to 1 chain (66') of the aspen clone. Some removal of aspen within the clone as well as ground disturbing activity or burning may occur to stimulate suckering. Each clone will be evaluated as to need for fencing or creation of other barriers to reduce ungulate browsing of regenerating aspen.	Boles and created slash may be removed or lopped and scattered, or piled and burned, or utilized for soil stabilization or utilized to create barriers. Bark beetle prevention measures will be implemented as necessary.

Condition-Based Management Strategy

The Black River project will use a condition-based management strategy that allows predetermined treatments to be aligned, prior to implementation, with current conditions on the ground. A combination of selection criteria and vegetation conditions are used to determine habitat and forest cover filters and modifiers, as well as the appropriate treatments for each. Using existing stand data, these conditions and criteria are quantified to estimate the acreages of specific treatments to propose in a project area. These estimates are used to analyze the effects from those treatments. Site-specific field reviews are conducted before implementation to verify that ground conditions match those predicted. If they do not, the same selection criteria are applied again based on the actual ground conditions to be sure that the right treatment occurs on the right acre.

The project decision and analysis used a site-specific treatment assigned at the stand level based on biotic and abiotic factors such as known habitat, soil types. The analysis used the best information and tools at the time to model a site-specific decision. Field verification could drive change to the baseline prescription for a higher quality of implementation. Baseline prescriptions is a place for field verification to start. This toolbox approach would be used to identify and analyze prescription options when discrepancies occur upon field verification. This approach describes a series of current conditions and then identify a prescription that could stands toward desired conditions. We will use decision matrices with a set of "if…then" determination points, based on conditions at the time of implementation, which would lead to the desired condition. Figure 6 demonstrates the toolbox process using cover and habitat cover types, a decision matrix and modifiers.

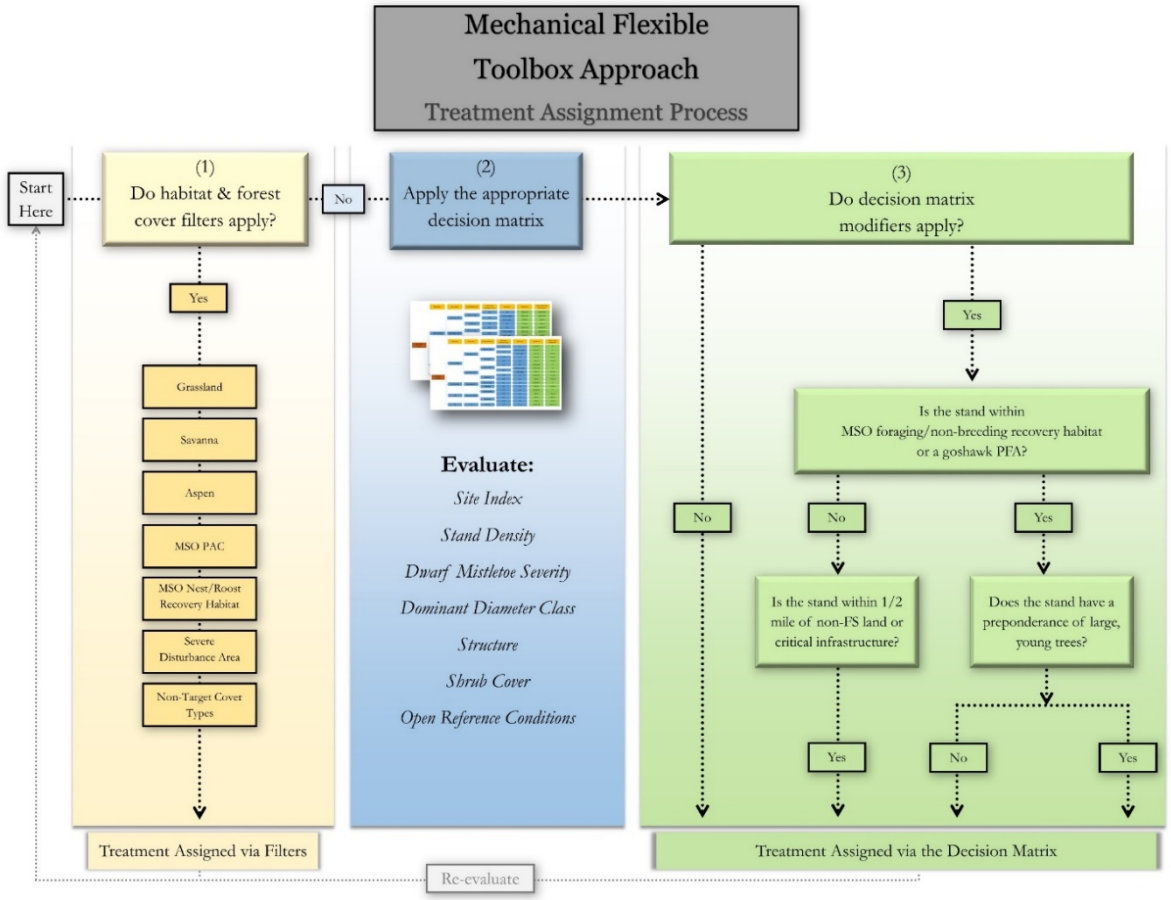


Figure 9. Mechanical Conditions Based Management Approach Treatment Assignment Process

The conditions-based management approach:

- Gives the ability to obtain more detailed site-specific information.
- Adapts to changes in environmental conditions.
- Uses expected conditions to make an informed decision about what types of treatments would work best in those conditions.
- Encourages application of the appropriate tool based on site conditions at time of implementation.
- Uses site-specific landscape features and current site conditions during implementation to guide selection of specific treatments or tools to move areas toward desired conditions and put the right treatment in the right place.
- Gives resource specialists flexibility to increase heterogeneity across the landscape by varying the extent, type, or intensity of treatments within the extent of the treatment.

The conditions-based management approach is used to:

- Identify forest cover and habitat types that warrant special consideration and require additional management constraints before prescribing treatments are “filtered” out of the decision matrix

treatment considerations. These include MSO PACs, MSO Nest/Recovery Habitat, Aspen Restoration, Grassland, and Savanna.

- Develop decision matrices to display the different site conditions that would lead to different treatments in areas outside of filters. While treatments in some cover and habitat types will not be determined by the decision matrices, others will make use of the decision matrices with added design features or "modifiers" to ensure resource protection. These include: MSO Recovery Habitat, NOGO Nest Stands, NOGO PFAs, SPLYT, and Sensitive Soils.
- Estimate the number of acres of each type of treatment proposed in each of the action alternatives. Proposed treatments, each with a defined range of openness, are analyzed at the higher end of openness or intensity, in order to analyze the maximum potential effects from these treatments.
- Prescribe appropriate treatments during implementation. Pre-implementation surveys will determine site-specific cover and habitat types and current conditions. Selection criteria for these types as spelled out in the FTA will be used to prescribe the appropriate treatments.

Due to the size and complexity of the Black River Restoration Project (92,434 acres) several years of data collection has occur across the project area in order to determine the existing condition and compare it to the desired condition outlined in the Forest Plan. While using tools such as the FSveg data analyzer gives a good idea of what each stand's existing condition is, there are always data gaps and slight errors in any modeling program. During implementation of the Silviculture projects within Black River a flexible treatment approach will be used in cases where the vegetation analysis of existing conditions is different than actual existing conditions encountered during implementation. In field checks during the summer of 2017, most of the modeled treatments appears to be accurate so few changes from the vegetation treatment described in this report are expected. However, the proposed approach builds on the method used in the 1st 4FRI EIS and the 4FRI Rim Country EIS (No Decision Yet) to give the desired flexibility in mechanical treatments in areas without other management constraints (such as Mexican spotted owl (MSO) and goshawk (NOGO) habitat, or sensitive soils).

It is desirable for the Black River Project to give forest and district silviculturists as much flexibility as possible to choose the best treatment for individual stands and portions of stands and prescribe the right treatment on the right acre. A condition-based management approach would be used to identify and analyze a suite of possible treatment options and would not tie implementers to a single pre-determined treatment for each individual stand in the project area. Within the broader adaptive management framework, learning from implementation and monitoring of mechanical treatments for restoration, we want to analyze a wide variety of possible treatments across the landscape, and defer the final treatment determination until we have the most accurate and current on-site stand conditions. Using this approach, we will describe a series of current conditions and then identify a mechanical treatment that could be applied to move the landscape toward desired conditions. In its simplest form, if we can describe existing stand conditions and the desired condition for a stand, then the silviculturist on the ground can design the appropriate prescription using guidelines provided in a condition-based management approach. This document applies only to mechanical treatments, and suggested treatments are intended to be used in conjunction with prescribed fire.

Condition-Based Mechanical Treatment Approach: Stand-Level Prescriptions

One way we can add the flexibility required to apply the right treatment to the right acre is to use a decision matrix to display the different conditions that would lead to different treatments. In this simplified example, we will use %SDI max (measure of existing stand density compared to its theoretical maximum density), site index (measure of site productivity), and dominant diameter class to determine

proposed treatments. A simplified decision matrix considering these conditions could look like the following example shown in table 41.

Table 41. Example simplified decision matrix for treatments using a condition-based management approach

%SDI Max	Site Index	Dominant Diameter Class	Treatment
>25%	>75	12+	Uneven-aged Group Selection, 10-25% interspace
		<12	Stand Improvement, 10-25% interspace
	55-75	12+	Uneven-aged Group Selection, 25-40% interspace
		<12	Stand Improvement, 25-40% interspace

For example, a dense ponderosa pine stand is highly departed from desired conditions. It has a basal area of 150, an SDI of 250 (56% of SDI Max), is dominated by trees greater than 12", and is in an area with a site index of 80. According to the decision matrix above, the stand would be assigned an Uneven-aged Group Selection, 10-25% interspace treatment. The treatment would be designed to reduce basal area and SDI, while creating up to 25% interspace within the stand in order to move the stand toward desired conditions.

HABITAT AND ECOSYSTEM COVER FILTER - AREAS NOT ASSIGNED TREATMENTS USING THE DECISION MATRICES

Before applying the decision matrix to stands in the Black River project area, it is necessary to acknowledge that there are several identified forest cover and habitat types that warrant additional consideration. For example, MSO habitat and other certain stand conditions require consideration of additional management constraints before prescribing treatments. While some of these situations warrant treatment considerations completely outside of the decision matrix, some of these conditions are included in the decision matrix with additional design features to ensure resource protection. For example, while MSO PACs may require certain types of treatment without consideration of the decision matrix, treatments in northern goshawk (NOGO) Post-Family Fledgling Areas (PFAs) or in Stands with a Preponderance of Large Young Trees (SPLYT) may only require additional design features to ensure adequate resource protection. Some stands have a soil or vegetation characteristic that may warrant treatments outside of the matrix (i.e., aspen stands). Habitat and forest cover types that will require additional consideration before application of the decision matrix are described here.

MSO Protected Activity Centers (PACs): PACs exhibit a variety of topographic and forest conditions and occupied PACs are considered to contain nesting habitat. Mechanical treatments in PACs should be designed to maintain or improve the characteristics that make each PAC effective at providing habitat while also making them more resilient to disturbance. Consideration should be given to 1) increasing the number of large trees; 2) creating additional foraging habitat for MSO; 3) the fire hazard index in the PAC and whether it is in wildland-urban interface (WUI); 4) restoration/protection of other resource values nearby, such as perennial water; and 5) protecting other values at risk. Treating areas near PACs should be considered in order in improve resiliency in the PACs themselves. PACs should be treated with consideration of the larger landscape and not just separate entities. Specific treatments in PACs would be determined prior to implementation and in consultation with U.S. Fish and Wildlife Service (FWS) personnel.

MSO Nest/Roost Recovery Habitat: Though these areas are distinct from PACs, their management objectives are similar. Any treatment proposed within MSO nest/roost recovery habitat should be designed specifically to maintain or accelerate the trajectory of these stands towards desired habitat conditions in the foreseeable future.

Aspen Restoration: Stands identified for aspen restoration will receive an aspen-specific restoration treatment and treatments will not be determined as a result of the decision matrix. These stands have been identified as those having most of the live basal area in aspen. Aspen restoration treatments may include conifer removal from within stands, and barriers to reduce browsing pressure on regeneration.

Grassland: Stands designated as grasslands will be given a grassland-specific restoration treatment and will not be assigned a treatment from the decision matrix. Stands or portions of stands that overlap with a grassland terrestrial ecosystem unit (TEU) were identified as grassland. Grassland-specific restoration includes a mechanical treatment that removes post-settlement conifers and manages for at least 90% of the treatment area as grass/forb, using pre-settlement tree evidence as guidance.

Savanna: Stands designated as savanna will be given a savanna-specific treatment and will not be assigned a treatment as a result of the decision matrices. Stands or portions of stands that overlap with a savanna terrestrial ecological unit (TEU) and are adjacent to stands identified for a grassland treatment are classified as savanna. Also, those stands or portions of stands that overlap with a savanna TEU and with an existing condition of less than 25% max SDI were identified as savanna. Savanna restoration includes a mechanical treatment that restores pre-settlement tree density and pattern and manages for a range of 70 to 90% interspace between groups or individual trees, using pre-settlement evidence as guidance.

***Severe Disturbance Areas*:** Severe disturbance areas are those where the spatial extent and/or the pattern of high severity effects is not within NRV. In some places this has resulted in aggressively sprouting species, such as alligator juniper and various species of oak dominating the vegetative response, making it difficult or impossible for ponderosa pine to establish or thrive. In other areas, extensive, overly dense patches of ponderosa pine regeneration have put stands on a trajectory toward stagnation, density-related mortality, or additional severe disturbance. In these areas of extensive, pure ponderosa pine regeneration, the decision matrix will be applied.

Restoration treatments in severe disturbance areas will include combinations of reforestation, prescribed fire, lopping/scattering, mastication, and other mechanical methods with the objective of identifying treatments that would be effective in restoring the fuel structure that produces the types of fire to which ponderosa pine is adapted.

***Wet Mixed Conifer / Spruce Fir PNVTs**:* In general, wet mixed conifer and spruce fir stands are not in need of restoration and are typically within their natural range of variation. In certain cases, these stands will be treated with a specific treatment for these vegetation types according to the desired conditions as outline in the Forest Plan and will not use the condition-based management approach described below.

AREAS CONSIDERED FOR REGULAR RESTORATION TREATMENTS

Habitat and Forest Cover Modifiers: Some habitat and stand structures will make use of the decision matrices but with specific design features to ensure resource protection. For example, while MSO PACs may require certain types of treatment apart from the decision matrices, treatments in northern goshawk (NOGO) Post-Family Fledgling Areas (PFAs) or in Stands with a Preponderance of Large Young Trees (SPLYT) may only require certain design features in addition to decision matrix treatments to provide adequate resource protection. Habitat and forest cover types that will require additional considerations or modifiers in addition to application of the decision matrices are described here.

MSO Recovery Habitat: Achieving management objectives within MSO recovery habitat can be addressed with the condition-based management approach. Stands in recovery habitat would be assigned a treatment using the decision matrix; however, additional management direction would be applied such

as maintaining increased basal area (40-110 BA for pine-oak and 40-135 BA for mixed conifer). Basal area would also be aggregated where some areas within the stand would have higher BA. This additional direction is included in the project design features to ensure resource protection.

NOGO Nest Stands: Achieving management objectives for northern goshawk nest stands can be addressed with the condition-based management approach. NOGO nest stands would be assigned a treatment using the decision matrix. However, additional direction would be included in project design features, such as maintaining increased basal area within nest areas, to maintain or improve habitat and ensure forest plan compliance.

NOGO Post-Fledging Areas (PFAs): Management objectives in NOGO PFAs are similar to those in NOGO nest stands and can be addressed with the condition-based management approach. NOGO PFA stands would be assigned a treatment using the decision matrix; however, additional direction would be included in project design features, such as maintaining increased basal area within PFAs, to maintain or improve habitat and ensure forest plan compliance.

***Stands with a Preponderance of Large Young Trees (SPLYT*)**: The iterative spatial analysis and field validation effort undertaken by the Forest Service and stakeholders yielded an initial filter for SPLYT located outside of MSO PACs, MSO recovery habitat, and wildland urban interface (WUI). For ponderosa pine SPLYT, criteria are that: a) the Quadratic Mean Diameter (QMD) of the top 20% of trees is >15" diameter at breast height (DBH), and b) there is >50 square feet/acre of basal area (BA) in trees >16" DBH. All stands would be field verified prior to mechanical thinning. Stands (or portions thereof) meeting SPLYT criteria, including those not captured by the data filter, would be treated at the lowest range of intensity within the identified silvicultural prescription up to 10% of the total Ponderosa Pine PNVT acres. For example, a stand identified by the decision matrix to receive an uneven-aged treatment leaving 10 to 25% interspace (UEA 10-25), would be treated to 10% interspace and to the upper end of its natural range of variation (NRV) for trees per acre (TPA) and BA in order to maintain large tree dominance and conditions favorable to canopy-dependent species. Stands (or portions thereof) that are identified by the SPLYT criteria data filter but, upon field verification, are determined not to meet the SPLYT criteria, will be treated within the range of intensities applied to other non-SPLYT stands. The 10% chosen to be treated with the lowest range of intensities will be determined by picking the stands that have the most basal area dominated by larger trees, soil conditions conducive to sustaining higher basal areas and have high stand site indexes.

Pronghorn Antelope: Management objectives in stands that are in known pronghorn antelope corridors and habitat can be addressed through the condition-based management approach. In general, unless other concerns such as MSO and NOGO habitat requirements are in effect, pronghorn antelope corridors and identified habitat will be treated at the higher ranges of intensity reducing basal areas and canopy cover towards the lower range of the desired conditions in the Forest Plan. Emphasis will be to retain large trees but in a more open stand condition. For example, a stand identified by the decision matrix to receive an uneven-aged treatment leaving 10 to 25% interspace (UEA 10-25), would be treated to 25% interspace and to the lower end of its natural range of variation (NRV) for trees per acre (TPA) and BA in order to maintain large tree dominance and conditions favorable to antelope.

Sensitive Soils: Achieving management objectives on stands with sensitive soils can be addressed with the condition-based management approach. Stands or portions of stands with sensitive soils will be identified in the project implementation plan and protection measures employed in the project layout process. Additional design features will be included to prevent soil displacement and compaction and ensure resource protection and forest plan compliance.

Dwarf Mistletoe: While the overall incidence (distribution and percent of landscape affected) of dwarf mistletoe (DM) is thought to have increased only modestly compared to historic conditions, the overall intensity and abundance of DM is thought to have increased considerably (Conklin and Fairweather 2010). In order to meet the purpose of increasing the resiliency and sustainability of ponderosa pine ecosystems within the Black River project area, it would be beneficial to develop treatments that focus on reducing the abundance and intensity of DM infection in stands. This section hopes to clarify the conditions that warrant various treatments in order to meet the Purpose and Need and move toward desired conditions in the Black River project area.

Because of the patchy nature of DM infections, it is recommended that the district silviculturist consider re-delineating a stand with high DM infection and treating the healthy and infected portions with separate prescriptions.

In lightly (0-20% DM infection) and moderately (20-80% DM infection) infected stands, the restoration treatments in the proposed action will address DM. In stands with light infections, project design features will be included to allow for removal of DM-infected trees as part of the uneven-aged group selection, single-tree selection, stand improvement, weed and release, and grassland treatments. Pockets of DM infection would be addressed through the reduction of basal area as well as the creation of openings and interspaces as part of these treatments.

In moderately-infected stands, the intermediate thin treatment would be particularly effective at addressing DM, especially at the lower part of the moderate range (20-50%). Towards the higher end of the moderate range (50-80% infection), mistletoe would remain as a component of the stand, while remaining basal area providing for full stocking would reduce the stimulation of DM in the remaining trees. Pockets of DM infections could be addressed through the reduction of basal area as well as the creation of small openings and interspaces.

With the proposed action, heavily infected stands (>80% DM infection) would be treated with the best suited treatment to control mistletoe. These approaches would maximize interspace and minimize residual basal area in order to retain the uninfected component of the stand as well as reduce dwarf mistletoe spread. Deferment of mechanical treatment would be another option in these stands. Relying on prescribed fire to keep the mistletoe in check. Because of the patchy nature of dwarf mistletoe infections, it is recommended that the district silviculturist consider re-delineating a stand with high mistletoe infection and treating the healthy and infected portions with separate prescriptions.

WUI (non-FS lands and critical infrastructure): For the purposes of the Black River Restoration Project, what is commonly referred to as Wildland-Urban Interface, or WUI, will follow the Forest Plan definition as follows (Except for Alternative 3 where the WUI definition is changed):

> **Wildland-urban interface (WUI)** - Wildland-urban interface includes those areas of resident populations at imminent risk from wildfire, and human developments. These areas may include critical communications sites, municipal watersheds, high voltage transmission lines, church camps, scout camps, research facilities, and other structures that, if destroyed by fire, would result in hardship to communities. These areas encompass not only the sites themselves, but also the continuous slopes and fuels that lead directly to the sites, regardless of the distance involved. (USDA 2015)

In these areas, in order to protect values at risk, the flexibility is given for more open treatments, up to 70% interspace. Stands or parts of stands within these areas that are identified as habitat and cover type filters or modifiers (as described in this condition-based management approach) will not be considered for

these types of increased intensity treatments but will be considered for the appropriate treatments per their descriptions.

These treatments to protect values at risk will be prioritized with site-specific considerations identified with Community Wildfire Protection Plans and local FS ranger districts, including:

- Susceptibility to wildfire
- Current conditions
- Prevailing winds
- Topography

The Black River Restoration Project has three main areas that are considered as WUI using the Forest Plan definition. These include the following areas:

1. Beaverhead / Sprucedale – This includes Josh Ranch (http://www.joshranch.com/), Sprucedale Guest Ranch (https://www.sprucedaleranch.com/) and several private residences and cabins along Forest Road 26. This area is identified in Greenlee County's Community Wildfire Protection Plan (CWPP) and is listed as a high-risk treatment management area and is a high priority for treatment even after the Wallow fire (Greenlee CWPP 2005).
2. Brentwood and Arizona Game and Fish Cabin – This includes the Brentwood Latter-Day Saints (LDS) church camp and the Arizona Game and Fish Department Cabin.
3. Big Lake Campground Complex and Utilities – This includes the Big Lake Campgrounds (Apache Trout, Rainbow, Cutthroat, Brookchar, Grayling), Big Lake Marina, Big Lake Visitor Center, water treatment facility, water storage tanks and all other surround infrastructure.

The current condition of each of these areas will be field reviewed prior to implementation by an interdisciplinary team of resource specialists, to determine what type and level of mechanical treatment is needed to protect the values at risk. A balance of visual quality and reduction of risk of wildfire will be the primary objectives for these treatments.

Wild and Scenic River Corridors: There are currently no designated wild segments of wild and scenic rivers in the Rim Country project area. Any mechanical treatments proposed in eligible wild and scenic river corridors in the Black River project area will be modified to meet the purposes of restoring natural geomorphic and ecological processes and the specific outstandingly remarkable values (ORVs) of the river (such as fish and wildlife habitat).

GENERAL TREATMENT TYPES:

- Uneven Age Management (UEA) - Uneven-aged (thinning throughout all diameters)
    - Establish grass/forb (non-forested) openings between residual tree groups and clumps.
    - Establish regeneration openings where seedling/sapling size class trees are underrepresented
    - Establish gaps between individual trees and clumps of trees within a group.
    - Enhance growing space for younger age classes to become free to grow with limited competition.
    - Retain as many old and/or large trees as possible
- Intermediate Thin (IT) - Intermediate Thin (thinning with a dwarf mistletoe cutting bias)

    - Thin stands that are moderately to heavily infected with dwarf mistletoe to improve growth and vigor. Retain the best dominant and co-dominant trees with the least amount of mistletoe.
    - Establish grass/forb (non-forested) openings between residual tree groups and clumps.
- Single Tree Selection (ST) - Mechanical and fire treatments that leaves fewer tree groups and more randomly spaced trees.
    - Designed to increase or maintain age class diversity and reduce understory brush and shrub response, creating small openings less than or equal to ¼-acre in size where seedlings and saplings are underrepresented, and brush cover is greater than 40%.
    - Maintains higher basal area where brush competition is expected to be strong to suppress woody understory response.
- Stand Improvement (SI) - Stand Improvement Thin (thinning young stands to select best future trees)
    - Thin young, even age stands to improve growth and vigor.
    - Begin conversion to uneven age condition and establish grass/forb (non-forested) openings between residual tree groups and clumps.
    - Retain as many old and/or large trees as possible.
- Even-aged Management - Overstory Removal (OR)
    - Remove scattered overstory trees severely infected with dwarf mistletoe that are over-topping young stands of pine with little or no DM infection.
    - Retain as many old and/or large trees as possible with low levels of infection.
    - Old Tree Implementation plan would be adhered to.

DECISION MATRICES

Once these areas that will not be considered for regular restoration treatment types were identified, a treatment strategy for the remaining conditions was developed. A decision matrix has been built that incorporates discrete attributes that can be used to segregate the stands for different treatments and build diversity across the landscape.

If the goal of a condition-based management approach is to prescribe the right treatment on the right acre, then vegetation condition should guide management decisions. One way to do this is to describe the stand structure, for example if it is even-aged or uneven-aged. We may want to thin even-aged stands differently than uneven-aged stands to move them toward the desired condition of uneven-aged stand structure. An even-aged stand would be treated to develop more openings, to encourage new cohorts and a more uneven-aged structure, and to develop one or two more age classes (additional age classes could be developed in later entries). An uneven-aged stand would be thinned to develop larger groups, in all diameter ranges, to maintain or enhance the current uneven-aged structure.

Another way to provide more flexibility is to consider the variety of site classes that occur across the project area. Stands with a higher site class may be able to be managed at a higher residual basal area and with less interspace. Additionally, the level of dwarf mistletoe infection should be considered in prescribing treatments in order to most effectively improve resilience without releasing or stimulating the infection. Figure 11 shows the condition-based management approach decision matrix that was developed specifically for Alternative 2 of the Black River Project.

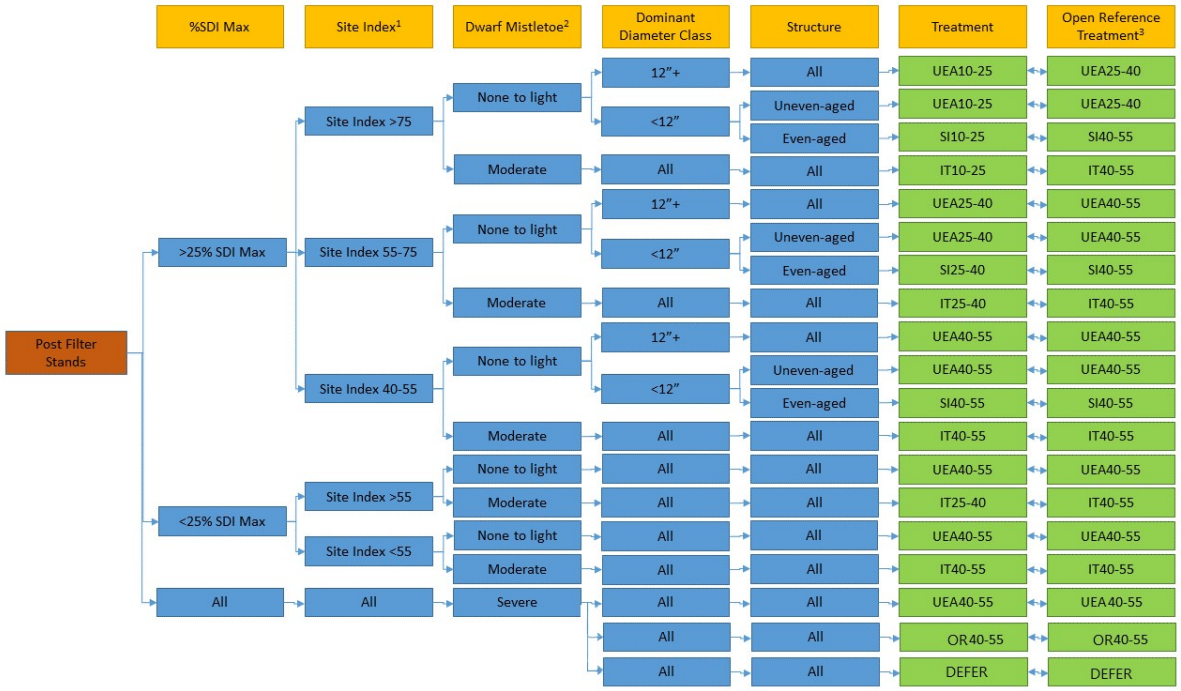


Figure 10. Condition-based management approach decision matrix for Alternative 2 treatment in the Black River Restoration Project. 6,7,8

The advantage of using this type of matrix is that we are looking at "conditions" and not necessarily "stands." This flexible approach prescribes treatments according to pre-defined conditions and not necessarily by previously defined stands, so that stand boundaries can be re-delineated based on current conditions. This is particularly important where there is a patchy condition in a stand, such as that caused by dwarf mistletoe or a group of large young trees. If it is necessary to have two or more distinct treatment prescriptions in one stand to accommodate intra-stand variability, then the silviculturist should delineate new stand boundaries.

Figure 12 shows the condition-based management approach for Alternative 3.

[6] Dwarf Mistletoe Infection: Light - < 20% TPA infected; Moderate – 20-80% TPA infected; Severe - > 80% TPA infected. In "Severe" DM infected stands (or areas of stands) Even-aged management silviculture systems are indicated (per Forest Plan)

[7] Treatment: The number following to the treatment type (10, 25, 40, 55) refers to the approximate percentage range of grass/forb (non-forested) opening that will be established by the treatment. The range of opening for a "10" would be 10-25%; for a "25" the range would be 25-40%; for a "40" the range would be 40-55%; for a "55" the range would be 55-70%.

[8] Defer: Deferment of any vegetation cutting treatments this entry. Prescribed fire will still be implemented in these stands.

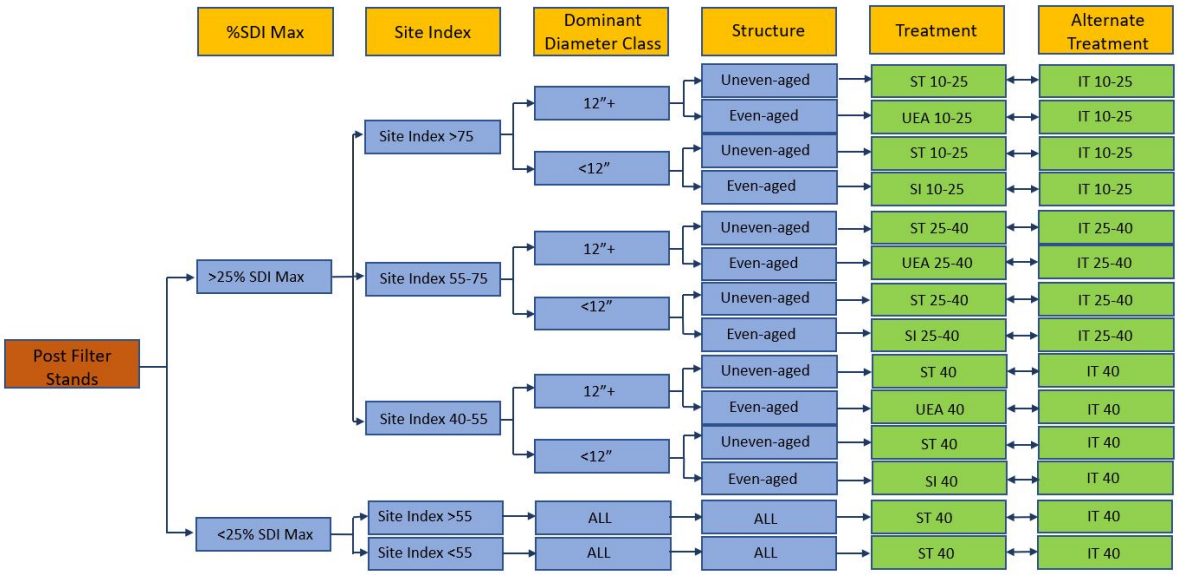


Figure 11. Condition-based management approach decision matrix for Alternative 3 treatment in the Black River Restoration Project.

While the decision matrix leads us in the right direction to apply the right treatment to the right acre, there is still a need to ensure that silviculturists have the flexibility to move toward desired conditions across the landscape. This method also allows, based on specific conditions, for a broad range of densities within the individual treatments identified in the decision matrix. We recognize that there will be a broad range of responses of vegetation, wildlife, and water to our proposed treatments, some unanticipated. This approach gives us the ability to adjust treatments in response to monitoring results or other new information.

This is somewhat of a hybrid approach which helps give fine-, mid-, and landscape-scale perspectives across the project area, in order to determine if proposed treatments are moving toward desired conditions at multiple scales. Acres of "conditions" and "outcomes" at multiple scales will be used to drive the analysis. Stand-level data can be aggregated up to the mid- and landscape-scales.

Density Management and the Relationship between Treatment Intensity, Tree Group Density, and Overall Average Stand Density

The degree of openness pre- and post-treatment and treatment intensity are important issues to address within the Black River Restoration Project. Terms like interspace, groups and regeneration opening can sometimes be confusing and may not correlate directly with other metrics such as canopy cover. Definitions for each of these metrics for Black River Restoration Project are taken directly from the Forest Plan. Table 42 shows the relationship between treatment intensity, tree group density and average density as it relates to various prescribed interspace vs treed percentages and regeneration openings. As interspace and regeneration percentages increase, the basal area within the tree groups increases in order to maintain the overall stand basal area prescribed.

Table 42. Relationship to treatment intensity, tree group density and average density

Treatment Intensity	Percent of area		Percent of treed area		Percent of Area Percent of Treed Area Avg. Group BA to Achieve Overall BA of:					
	Interspace	Trees	Groups and Individuals	Regeneration Openings	40	50	60	70	80	90
10–25	10	90	90	0		56	67	78	89	100
			85	5		59	71	82	94	
			80	10		63	75	88	100	
			75	15		67	80	93	107	
			70	20		71	86	100	114	
	15	85	85	0		59	71	82	94	106
			80	5		63	75	88	100	
			75	10		67	80	93	107	
			70	15		71	86	100	114	
			65	20		77	92	108	123	
	20	80	80	0		63	75	88	100	113
			75	5		67	80	93	107	
			70	10		71	86	100	114	
			65	15		77	92	108	123	
			60	20		83	100	117	133	
25–40	25	75	75	0		67	80	93	107	120
			70	5		71	86	100	114	
			65	10		77	92	108	123	
			60	15		83	100	117	133	
			55	20		91	109	127	145	
	30	70	70	0		71	86	100	114	129
			65	5		77	92	108	123	
			60	10		83	100	117	133	
			55	15		91	109	127	145	
			50	20		100	120	140	160	
	35	65	65	0		77	92	108	123	138
			60	5		83	100	117	133	
			55	10		91	109	127	145	
			50	15		100	120	140	160	
			45	20		111	133	156	178	
40–55	40	60	60	0	67	83	100	117	133	150
			55	5	73	91	109	127	145	

			50	10	80	100	120	140	160	
			45	15	89	111	133	156	178	
			40	20	100	125	150	175	200	
	45	55	55	0	73	91	109	127	145	164
			50	5	80	100	120	140	160	
			45	10	89	111	133	156	178	
			40	15	100	125	150	175	200	
			35	20	114	143	171	200	229	
	50	50	50	0	80	100	120	140	160	180
			45	5	89	111	133	156	178	
			40	10	100	125	150	175	200	
			35	15	114	143	171	200	229	
			30	20	133	167	200	233	267	
55–70	55	45	45	0	89	111	133	156		
			40	5	100	125	150	175		
			35	10	114	143	171	200		
			30	15	133	167	200	233		
			25	20	160	200	240	280		
	60	40	40	0	100	125	150	175		
			35	5	114	143	171	200		
			30	10	133	167	200	233		
			25	15	160	200	240	280		
			20	20	200	250	300	350		
	65	35	35	0	114	143	171	200		
			30	5	133	167	200	233		
			25	10	160	200	240	280		
			20	15	200	250	300	350		
			15	20	267	333	400	467		

Note: Red fill indicates red SDI zone for all diameters. Red zone group BA ranges from 125 BA for 8-inch QMD to 195 BA for 24-inch QMD.

* Average Group Basal Area (BA) to achieve overall BA.

Table 43. Relationship of basal area and quadradic mean diameter (QMD) to trees per acre (TPA) showing 4 SDI zones

TPA by QMD and BA:

	Grp BA																												
Grp QMD	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195
8	158	172	186	200	215	229	243	258	272	286	301	315	329	344	358														
9	125	136	147	158	169	181	192	204	215	226	238	249	260	272	283	294													
10	101	110	119	128	138	147	156	165	174	183	193	202	211	220	229	238	248	257											
11	83	91	99	106	114	121	129	136	144	152	159	167	174	182	189	197	205	212	220										
12	70	76	83	89	96	102	108	115	121	127	134	140	146	153	159	166	172	178	185	191									
13	60	65	71	76	81	87	92	98	103	109	114	119	125	130	136	141	147	152	157	163	168								
14	51	56	61	66	70	75	80	84	89	94	98	103	108	112	117	122	126	131	136	140	145	150							
15	45	49	53	57	61	65	69	73	77	81	86	90	94	98	102	106	110	114	118	122	126	130							
16	39	43	47	50	54	57	61	65	68	72	75	79	82	86	90	93	97	100	104	107	111	115	118						
17	35	38	41	44	48	51	54	57	60	63	67	70	73	76	79	83	86	89	92	95	98	102	105	108					
18	31	34	37	40	42	45	48	51	54	57	59	62	65	68	71	74	76	79	82	85	88	91	93	96	99				
19	28	31	33	36	38	41	43	46	48	51	53	56	58	61	63	66	69	71	74	76	79	81	84	86	89	91			
20	25	28	30	32	34	37	39	41	43	46	48	50	53	55	57	60	62	64	67	69	71	73	76	78	80	83			
21	23	25	27	29	31	33	35	37	40	42	44	46	48	50	52	54	56	58	60	62	64	67	69	71	73	75	77		
22	21	23	25	27	28	30	32	34	36	38	40	42	44	46	47	49	51	53	55	57	59	61	63	64	66	68	70	72	
23	19	21	23	34	26	28	30	31	33	35	36	38	40	42	43	45	47	49	50	52	54	56	57	59	61	62	64	66	
24	18	19	21	22	24	26	27	29	30	32	33	35	37	38	40	41	43	45	46	48	49	51	53	54	56	57	59	61	62

Color coding key:
Green = SDI zones 1 and 2 (15 to 35% of maximum SDI). This is considered the lower range of stocking.
Yellow = SDI zone 3 (36 to 45% of maximum SDI). This is considered the middle range of stocking.
Orange = SDI zone 3 (46 to 55% of maximum SDI). This is considered the upper range of stocking.
Red = SDI zone 4 (56% + of maximum SDI). Tree groups will not be managed within this zone.
Note: SDI "zones" are explained in the silviculture report.

Tracking of Treatment Changes Using the Condition-Based Management Approach.

The Black River Restoration Project will track changes that may occur during implementation and prescription development through a simple tracking system using the following procedure:

1. As silviculture prescriptions are developed and certified, each treatment intensity will be tracked via a shareable spreadsheet and entered into the Forest Service's Forest Activity Tracking System (FACTS) database. This will allow for up to date comparisons of what is being implemented versus what was planned and modeled through the analysis. The goal will be to be able to run queries in FACTS to see treatment acres by type easily.

2. In order to track the spatial aspect of treatment changes a map will be created for each timber sale area that compares each sale area highlighting areas where more aggressive treatments are being implemented vs less aggressive treatments.

3. This information will be presented regularly by the District and/or Forest Silviculturist at 4FRI stakeholder meetings. With the goal of obtaining feedback from stakeholders and to be transparent on the changes.

Due to the possibility of treatment intensity changes using the condition-based management approach it is necessary to set acreage limits across the Black River Restoration Project for each type of treatment intensity and to outline where change treatment types versus treatment intensity is acceptable. Treatment intensity focuses mainly on interspace percentage and not density or basal area levels for each treatment.

Table 44 is useful to compare how the intensity will affect basal area in groups and overall stand level. Basal Area target will be prescribed by a certified silviculturist based on Forest Plan desired conditions and treatment needs. Table 45 outlines treatment intensities used within the project area comparing the various treatment types for each alternative.

Table 44. Treatment types showing intensity, percent interspace, and burning method.

Vegetation Treatment Type	Intensity	percent interspace low	percent interspace high	Rx Burning
Treatments in General Forest and Forage				
Uneven-aged Thinning (UEA)				
UEA10	low	10	25	Thin and Burn
UEA25	med	25	40	Thin and Burn
UEA40	high	40	55	Thin and Burn
Intermediate Thinning (IT)				
IT10	low	10	25	Thin and Burn
IT25	med	25	40	Thin and Burn
IT40	high	40	55	Thin and Burn
Single Tree Selection (ST)				
ST10	low – med	0	25	Thin and Burn
Stand Improvement Thinning (SI)				
SI10	low	10	25	Thin and Burn
SI25	med	25	40	Thin and Burn
SI40	high	40	55	Thin and Burn
Overstory Removal (OR)				
OR40	high	40	55	Thin and Burn
Treatments in MSO habitat				
Burn Only	low	0	10	Burn Only
MSO Recovery	low - med	0-25	40	Thin and Burn
MSO Nest/Roost	low	0	25	Thin and Burn
PAC	low	0	25	Thin and Burn

When using the condition-based management approach, moving from one treatment type (UEA, IT, SI, ST) to another is acceptable without having to track or keep with set acreage limits (Not including OR treatment type). The type of treatment change is less of an issue as the intensity of the treatment. When the condition-based management approach shows a change in intensity (Low, Medium, High), then total treatment intensity acreage across the project area will to be tracked so overall project limits do not exceed what was analyzed. Table 44 shows the planned mechanized treatments within the Black River Restoration project with interspace range, relative intensity and acreages for each alternative. These are the effective treatment intensities and serve as acreage limits for treatment intensities for the lifespan of the Black River Project and will be tracked as outlined above.

Table 45. Black River mechanized treatments showing, interspace, intensity and analyzed acres.

Treatment	Interspace Range (%)	Basal Area Range (ft^2) PP / DMC	Treatment Intensity	Alt2 (Acres)	Alt 3 (Acres)
Intermediate Thin IT 10 - WUI	10 - 25%	20-50 / 30-60	Low	186	186
IT 10-25	10 - 40%	50-80 / 60-100	Low - Medium	13,317	13,620
IT 25	25 - 40%	50-80 / 60-100	Medium	0	1374
IT 25 - WUI	25 - 40%	20-50 / 30-60	Medium	3,600	2,226
IT 25-40	25 - 55%	50-80 / 60-100	Medium - High	2,928	2,928
IT 40	40 – 55%	50 – 80 / 60 – 100	Medium	0	544
IT 40 - WUI	40 - 55%	20-50 / 30-60	Medium	970	622
IT 55 - WUI	55 - 70%	20-50 / 30-60	Very High	35	0
Single Tree Selection[2] ST 10	0 -25%	50-80 / 60-100	Low - Medium	0	5,006
ST 10 - WUI	25%	20-50 / 30-60	Medium	0	1,111
MSO Nesting / Roosting Intermediate Thin	0 - 10%	120-160 / 120-200	Low	1,500	1,500
MSO PAC Treatment	0 - 10%	120-160 / 120-200	Low	276	264
Overstory Removal OR 40-55	40 -70%	20-30 / 30-40	High	302	0
OR 55 - WUI	55 – 70%	20-30 / 30-40	Very High	161	0
Stand Improvement SI 10-25	10 – 40%	50-80 / 60-100	Low - Medium	505	505
SI 25	25 – 40%	50-80 / 60-100	Medium	0	235
SI 25 - WUI	25 – 40%	20-50 / 30-60	Medium	564	329
SI 25-40	25 – 55%	50-80 / 60-100	Medium - High	55	55
Uneven-aged Group Selection[9] UEA 10-25	10 - 40%	50-80 / 60-100	Low - Medium	7,692	5,390
UEA 25	25 – 40%	50-80 / 60-100	Medium	0	817
UEA 25 – WUI	25 – 40%	20-50 / 30-60	Medium	3,950	2,029
UEA 25-40	25 - 55%	50-80 / 60-100	Medium - High	1,097	842
UEA 40	40 – 55%	50–80 / 50-100	High	0	4,332
UEA 40 - WUI	40 – 55%	20-50 / 30-60	High	1,333	867
UEA 40-55	40 – 70%	50-80 / 60-100	High	4,989	0
UEA 40-55 - WUI	40 – 70%	20-50 / 30-60	High – Very High	62	0

[9] For all UEA treatments in Alternative 2 (Proposed Action) Single Tree Selections may be implemented to obtain uneven-aged stand structure if stand conditions are conducive. UEA treatments were modeled and analyzed as they are deemed more intensive. Final determination will be made at the time of silviculture prescription development.

Treatment	Interspace Range (%)	Basal Area Range (ft^2) PP / DMC	Treatment Intensity	Alt2 (Acres)	Alt 3 (Acres)
UEA 55 - WUI	55 – 70%	20-50 / 30-60	Very High	1,271	0
Total	N/A	N/A	N/A	44,793	44,782

Total treatment intensity levels for the Black River Restoration Project are shown in Table 45. Intensities can shift across the landscape spatially but will be required to remain within these overall project levels. If acres shift from high to medium, then more acres may be treated under medium intensity as is shown in the table. Successful tracking is key to be able to ensure overall intensity levels are within the analysis.

Table 46. Black River Total Mechanized Treatment Intensities based on treatments analyzed under the Black River Restoration Project.

Treatment Intensity	Alternative 2 Acres	Alternative 3 Acres
Very High	1,467	0
High – Very High	62	0
High	6,624	5,199
Medium – High	4,080	3,825
Medium	9,084	9,287
Low - Medium	21,514	24,521
Low	1,962	1,950