Appendix D – Implementation Plan for Alternatives 2 and 3

The environmental impact statement (EIS) for the Rim Country project describes the purpose and need, alternatives, and the potential maximum effects from the activities in those alternatives. This implementation plan is designed to be integral to the selected alternative and record of decision (ROD). The process described in this appendix describes the link from the EIS to the project-specific work without the need for additional NEPA analysis. It should be considered in conjunction with Appendix C that provides the design features, best management practices, and mitigation and conservation measures. Table D-1 contains the checklist designed to support implementation compliance.

Table D-1 shows the compliance evaluation and documentation requirements to demonstrate this compliance. Sections A through F provide direction that would be used by implementers to ensure that implementation meets the purpose and need and land management plan standards and guidelines. Silvicultural prescriptions will document the stand level desired conditions and objectives which is consistent with this analysis, incorporate design features (Appendix C), and provide the course of action needed to move toward the project desired conditions. Documents that provide direction of management activities including land management plans, recovery plans, and conservation agreements may be revised over time. This implementation plan may require modifications to conform to updated direction.

Description of Implementation Plan Components

Section A – Implementation Checklists: The checklist is designed to track compliance with NEPA, Endangered Species Act, NHPA and other law, regulation, and policy and ensure activities are consistent and compliant with the analysis and decision (correct location, appropriate number of acres by treatment type). The checklist will be used by the implementation team leader and documented.

Section B – Old Tree Implementation Plan: This section provides the Old Tree Implementation Plan, including old tree descriptions, illustrations, and guidance for retention of old trees. This section applies to all treatments implemented in the Rim Country project.

Section C – Large Tree Implementation Plan: This section includes guidance designed to be reviewed by the district implementation team and silviculturist during the development of site-specific prescriptions and during implementation to identify the appropriate retention of large trees. This section applies to all treatments implemented in the Rim Country project.

Section D – Rim Country Condition-based Management Approach: This condition-based management approach uses special management considerations, decision trees and decision tree modifiers based on existing conditions and location specific criteria to assign appropriate treatments across the Rim Country Landscape. The approach integrates upland and aquatic restoration activities and is designed to be used during the planning process and implementation.

Section E – Management Direction, Desired Conditions and Treatment Design: This section includes existing land management plan management direction, desired conditions, and treatment-specific silvicultural design. It is designed to be used by the district implementation team.

Section F – Density Management and the Relationship between Treatment Intensity, Tree Group Density, and Overall Average Density.

Section G – Arizona GFD Aquatic Restoration Priority Treatment Table.

Section A – Implementation Plan Checklist

Table D-1. Implementation Plan Checklist

Implementation Plan Checklist	Yes	No	N/A
Have project objectives been developed in an interdisciplinary manner?			
Is the treatment on a line officer approved 5 year plan? (for vegetation/fuels projects only)			
An approved prescribed fire plan: (1) will be completed for all burning units and an ADEQ burn plan (2) will be submitted to the ADEQ for approval. All prescribed fire operations would be coordinated with and approved by the ADEQ prior to burning.			
For thinning operations, are sale prep checklist, sale folder checklist, and sale package complete? Are sales reviewed through a plan-in-hand process and signed off by district interdisciplinary team?			
Are treatment silviculture prescriptions completed and signed? • Objectives are consistent with management direction? • Have silviculturists signed off on desired forest conditions in burn plans?			
Have opportunities for upland and aquatic integration been explored?			
Is treatment consistent with project design features?			
Is treatment consistent with the applicable Land Management Plan?			
Are wildlife surveys, if necessary, complete? In threatened and endangered species habitat, are the actions consistent with the FWS biological opinion?			
Has the Pre-implementation Compliance Review for the Regional Mexican Spotted Owl Recovery Strategy been completed (see appendix K)?			
Are botanical surveys, if necessary, complete? Necessary design features (Appendix C) for botany included?			
Are heritage surveys complete?			
Tribal outreach and consultation (if undertaken) complete?			
Is the action consistent with the letter of concurrence from Arizona SHPO?			
Are rights-of-way and land line locations in place (if applicable)?			
Are treatments consistent with desired conditions and implementation strategies in the Implementation Plan?			
Has implementation monitoring and adaptive management strategies been documented and used/planned for higher quality outcome?			
For any project work occurring in an IRA: (1) is the treatment plan consistent with the approved 2001 Roadless Area exception criteria indicated in the Rim Country project Regional Forester Brief and (2) has the coordination with the Regional Office IRA Lead occurred?			
Are road packages completed for timber sales?			

Line Officer Signature (required) Date

Section B – Old Tree Implementation Plan

Old Tree Descriptions and Illustrations

Old trees would be retained, with few exceptions, regardless of their diameter, within the Rim Country analysis area. Removal of old trees would be rare. Exceptions would be made for threats to human health and safety, and those rare circumstances where the removal of an old tree is necessary in order to prevent additional habitat degradation that would be caused by forest thinning and burning operations. Old trees would not be cut for forest health reasons or to balance age or size class distributions.

One example of a situation where the removal of an old tree is necessary in order to prevent additional habitat degradation is in the rare case of an old tree growing on the side of an existing curve in a road. Hauling 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 to preserve the old tree would result in a larger area of the forest being permanently disturbed, versus the large tree and widening the curves radius. This is an example where cutting the old tree would result in less habitat degradation then relocating a road.

Threats to human health and safety would include hazard trees as defined by Forest Service Manual and Forest Service Handbook Direction (currently FSM 2332.1, FSM 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.

Old Tree Descriptions and Illustrations – Operationally, the identification of old trees (trees approximately 150 years and older) will be made in consideration of the tree forms depicted in Figure D-1 below as well as the written descriptions from Thomson (1940) listed below. All of these factors for age classes 3 and 4 should be taken into account when identifying old trees. For species other than ponderosa pine, consider tree characteristics identified in Van Pelt (2007) and Van Pelt (2008).

Age – Approximately 150 years and older.

Diameter at Breast Height (d.b.h.) – Site dependent.

Bark – Ranging from reddish brown, shading to black in the top with moderately large plates between the fissures to reddish brown to yellow, with very wide, long, and smooth plates.

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.

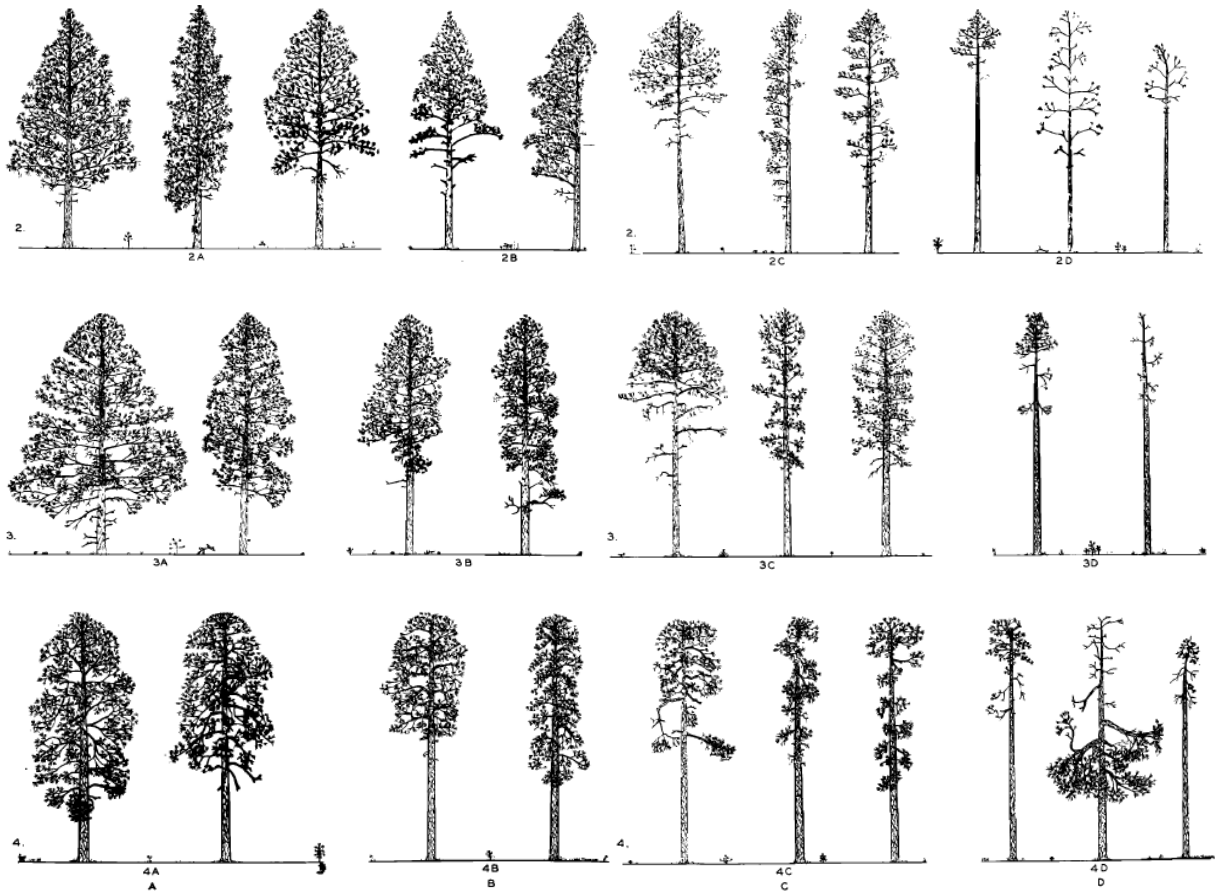

Figure D-1. Illustrations of age classes 2, 3 and 4 from Thomson (1940). Trees with physical characteristics of age classes 3 and 4 may be considered as old trees

Ponderosa Pine Age Class Descriptions

Thomson (1940) Age Class 3: Intermediate-mature; bark reddish brown shading to black in the top with moderately large plates between the fissures; tops usually pyramidal or rounded, occasionally pointed; branches upturned in top third of crown, those in the middle horizontal and drooping in the lower third.

Thomson (1940) Age Class 4: Mature-overmature; trees usually large; bark reddish-brown to yellow with wide, long and smooth plates; tops usually flat and making no further height growth; branches mostly large and drooping, gnarled or crooked.

Photo Guide for Identification of Old Ponderosa Pine Trees

Figure D-2. Typical bark characteristics of old ponderosa pine trees (Photos courtesy of Brady Smith and Ecological Restoration Institute)

Figure D-3. Typical tree crown characteristics of old ponderosa pine trees (Photos courtesy of Patrick Moore)

Section C – Large Tree Implementation Plan

The large tree implementation plan is designed to inform implementation. The plan's ecological objectives are consistent with the desired conditions found in the three Rim Country land management plans 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).

For the purpose of this document, large post-settlement trees, as defined by the socio-political process, are those that are 16-inch diameter at breast height (d.b.h.) or larger. Groups of trees greater than or equal to 18-inch d.b.h. 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 land management plan desired conditions conflict with the exception condition categories listed below, no large trees would be felled until the NEPA decision is reviewed by the district. The district would decide whether the action is consistent with the analysis and the decision made. The exception categories for falling large trees are listed below.

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. Vegetation and other biological diversity are adapted to mesic habitat or aquatic environments (Feth and Hem 1963).

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. In the late 1800s, unsustainable livestock grazing practices significantly reduced herbaceous cover, reducing competition pressure on conifer seedlings. Coupled with the onset of fire suppression in the early 1900s, conifer trees rapidly encroached and recruited into native grasslands (for example, Moore and Huffman 2004, Coop and Givnish 2007). This cause and effect relationship allowed for an increase in conifer tree development. Due to the absence of frequent fires and the presence of livestock grazing, the establishment of large post-settlement trees may reduce available soil moisture (Simonin et al. 2007) and block the sunlight necessary to support the unique biophysical conditions associated with seeps and springs.

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, is 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.

Riparian

Riparian areas occur along ephemeral to 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 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 particular seep or spring in the past.

Post-treatment snags and logs that include large trees are available onsite.

Wet Meadows

High elevation streamside or spring-fed meadows occur in numerous locations throughout the Southwest. However, less than 1 percent of the landscape in the region is characterized as wetland (Dahl 1990), and wet meadows are just one of several wetland types that occur. Patton and Judd (1970) reported that approximately 17,700 hectares of wet meadows occur on national forests in Arizona and New Mexico.

Wet meadows may be referred to as riparian meadows, montane (or high elevation) riparian meadows, sedge meadows, or simply as wet meadows. 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) 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.

Wet meadows are one of the most heavily altered ecosystems. They have been used extensively for grazing livestock, have become the site of many small dams and stock tanks, have had roads built through them, and have experienced other types of hydrologic alterations. Most notably, the lowering of their water tables due to stream down cutting, surface water diversions, or groundwater withdrawal (Neary and Medina 1996) has occurred. Due to the presence of livestock grazing and 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.

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 particular 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.

Encroached Grasslands

Encroached grasslands are herbaceous ecosystems that have infrequent to no evidence of conifer trees growing prior to settlement. The two prevalent grassland categories in the 4FRI landscape are montane (includes subalpine) grasslands and Colorado Plateau (a subset of Great Basin) grasslands, with montane grasslands being most common (Finch 2004). 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. Grasslands in this region evolved during the Miocene and Pliocene periods, and the dark, rich soils observed in grasslands today have taken more than 3 million years to produce. 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).

Typical montane grasslands in this region are characterized by Arizona fescue (*Festuca arizonica*) meadows on elevated plains of basaltic and sandstone residual soils. Montane grasslands generally occur in small (less than 100 acres) to medium sized (100 to 1,000 acres) patches. Historic maintenance of the herbaceous condition in these grasslands is subject to some debate though appears to be primarily driven by periodic fire. The cool-season growth of Arizona fescue also plays a large role in maintenance of parks and openings by directly competing with conifer seedlings. Identification of grasslands in this region should use a combination of the threatened, endangered, and sensitive (TES), Southwest Regional GAP

Analysis, and Brown and Lowe Vegetation Classification (Brown and Lowe 1982, TNC GIS Layer 2006), terrestrial ecological unit (TEU) data, ecological response unit (ERU), among other existing vegetation and soils data.

Prior to European settlement, conifer trees were rarely established in grasslands because they were either suppressed by production of cool-season grasses or killed by frequent fire (Finch 2004). In the late 1800s, unsustainable livestock grazing practices significantly reduced herbaceous cover, reducing competition pressure on conifer seedlings. Coupled with the onset of fire suppression in the early 1900s, conifer trees rapidly encroached and recruited into native grasslands (Moore and Huffman 2004, Coop and Givnish 2007). 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 particular seep or spring in the past.

Aspen Stands and Patches

Quaking aspen (*Populus tremuloides*) generally occurs within mixed conifer forests. 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). Aspen is currently declining at an alarming rate (Fairweather et al. 2008).

Aspen occurs in small patches throughout the Rim Country project area. Bartos (2001) refers to three broad categories of aspen: (1) stable and regenerating (stable), (2) converting to conifers (seral), and (3) decadent and deteriorating. All of the aspen occurring within conifer forests of the Rim Country project area is seral aspen, which usually regenerates after disturbance through root sprouting.

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 (Bartos 2001). 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). More recently, aerial and ground surveys indicate more rapid decline of aspen, with very high mortality occurring in low and mid-elevation aspen sites. Major factors thought to be causing this rapid decline of aspen include frost events, severe drought, and a host of insects and pathogens (Fairweather et al. 2008) that have served as the “final straws” for already compromised stands.

Favorable soil and moisture conditions maintain stable aspen over time. Aspen stands have been mapped across the entire Rim Country area.

Ecological Objectives

Aspen stands and patches 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.

Ponderosa Pine/Gambel Oak Forest (Pine-Oak)

A number of habitat types exist in the southwestern United States that could be described as pine-oak. Ponderosa pine forests are interspersed with Gambel oak (*Quercus gambelii*) trees in locations throughout the Rim Country project area in a habitat association referred to as PIPO/QUGA (Forest Service 1997, USDI 1995).

In southwestern ponderosa pine forests, Gambel oak has 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). 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.

Gambel oak provides 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).

Gambel 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 are particularly valuable because they typically provide more natural cavities and pockets of decay that allow excavation and use by cavity nesters than conifers. In addition to its important ecological role, Gambel oak has high value to humans as it is a popular firewood that possesses superior heat-producing qualities compared to other tree species (Wagstaff 1984).

Gambel oak densities appear to have increased in many areas with fire exclusion, especially in the small and medium diameter stems (less than 8-inch d.b.h., (Abella and Fulé 2008)). Chambers (2002) found that Gambel oak on the Kaibab and Coconino National Forests was distributed in an uneven-aged distribution, dominated by smaller size classes (less than 5 centimeter d.b.h.) and few large diameter oak trees. Because of Gambel oak's slow growth rate, there may be little opportunity for these small Gambel oak trees to attain large diameters (more than 85 centimeters) (Chambers 2002).

Conifer competition with oak has been identified as an issue in slowing oak growth, particularly for older oaks (Onkonburi 1999). Onkonburi (1999) also found that for northern Arizona forests, pine thinning increased oak incremental growth more than oak thinning and prescribed fire. Fulé et al. (2005) found that

oak diameter growth tended to be greater in areas where pine was thinned relative to burn only treatments and controls. 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 Gambel Oak

Small oak trees develop into larger size classes.

Fire treatments retain small and shrubby oak in numbers and distribution.

All growth forms of Gambel oak are present and larger, older oak trees are enhanced and maintained.

Large, post-settlement trees are not restricting oak development.

Frequent, low intensity surface fire occurs in ponderosa pine-Gambel oak forests.

Brushy thicket, pole, and dispersed clump growth forms of Gambel oak are present and maintained by allowing natural self-thinning, thinning dense clumps, and/or burning.

Gambel oak growth forms are protected from damage during restoration treatments including thinning and post-thinning slash burning.

In Mexican Spotted Owl Recovery Habitat

Within Mexican Spotted Owl (Mexican spotted owl) habitat and designated critical habitat, the recovery plan for the Mexican spotted owl improves key habitat components and primary biological factors, which includes Gambel oak.

Within 30 feet of oak 10- inch diameter at root collar or larger, post-settlement mixed conifer trees up to 18-inch d.b.h. (that do not have interlocking crowns with oak) are not restricting oak development.

Outside Mexican Spotted Owl Recovery Habitat

Large post-settlement trees' drip lines or roots do not overlap with those of Gambel oak trees exhibiting greater than 8 inch DRC.

Within-stand Openings (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.

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 by overgrazing (Sánchez Meador et al. 2009). 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 does 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 range from 10 percent on highly productive sites to as high as 90 percent on those soil types that have an open reference condition.

Suitable openings for successful natural regeneration in this project would range in size from 3/10 to 8/10 of an acre.

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

While relatively uncommon, there are areas where dense stands of large young ponderosa pine trees occur. These stands exhibit continuous canopy which in some limited cases can promote unnaturally severe fire effects under extreme weather conditions. At the fine scale, this management approach would apply on a case-by-case basis, where cutting of large young trees is essential to meet site-specific ecological objectives listed below. This exception will not be applied in stands or portions of stands meeting the "Stands with an Abundance of Large Trees" (SALT) criteria, unless necessary to reduce high-severity fire behavior and potential spread into adjacent WUI, critical infrastructure, or important habitats such as Mexican spotted owl habitat and/or northern goshawk nest stands.

Ecological Objectives

Natural heterogeneity of forest, savanna, and grasslands occurs at the landscape-scale and within stands.

Old growth structure is restored by retaining the largest trees on the landscape.

Decreased shading and interception from the canopy, decreased needle litter and duff, and surface fire restore and maintain a mosaic of natural vegetative communities.

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/develop desired forest structure over time.

Openings and interspaces contribute to the ecological objective of natural heterogeneity of historical forest structure, age class diversity, and open space.

Section D – Rim Country Condition-based Management Approach

In order to place the right treatment in the right location to most effectively meet the desired condition, the Rim Country Project will use a condition-based management approach (Figure D-4) for treatment allocation. This type of approach does not assign specific treatments to specific acres, but rather assigns treatments to a set of conditions that occur on the landscape. Once these conditions are identified by an interdisciplinary team, they can use this implementation plan in order to identify the appropriate treatment. The need for this approach is derived from applying adaptive management considerations and lessons learned from past related projects. While the Rim Country Condition-based management approach can be described as one unified approach, it has two distinct components. The set of vegetation focused strategies refers to restoration treatments on upland areas (Figure D-4, green box), while the aquatic and watershed focused strategies refers to restoration treatments in riparian areas, streams, springs and wet meadows (Figure D-4, blue box). The integration of these two components is integral to successful and efficient implementation.

The process begins with an initial project resource review of forest conditions and site-specific considerations that would inform the condition-based management process. This process would include the consideration of the vegetation focused strategies, the aquatic and watershed strategies as well as the integration of the two approaches. The area would then be evaluated for special management considerations that would result in a specific treatment assignment, such as Protected Activity Centers, Mexican Spotted Owl Recovery Nest/Roost habitat, WUI, severe disturbance areas, and others. Areas that do not fall within the special management considerations would be limited to the ponderosa pine, ponderosa pine/evergreen oak cover type as well as Mexican spotted owl foraging non-breeding ponderosa pine oak and dry mixed conifer habitat. These areas would be assigned a treatment using a decision tree. Finally, a set of decision tree modifiers would be used to identify an appropriate treatment intensity within the ranges describe by the decision tree. The result will be an ecologically appropriate treatment that will best meet the desired condition across the landscape.

The intent of mechanical treatments is to realize the full range of historical forest structural conditions identified in tables such as D-2 in terms of basal area and trees per acre. The intent is not to manage to the minimum end of the range of these treatment metrics. In portions of some areas (for example, Mexican spotted owl habitat, SALT stands, north aspects), stands will exceed these central tendencies for basal area and trees per acre. Additionally, stands (or portions thereof) may be considered for deferral of mechanical treatment if already meeting desired conditions with respect to composition, structure and expected fire behavior.

Changes in Treatment Intensity

As a result of this condition-based management approach, some treatments assigned to individual stands may be less intense or more intense than those identified in the analysis. One example of this is if during field verification, a site is less productive than was analyzed, it may result in a more intense treatment being assigned to that stand (such as a UEA-moderate site treatment stand being reassigned to a UEA-low site treatment). Another example would be if additional acres are identified as Mexican spotted owl PAC or Nest/Roost Recovery habitat, then those acres would be reassigned to the appropriate treatment type. A third example would be if an area was newly identified as Wildland Urban Interface, then that area may be reassigned a WUI treatment in order to protect values at risk. This is not an inclusive list of the ways in which treatment intensity may change during implementation, however, it is important to consider that as the number of acres of these individual treatments may not exceed those analyzed, the effects of the treatments will remain within those analyzed.

Rim Country EIS Tracking Process

In order to ensure that the acreage and intensity of implemented treatments would be within the scope of the effects analysis, a robust treatment tracking system would be necessary and summarized at the Forest scale. A system would be put in place that would track several key elements of the proposed treatment from the planning process through to implementation. The system would be maintained at the administrative unit scale and in as close to real time as feasible. This system would be used to track the acres of particular treatments implemented and ensure that treatments are not applied on a greater number of acres than were analyzed in the EIS. At the minimum, this system would track:

- Spatially, area covered proposed for treatment under the Rim Country EIS, including stand ID and treatment type
- Actual assigned treatment post-IDT walkthrough, from the prescription
- Actual cut unit polygon, post layout, including stand ID and treatment type

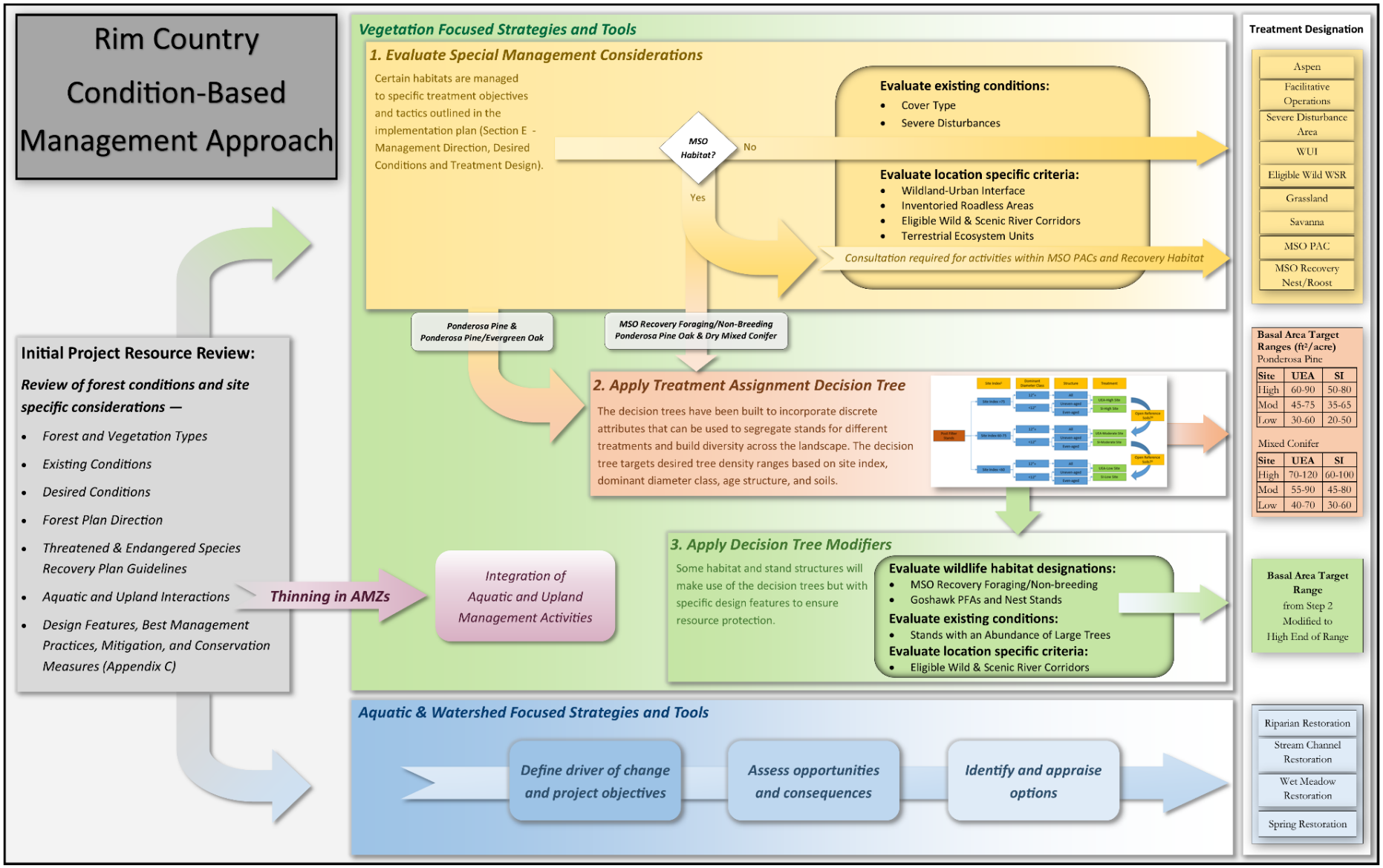

Figure D-4. Condition-based management approach for Rim Country

Initial Project Resource Review

The first step in any project implementation approach would be the initiation of a pre-project review. This would include a review of existing conditions, land management plan components, federally-listed species recovery plans, and the current land management plan Biological Opinion. A review of the project design features, best management practices, project checklists and mitigation measures would also occur. Additionally, this review process would identify upland vegetation as well as aquatic and watershed focused restoration priorities in the project area. For more information on the integration of these two components of the Rim Country Condition-based Management Approach, see the section below *Integration of Aquatic and Upland Management Activities.*

Integration of Aquatic and Upland Management Activities

Restoration treatments for mechanical harvest and aquatic/watershed condition-based management discussed in previous sections inherently overlap in riparian areas and associated upland/riparian transition zones. The need to integrate the two processes was identified to ensure riparian and aquatic values are part of the overall timber and fuels restoration designs. Integration also provides for efficient use of resources, project prioritization, and successful ecological outcomes.

A working group comprised of the planning team, stakeholder members, and implementers worked collaboratively to develop the following section outlining when, where, and how that integration occurs. The overarching goal is to ensure riparian and aquatic values are incorporated whenever thinning is proposed within a riparian area from project planning through implementation and monitoring. Large-scale projects, such as Rim Country, present opportunities for ecosystem restoration that cannot be achieved with site or reach scale projects because they can address causes of degradation rather than the outcomes. Ecological restoration should integrate with the landscape, reduce or eliminate threats to integrity of the system, and make the system more resilient to normal events in a self-sustaining manner (SER 2004).

Aquatic Management Zones (AMZs) guidance is found in the Rim Country project design criteria that provides the basis for where integration is needed. While AMZ vegetation may include or be predominantly conifers (for example ponderosa pine), riparian areas function differently than uplands and any restoration actions should be based on riparian and aquatic values. To ensure a higher level of consideration for these values, AMZs will be considered separate, stand-alone units in regard to thinning or fuels. This allows for easy mapping and identification as unit boundaries are being developed.

If an AMZ is identified within or near a potential upland restoration treatment unit, discussion is necessary to determine what riparian and aquatic values exist in the AMZ and how riparian restoration can be included into the design (for example, prescription, methods, desired condition). Key resources include fisheries, aquatics, wildlife, botany, hydrology, timber and silviculture. Depending on the scope of the restoration engineering, recreation, heritage, and range disciplines may also be needed. Stakeholders and partners should also be engaged as early as possible to provide information and expertise to ensure the projects are based on well-balanced and thorough plans.

Project design criteria describing aquatic management zones for all stream types, wet meadows, springs, and wetlands of any size (for example seeps) are listed below. Though select project design criteria are listed below, for further guidance or consideration also consult Appendix C

- **SW001** – All waterbodies, including reservoirs, lakes, streams, and water dependent features including groundwater dependent ecosystems such as springs, seeps, fens, and other wetland

features such as wet meadows would be protected with AMZs (referred to as Riparian Management Zones on the Tonto National Forest), measured as the slope distance from the edge of each side the stream and or riparian areas (wet meadows, springs, wetlands etc.). AMZ widths should be based on Land Management Plan direction or other guidance documents. Where AMZ widths are not customized to site conditions or species (see AQ021, AQ0040), the default minimum width for ground-based mechanical and prescribed burning treatments for perennial, intermittent, and ephemeral streams are 150, 75, and 50 feet, respectively. AMZ widths for all other features are 150 feet. Features to be protected with an AMZ will be shown on the project task order, contract or agreement maps, or burn plan maps. AMZ widths will be clearly labeled or described. Project specific design features such as Best Management Practices for water quality protection within AMZs will be implemented prior to construction when specified. (See SW003 for acceptable activities within AMZ's).

- **SW002** – Unless prescribed by Land Management Plan direction, AMZs can be increased by an interdisciplinary team (IDT) of qualified specialists prior to project implementation based on desired conditions along the stream reach and the nature of resource values at risk (such as the presence of aquatic Endangered Species Act species or its potential introduction), special concerns for water quality degradation, erosion hazard, existing vegetative ground cover conditions, stream bank and riparian conditions, natural geologic features, and flow regime. The IDT will determine appropriate AMZ widths and treatment limitations within these zones. These changes should be reflected in the plan-in-hand documents and included in the task order or contract maps.
- **AQ019 – Narrow-headed gartersnakes:**
  - AMZ in Narrow-headed gartersnake proposed critical habitat will be 150 ft. on either side of the stream.
  - No mechanical or hand piling will occur within the gartersnake AMZ to minimize harm during controlled burns or pile burning because gartersnakes utilize piles for cover (also see FE006).
  - Disturbance of rock/boulder piles and large woody debris in narrow-headed gartersnake habitat or proposed critical habitat will be avoided to the greatest extent practical during their hibernation period (November/December-February, depending on elevation).
  - Do not build temporary roads in narrow-headed gartersnake AMZs.

Riparian areas function differently than uplands of similar vegetation types and should be treated with a focus on riparian and aquatic desired conditions. Considerations include:

- Maintaining or enhancing native riparian species composition, diversity, and health.
- Maintaining or enhancing shade canopy to reduce stream temperatures.
- Large woody debris input for instream habitat complexity and maintenance.
- Organic matter inputs to streams for aquatic food webs.
- Providing streamside habitat and stabilization of streambanks.
- Habitat for rare plants.

Further guidance or considerations for treatments in riparian areas, ecological considerations for riparian restoration, and potential desired conditions are listed below for assistance.

EPA Watershed Academy Web: Forestry Best Management Practices in Watersheds. (https://cfpub.epa.gov/watertrain/moduleFrame.cfm?parent_object_id=1517)

Riparian Fuel Treatments In the Western USA: Challenges and Considerations (Dwire et al. 2016, GTR-352) https://www.fs.fed.us/rm/pubs/rmrs_gtr352.pdf

Region 3 Riparian and Aquatic Ecosystem Strategy and Conditions supplement. https://www.fs.usda.gov/detailfull/r3/landmanagement/resourcemanagement/?cid=fseprd601133

Condition-based Management Approach for Vegetation-focused Restoration Treatments

Evaluate Special Management Considerations

For upland vegetation focused activities, some existing conditions or locations specific criteria may result in the assignment of a unique treatment assignment. Stands or portion of stands with existing cover types such as the presence of aspen inclusions or those identified for facilitative operations (such as pinion-juniper, mixed-conifer with aspen, madrean pinion-oak, and encinal woodland) would have a specific treatment type identified in Figure D-4 and described below. These stands or areas within these stands would be treated with the objectives and tactics outlined in Section E of this implementation plan, Management Direction, Desired Conditions and Treatment Design.

Mexican Spotted Owl Protected Activity Centers and Recovery Nesting and Roosting Habitat

One of the more sensitive components of the Rim Country Condition-based Management approach is the management of Mexican Spotted Owl Protected Activity Centers and Recovery Nesting and Roosting Habitat. Due to the special considerations that go along with these areas, biologists will coordinate with US Fish and Wildlife Service prior to implementing treatments in PACs and recovery nesting and roosting habitat. Additionally, a Mexican spotted owl conservation and recovery framework has been developed. This framework includes a project planning checklist, pre-implementation compliance review, habitat treatment and implementation guidance and other resources for use when considering treatments in protected activity centers and recovery nesting and roosting habitat. This guidance should be used when determining whether treatments in these habitats are appropriate and will assist in the development of any necessary treatment.

Aspen

In Rim Country aspen generally persists as inclusions within the mixed conifer with aspen cover type. These stands or portions of stands have been identified as those having considerable live basal area in aspen. Aspen restoration treatments may include conifer removal from within stands to reduce competition, construction of barriers to reduce browsing pressure on regeneration, prescribed fire, cutting of aspen stems or root separation to promote regeneration as well as other active and passive restoration methods outlined in Kitchen (2019) and Rogers (2017). Inclusions of aspen stands in the analysis may be treated as aspen upon field verification.

Facilitative Operations

Facilitative operations are treatments implemented in non-target cover types (pinyon juniper, mixed conifer with aspen, madrean pinyon oak, and encinal woodland) as needed to support the use of prescribed fire in target cover types. Facilitative operations would be used in non-target cover types that lie between target cover types and existing features appropriate to use as prescribed fire boundaries, or that are surrounded by target cover types. Facilitative operations treatments would either move these areas

toward desired conditions as described in the land management plans or maintain the current condition. The inclusion of facilitative operations in burn units would be designed to improve safety, improve treatment effectiveness, expand burn windows, and minimize disturbance.

Severe Disturbance Areas

Severe disturbance areas are those where the spatial extent and/or the pattern of high-severity effects is not within desired conditions, likely as a result of high-severity wildfire or insect outbreak. 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 tree would be applied to determine the appropriate treatment.

Restoration treatments in severe disturbance areas will include combinations of reforestation in areas with inadequate natural regeneration, prescribed fire to manage fuel loadings, lopping/scattering, mastication, and other mechanical methods. In these areas, the objective is to restore the fuel structure that produces the types of fire-adapted ecosystems are dependent and put stands on a trajectory toward the natural range of variability.

WUI (non-National Forest System lands and critical infrastructure)

For the purposes of the Rim Country Project, what is commonly referred to as Wildland-Urban Interface, or WUI, will consist of those areas within ½ mile of non-National Forest System lands with structures or critical infrastructure (communication sites, high value recreation sites, transmission lines, Forest Service building complexes). In these areas, in order to protect values at risk, the flexibility is given for more open treatments that will result in post-treatment stand densities between 30-60 ft^2/acre of basal area.

Stands or parts of stands within these buffers that are identified as special management considerations or decision tree 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 in this condition-based management approach.

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

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

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.

Eligible Wild River Corridors (Apache-Sitgreaves National Forest Only)

There are currently no designated wild segments of wild and scenic rivers in the Rim Country project area. However, the Willow Creek and Woods Canyon-Chevelon Creek eligible wild and scenic rivers include eligible wild segments within the project area. Eligible rivers are managed to retain their status

until a suitability determination has been made whether to recommend their inclusion in the National Wild and Scenic Rivers System. Tree cutting is not suitable within these corridors, 1/4 mile on each side of these eligible wild river segments (USDA, 2017). Prescribed fire may be used to move these areas toward desired conditions. Design features have been included in Appendix C specifically for management of eligible wild and scenic river corridors.

Grassland

Areas or portions of stands that overlap with a grassland terrestrial ecosystem unit were identified as grassland. Grassland-specific restoration includes a mechanical treatment that removes post-settlement conifers and manages for at least 90 percent of the treatment area as grass/forb, using pre-settlement tree evidence as guidance. Inclusion of grasslands based on soils that are not identified in the analysis may be treated as grassland upon field verification.

Savanna

In ponderosa pine stands outside of other special management considerations listed above, terrestrial ecological units indicating an open reference condition will be used to target treatments toward the lower end of the natural range of variability. While these ecological units are relatively abundant on the far west and far east sides of the project area, application of savanna treatments would be further limited in extent to those stands or portions of stands that are adjacent to grasslands or currently exhibiting forest densities near the lower end of the natural range of variability with less than 25 percent of maximum stand density index for ponderosa pine. Savanna restoration includes a mechanical treatment that restores pre-settlement tree density and pattern and manages for a range of 70 to 90 percent interspace between groups or individual trees, using pre-settlement evidence as guidance. Inclusion of savanna based on soils that are not identified in the analysis may be treated as savanna upon field verification. Remaining stands or portions of stands that overlap with terrestrial ecological units indicating an open reference condition that do not meet the criteria above will be assigned the treatment in the open reference condition column on the decision tree. These stands would have post-treatment tree densities higher than savannas and lower than other similar stands across the project area based on the stand site index alone.

Treatment Assignment Decision Tree

Stands or portion of stands that are not identified by any of the Special Management Considerations above will be assigned a treatment through the use of a decision tree. The following decision tree has been built to incorporate discrete attributes that can be used to segregate stands for different treatments at ecologically appropriate treatment intensity ranges, move stands toward NRV, and build diversity across the landscape.

The decision tree considers site productivity, dominant diameter class, and stand structure to identify an ecologically appropriate restoration treatment assignment. Stands on higher productivity sites will generally receive a lower intensity thinning treatment to reflect the higher end of NRV for post-treatment basal areas where stands on lower productivity sites will generally receive a higher intensity thinning treatment to reflect the lower end of NRV. Stands dominated by larger size trees, whether they be even-aged or uneven-aged in current stand structure will receive an uneven-aged thinning (UEA) treatment to maintain or improve stand structure toward the desired condition. Stands dominated by smaller trees and even-aged structure will receive a stand improvement (SI) treatment to create more uneven-aged conditions while stands dominated by smaller trees and uneven-aged structure will receive a uneven-aged thinning treatment to maintain and improve stand structure toward the desired condition. Generally, to accelerate stands toward a more uneven-aged structure, an even-aged stands would be treated to develop more openings, to encourage new cohorts and to develop two or more age classes.

Some stands have been identified as being in an open reference condition based on the criteria listed above in the savanna section. Remaining stands or portions of stands that overlap with terrestrial ecological units indicating an open reference condition that do not meet the savanna criteria above will be assigned the treatment in the open reference condition column on the decision tree. These stands would have post-treatment tree densities higher than savannas and lower than other similar stands across the project area based on the stand site index alone.

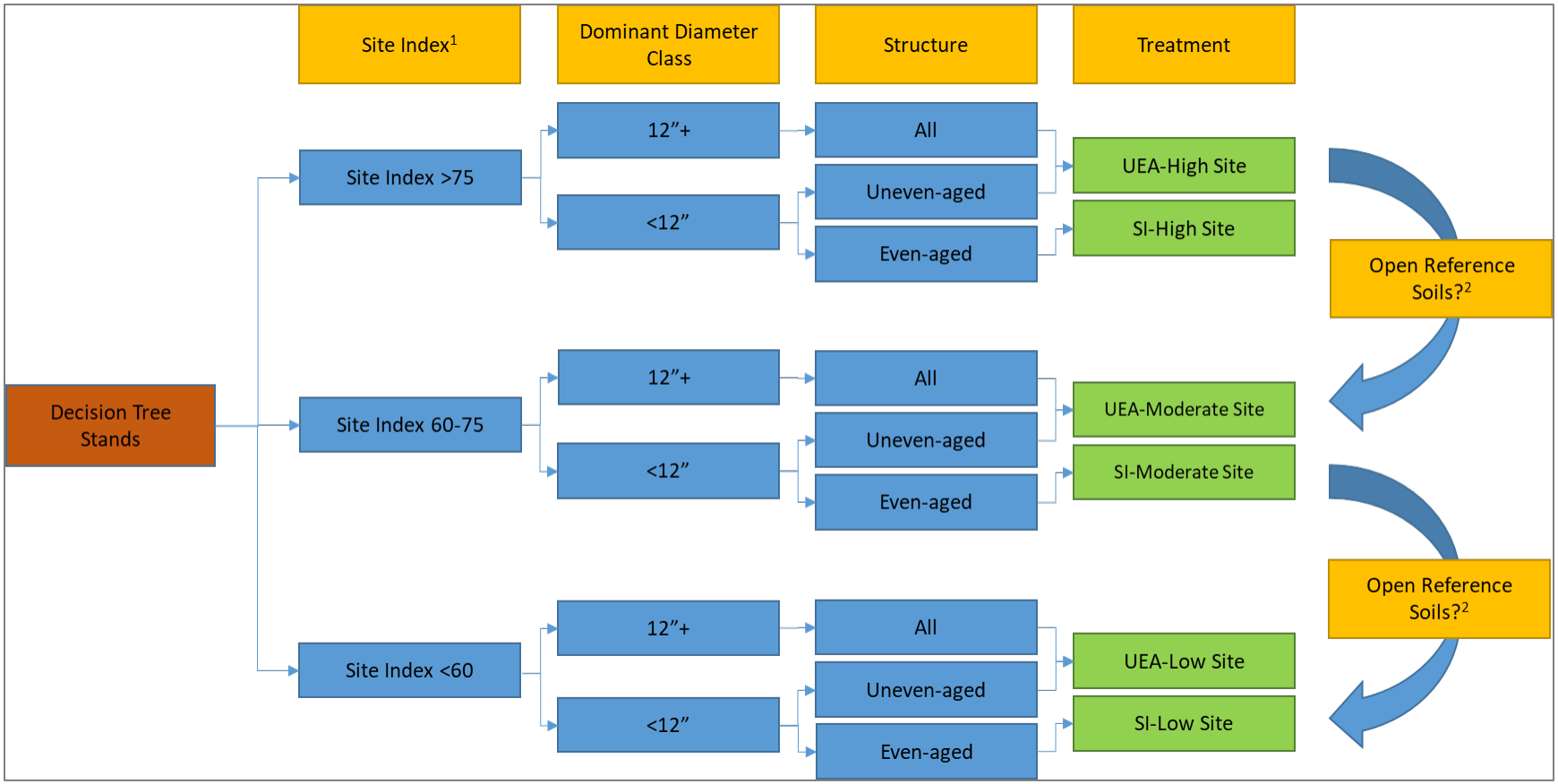

Figure D-5. Decision tree for the Rim Country condition-based management approach

[1]Stands with a Site Index less than 40 are confined to woodland sites.

[2]Open Reference Treatment: Alternative treatment applied to those stands or parts of stands that occur on mollic intergrade soils where we have not proposed a savanna treatment as described in the savanna section of the Rim Country condition-based management approach.

Table D-2. Post-treatment Ranges for Uneven-aged Thinning (UEA) and Stand Improvement Thinning (SI) Treatments Assigned Using the Rim Country Condition-based Management Approach

		Central Tendencies +/-	
	Treatment	Basal Area square feet per acre	Idealized Trees per Acre
Ponderosa Pine	UEA Thin - High Site Site index > 75)	60-90	49-74
	UEA Thin - Moderate Site (Site index 60-75)	45-75	37-61
	UEA Thin - Low Site (Site index <60)	30-60	29-49
	Stand Improvement - High Site (Site index >75)	50-80	41-65
	Stand Improvement - Moderate Site (Site index 60-75)	35-65	29-53
	Stand Improvement - Low Site (Site index <60)	20-50	17-41
Dry Mixed Conifer	UEA Thin - High Site (Site index > 75)	70-120	57-98
	UEA Thin - Moderate Site (Site index 60-75)	55-90	45-74
	UEA Thin - Low Site (Site index <60)	40-70	33-57
	Stand Improvement - High Site (Site index >75)	60-100	49-82
	Stand Improvement - Moderate Site (Site index 60-75)	45-80	37-65
	Stand Improvement - Low Site (Site index <60)	30-60	29-49

Decision Tree Modifiers

Some habitat and stand structures will make use of the decision tree but with specific design features to ensure resource protection. For example, while Mexican spotted owl PACs may require certain types of treatment apart from the decision tree, treatments in northern goshawk (NOGO) Post-Family Fledgling Areas (PFAs) or in Stands with an Abundance of Large Trees (SALT) may only require certain design features in addition to decision tree 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 tree are described here.

Mexican Spotted Owl Foraging/Non-breeding Recovery Habitat

Achieving management objectives within Mexican spotted owl recovery habitat can be addressed with this Condition-based Management Approach. Stands in recovery habitat would be assigned a treatment using the decision tree, 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).

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 tree. However, additional direction, such as promoting multi-aged stands and stands dominated by large trees with relatively denser canopies (with basal areas generally 10 to 20 percent greater than surrounding areas) is necessary to maintain or improve habitat and ensure land management plan compliance.

NOGO Post-Fledging Areas (PFAs)

Management objectives in NOGO PFAs are like 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 tree; however, additional direction comes from Land Management Plans (with basal areas

generally 10 to 20 percent greater than surrounding areas), to maintain or improve habitat and ensure land management plan compliance.

Stands with an Abundance of Large Trees (SALT)

The Rim Country DEIS (Section D, p. 638) included a collaboratively developed definition that used stand data to identify and map occurrence of SPLYT stands across the Rim Country footprint. However, this classification included a variable that could not be readily measured in the field (quadratic mean diameter), presenting a significant obstacle to implementation of the conditions-based management approach. It was also noted that the similarly-named exception category in the Large Tree Implementation Plan (LTIP) presented semantic confusion as well as potentially contradictory direction to implementers with respect to retention of large trees. A revised approach that best meets the original intent of SPLYT was developed collaboratively, removes ambiguity in the LTIP exception category, and provides consistency with other FEIS changes developed collaboratively by the working group. The approach developed for the FEIS identifies Stands with an Abundance of Large Trees (SALT) in order to preserve desirable large tree forest structure.

These are ponderosa pine stands located outside of Mexican spotted owl PACs, Mexican spotted owl recovery habitat, and the wildland urban interface (WUI), that have a well-developed component of large young trees greater than 16 inches d.b.h. (“blackjacks”) and often older trees as well. These stands can also have patches of interconnected and multi-layered canopy that support canopy-dependent wildlife species. The nomenclature from the first 4FRI EIS (Stands with a Preponderance of Large Young Trees, "SPLYT") has been changed to prevent confusion with the similarly-named Large Tree Implementation Plan (LTIP) exception category #8.

The iterative spatial analysis and field validation effort undertaken by the Forest Service and stakeholders yielded an initial SALT data filter of greater than 40 square feet/acre of basal area (BA) in ponderosa pine trees greater than 18 inches diameter at breast height (d.b.h.). All stands would be field-verified prior to mechanical thinning. Stands (or portions thereof) meeting SALT criteria, including those not captured by the data filter, would generally be treated at the lowest range of intensity within the identified silvicultural prescription. In order to meet desired conditions reflecting the full range of historical forest structure and avoid "managing for the minimum," treatment intensity could be further reduced. For example, a stand identified by the condition-based management decision tree to receive an uneven-aged moderate site treatment, leaving 45-75 square feet/acre of basal area, would be treated to a minimum of 75 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 SALT data filter but, upon field verification, are determined not to meet the criterion, will be treated within the range of intensities for the identified silvicultural prescription.

Eligible Wild and Scenic River Corridors

There are currently no designated wild and scenic rivers in the Rim Country project area. However, as part of its land management plan revision process, the Tonto National Forest is completing a wild & scenic river eligibility study that will replace the 1993 study. For analysis purposes and to be consistent with the land management plan revision, the Rim Country FEIS includes the eligible rivers listed in the most current eligibility study based on comments received from the 2017 Tonto National Forest Draft Wild and Scenic Rivers Eligibility Study. Design features have been included in Appendix C specifically for the purpose of adjusting proposed treatments in the future as eligibility and suitability are determined across all Forests in Rim Country. Any mechanical treatments proposed in eligible wild and scenic river corridors in the Rim Country 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).

Stands Infected with Dwarf Mistletoe

While the overall incidence (distribution and percent of landscape affected) of dwarf mistletoe is thought to have increased only modestly compared to historic conditions, the overall abundance of mistletoe is thought to have increased in many areas (Conklin and Fairweather 2010). In order to meet the purpose of increasing the resilience and sustainability of ponderosa pine ecosystems within the Rim Country project area, dwarf mistletoe will be managed as an individual tree removal criterion rather than a mistletoe specific treatment type. The presence or intensity of a dwarf mistletoe infection is not a criterion for treatment assignment in the Rim Country Condition-based Management Approach. Management of dwarf mistletoe should focus on southwestern dwarf mistletoe, and its most common host, ponderosa pine.

In lightly (0 to 20 percent of the target species in the stand are infected) and moderately (20 to 80 percent infection) infected stands, the restoration treatments in the modified proposed action will address dwarf mistletoe. In stands with light and moderate infections, the proposed action allows for removal of individual infected trees as part of the uneven-aged thinning and stand improvement treatments. Pockets of mistletoe infection could be addressed through the reduction of basal area as well as the creation of openings as part of these treatments. Information on the ecology of dwarf mistletoes can be found at (USDA 2013). Additional management information has been described by Conklin and Fairweather (2010).

In severely infected stands (80 percent or more infected), the forest health objective must also be weighed against other resource objectives. Generally, these stands would be assigned a similar treatment type to stands without a severe dwarf mistletoe infection, however, mechanical deferral may also be an option. 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 or even deferring stands from mechanical treatment where a mechanical approach would not lower the level of dwarf mistletoe infection.

Inventoried Roadless Areas

All or portions of eight Inventoried Roadless Areas exist in the project area. Restoration activities within IRAs would be consistent with the 2001 RACR Exception Criteria (see the Inventoried Roadless Area Specialist Report – Regional Forester IRA Briefing Paper), require additional notification and approvals, and incorporate design features (appendix C). Treatments in Inventoried Roadless Areas shall be designed to maintain the overall roadless character of inventoried roadless areas. Additional considerations for management activities in IRAs are listed below:

- Temporary roads shall not be built in Inventoried Roadless Areas. No road realignment or reconstruction is allowed in Inventoried Roadless Areas;
- Strive to make stump heights 8 inches above ground (uphill side) or lower, with 12-inch heights the exception and rarely occurring;
- Slash must be treated or removed;
- Use existing barriers (roads) and natural barriers as control lines whenever possible;
- Cable operations shall not be conducted in Inventoried Roadless Areas.

Special Designations

Some areas within the Rim Country project area have special land management designations that require additional considerations when applying mechanical and prescribed fire treatments. Among these are Research Natural Areas (RNA), and Botanical Areas (BA). Research Natural Areas are areas that the Forest Service has designated to be permanently protected and maintained in natural condition. These protected natural areas include unique ecosystems or ecological features; rare or sensitive species of plants and animals and their habitat; and/or high-quality examples of widespread ecosystems. A botanical area is a unit of land that contains plant specimens, plant groups, or plant communities that are significant because of their form, color, occurrence, habitat, location, life history, arrangement, ecology, rarity, or other features. For additional management direction of Research Natural Areas and Botanical Areas, consult individual land management plans.

Mechanical Treatment Condition-based Management Approach Summary

The objective of the condition-based management approach is to provide a higher quality treatment by accurately assessing forest stands in fine detail with professional walkthrough assessments. Figure D-4 demonstrated the condition-based management approach in more detail. Tables imbedded into this section would be used by field personnel upon prescription writing.

Condition-based Management Approach for Aquatics and Watershed Restoration Treatments

The Rim Country project area encompasses over 1.2 million acres ranging in elevation from around 4,300 to 8,850 feet and includes 11 vegetation cover types. This project area includes stream types ranging from high gradient headwater streams, meandering meadow reaches, and low gradient depositional valleys. There are approximately 4,000 miles of stream channels, including perennial, intermittent, and ephemeral. Wetlands such as wet meadows and springs also occur, providing unique aquatic and riparian habitats. There are 411 known springs on the three national forests that are either developed or undeveloped, and occur in meadow and riparian settings. It is estimated there are up to 10 times the number of unmapped springs that are not developed in the Rim Country project area. Riparian areas include vegetation types such as herbaceous sedge/rush, willow/alder, and cottonwood/sycamore vegetation.

Seeps, springs, wet meadows, riparian areas, and Emory oak groves are all places that may have cultural significance for tribal communities and could be sensitive for cultural resources. Input from tribes and heritage program staff should be solicited during project design and before project implementation.

Conditions within these watershed and aquatic systems range from relatively pristine to highly impacted. There are legacy impacts from timber management, fire suppression, channel modification, water developments such as springs and stock tanks, unregulated grazing, as well as more contemporary impacts from roads, non-native species, wildfires, recreation, and off-highway vehicle use. Some of these impacts are irreversible; however, in many systems there is potential for a new functional equilibrium. In other systems, there is the opportunity for either full restoration or preventing further degradation.

Areas for potential aquatic and riparian restoration were identified using Riparian Mapping (RMAP) layers and information from Terrestrial Ecological Unit Inventory (TEUI). TEUI is a system to classify ecosystem types and map ecological units at different spatial scales. Streams that have been identified as candidate areas for stream restoration were identified spatially using factors that promote successful treatments and project design features. It was determined that most restoration techniques are more successful in lower gradient streams. In addition, many of the low gradient areas are those that have been

impacted and are in need of restoration. Stream gradient was mapped using LiDAR data and averaged within reaches. Reaches based on Rosgen stream types with low (0-2 percent) and moderate (2-4 percent) stream gradient are identified for general stream treatment. A subset of those stream restoration areas where there is the potential to use large machinery were further identified as heavy mechanical treatment areas. These were identified by the ability of machinery to access locations and design features (slope restriction). Reaches with canyon slopes more than 25 percent and further than 0.25 miles from roads were excluded from the heavy mechanical subset. In areas where restoration is needed for issues such as conifer encroachment within riparian areas, prescribed fire may be the preferred restoration method and are identified.

It is anticipated that project proposals for riparian restoration will be developed both by Forest Service personnel and by the array of partners and cooperating agencies that have developed this project. In addition to restoration projects, it is important to also focus on protecting areas with intact processes and high-quality habitat. As projects are developed, they should be developed and evaluated by appropriate professionals (for example, hydrologists, geomorphologist, biologists), regardless of whom proposes them, regarding how the project will achieve progress toward restoration goals. Projects should follow these guidelines (1) principles of watershed processes, (2) protecting existing high-quality habitats, and (3) current knowledge of the effectiveness of specific techniques (Roni et al. 2002).

There are two major drainage systems encompassed in the action area, the Little Colorado River which flows northerly, and the Salt River which flows southerly. The restoration goals in the north and south flowing streams are outlined below with the intention to guide project prioritization and to provide a framework for project development. Watershed restoration assessments, which outline needed restoration work are in place and are being implemented for some but not all of the watersheds within the project area. There are many areas where projects have not yet been developed.

Salt River

South flowing streams of the project area are mainly on the Tonto National Forest. Many of these streams are managed both for native species as well as recreational fishing. Primary effects are from diverse land management practices including grazing, road building, and high levels of recreation which have led to soil compaction, increased erosion, impairment of riparian and stream habitat, reduction in water quality, and overgrown and decadent forests at higher risk of large uncharacteristic fires. Large, often stand-replacing, fires over the past 25 to 30 years in this watershed have resulted in high amounts of sediment input into the system. Post-fire flooding, channel instability, and sediment contributions to the East Verde River are evident at several locations along the stream. In the East Verde River headwaters, which is one of the priority watersheds for the Tonto National Forest, high flood events, exacerbated by denuded headwaters and hydrophobic soils resulting from large fires, heavily scoured much of the East Verde River, in many places down to bedrock. Recent projects have concentrated on diversifying instream habitats to increase abundance and age class diversity for both native and sport fish.

Little Colorado River

The streams on the north part of the project area flow north into the Little Colorado River. Many of these are currently or were historically occupied by Little Colorado Spinedace. One of the main limiting factors for this species is the limited amount of perennial surface water flow in many of these streams. These streams are very vulnerable to drought or other stressors which exacerbate intermittency. Historically, meadows primarily in the headwaters and along the floodplain functioned as important water source/storage areas to help maintain flow for these systems during dry seasons, functioning as a sponge. In addition, these meadow systems could help regulate and store water during high flow events,

minimizing damaging flows downstream. Historic and current uses such as high levels of grazing, roads, logging, and other uses have contributed to the formation of headcuts and other degraded conditions through many of those meadows which has limited their ability to store water. The 1999 East Clear Creek Watershed Recovery Strategy and Watershed Condition Framework scores indicate soil conditions in the meadows are unsatisfactory due to past heavy livestock grazing, roads, and current wild ungulate use, as well as recreation pressures that have reduced ground cover, compacted soils, and contributed to the lowering of the water table. Meadow areas are located within almost all headwater drainages of the Little Colorado River streams. Compaction and unsatisfactory soil conditions in the headwater meadows leads to increased runoff, sedimentation, and reduced baseflows, which have the potential of negatively affecting spinedace habitat as well as perennial flow much farther downstream.

The priority goal for aquatic restoration in the Little Colorado River drainages would be to enhance and protect surface water flow and increase habitat for Little Colorado Spinedace. Projects focused on restoring hydrologic function to headwater wet meadows and floodplains along these streams are crucial to maintaining and improving flow in downstream areas, restoring surface water permanency crucial for spinedace persistence and population expansion and recovery. Other high priorities would include projects to decommission or relocate poorly located roads which have confined stream channel morphology or altered water movement through meadow systems, as well as addressing headcuts and their root causes lower in the drainage network.

Aquatics and Watershed Restoration Condition-based Management

Due to the size and complexity of the 1.24-million-acre Rim Country project area the site-specific identification and analysis of all areas of need and the possible combinations of restoration activities is not available within the necessary timeframe for Rim Country analysis. Prior to proposing aquatics and watershed restoration treatments, project leaders, specialists, and partners would need consider the restoration needs and goals for the specific area, the extent and cause of degraded resources, water quality issues, threatened and endangered species habitat, scenic sensitivity levels, and effects on non-forest lands. Complete baseline information on the condition of every acre is not currently available, however, there are a few categories of watershed and aquatic impairments that are common throughout the project area such as downcutting of streams and lack of floodplain connection, especially in low gradient areas. In order to have a variety of methods that could address the most common restoration needs a suite of restoration treatments are being proposed.

Having a suite of tools available for designing restoration projects will enable managers and partners to find the best solutions for a site-specific problem. It is anticipated for a given project, a variety of tools may be integrated within the project design to achieve the desired outcome. In addition, tools that might be appropriate in one area (for example stream type) may not be the right tool somewhere else. Landscape features that affect watershed and aquatic systems and how they function include: valley width, gradient, upland and riparian cover types, slope, access, soil types, hydrology (stream or spring flow), and substrate size. These features would be considered in determining site specific restoration treatments and the appropriate tools. Condition-based management also provides the ability to adapt treatments to unanticipated conditions within the analysis framework. It does not cover every foreseeable situation that may require restoration and some treatments that may cause effects potentially beyond the sideboards or limitations described in this NEPA analysis would require subsequent NEPA analysis.

The suite of tools helps address the effects of roads on watershed and aquatic systems, such as unauthorized routes and trails and stream crossings. The miles of unauthorized routes (roads or trails) within the project area are unknown, but generally have similar effects on these systems. Based on current mapping, it is estimated that there are over 800 road and stream crossings in the project area. It is

assumed that road crossings are generally stable on maintenance level 3 thru 5 roads (suitable for passenger cars to high degree of user comfort), and range from stable to unstable on maintenance level 1 and 2 roads (basic custodial care, such as closed, to open to high clearance vehicles). The tools presented should give adequate flexibility to design projects to address problems with existing maintenance level 1 and 2 roads which are causing resource damage as well as maintenance for level 3-5 roads which may be destabilizing streams.

Whenever possible, restoration treatments should be coordinated with other activities in the same area to create efficiencies, focus efforts, and reduce miles of roads or trips to an area. Restoration treatments could be incorporated into mechanical thinning contracts or stewardship agreements, or could be stand-alone projects specifically developed to address high-priority needs for comprehensive restoration.

Introduce Evaluation Methods

Aquatic Restoration Review Team

It is anticipated that an Aquatic Restoration Review Team (ARRT) would be established to guide restoration priorities and review all aquatic and watershed restoration proposals submitted. The ARRT is proposed to consist of a three-member core group of fish biologists and hydrologists, one each from the US Forest Service, USFWS, and Arizona GFD for the Rim Country Project area. The core team would have on-the-ground knowledge of aquatic systems in the Rim Country Project area and possess expertise and experience in their field. Additional core team members from Bureau of Reclamation or Army Corp of Engineers may be considered. Additional technical experts from needed fields of expertise (such as fluvial geomorphology, engineering, riparian ecology, soils) from these or other agencies may be recruited depending upon projects to be reviewed. Projects which require additional technical experts may include actions like stage-0 restoration, large aquatic passage projects, and channel realignment. In Oregon and Washington, the interagency group that works with salmon habitat restoration has developed a matrix of review based on the anticipated impacts and stream response (Skidmore et al. 2011) and could be adapted to fit the ARRT needs. Oregon Watershed Enhancement Board's restoration proposal evaluation criteria of Proposal Clarity, Technical Soundness, Watershed Context, Capacity of Applicant, and Cost Effectiveness, may also be useful review criteria to incorporate (*see diagram D-6 for additional information).*

A request for proposals would occur biannually, after which the ARRT would meet to review project proposals and facilitated by Forest Service personnel and/or a stakeholder. It is anticipated that the ARRT would review both heavy mechanical and general project proposals initially but would later focus on only heavy mechanical project proposals once processes are refined and implementer expertise is further developed. Additionally, as local personnel gain experience with project implementation and understanding, the ARRT may decrease the review needs for projects that are similar to those already implemented.

After proposal submittal and prior to the ARRT meeting, site visits of all proposal projects would occur including the proponent and at least one member of the ARRT core group. During the review meeting a notetaker would be present and team members would review proposals focusing on their strengths, concerns, and other relevant information. The ARRT makes recommendations of either Support, Support with Conditions, or Do Not Support, and then they priority rank them. The recommendations are then provided to the 4FRI Board of Directors and presented by the ARRT to the 4FRI stakeholder group.

Focus areas for projects would be guided by the ARRT and preferred projects would focus on hydrological function of the project streams and species recovery. Watershed restoration action plans have

been developed or are in progress for priority watersheds within the Rim Country action area and these can assist in determining priorities. These include East Verde River Headwaters, Tonto National Forest, Long Tom Canyon-Chevelon Canyon and Upper Wildcat Canyon on the Apache Sitgreaves National Forest, and East Clear Creek-Blue Ridge Reservoir on the Coconino National Forest. These plans outline priority projects to improve watershed conditions and could provide initial guidance for needed restoration. In addition, some projects have already been implemented over the past decades and could help provide some guidance for what methods have worked well or not. Yochum and Reynolds (2020) provide guidelines for Forest Service stream restoration projects and the information needed to development and design. In addition, a variety of case studies of various methods are presented in the documents cited above.

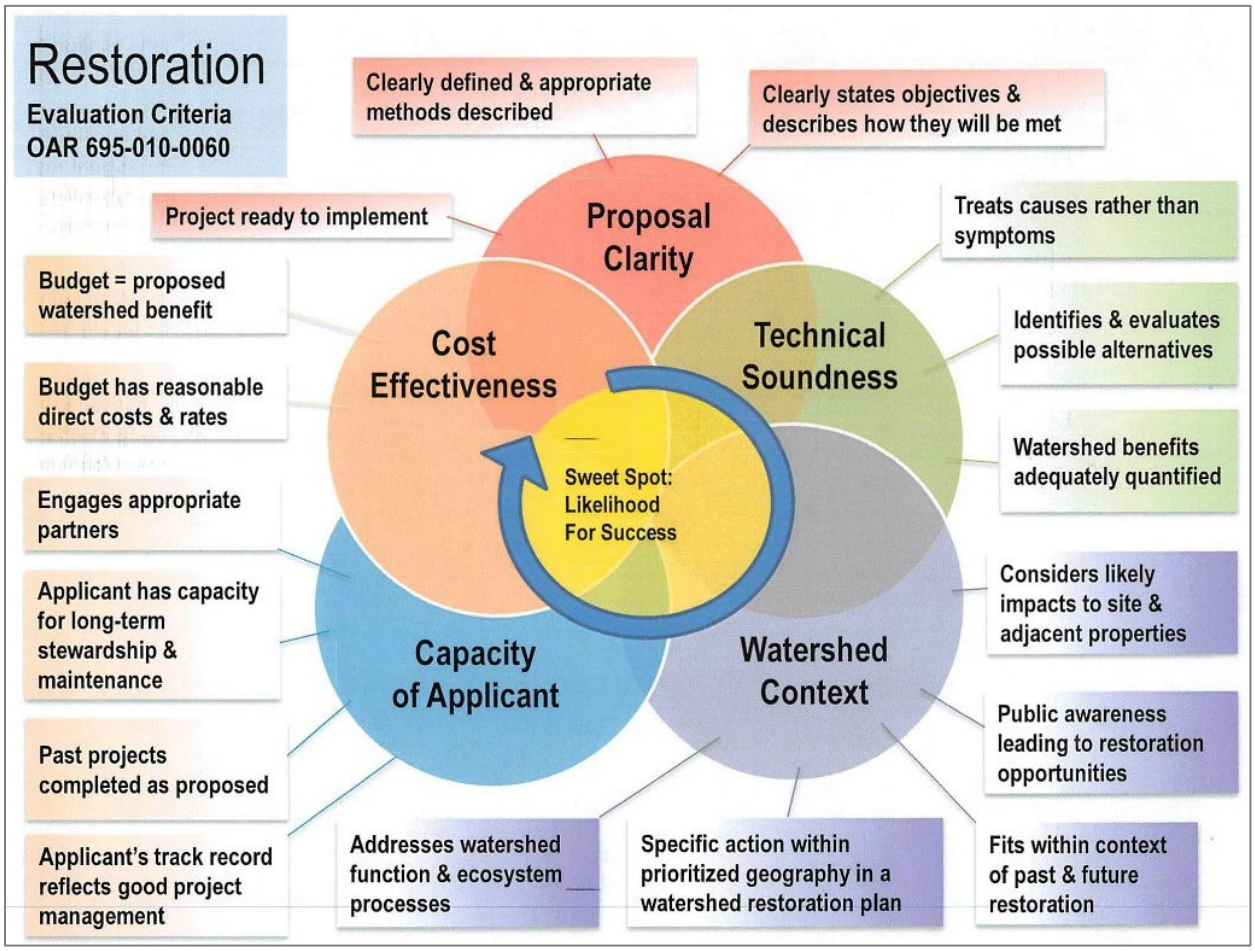

Figure D-6. Oregon Administrative Rule bubble diagram of review criteria

Project Screening and Decision Matrix

To guide the planning and implementation of site-specific aquatics and watershed restoration treatments and assist with their prioritization, a decision matrix was developed to be included in the condition-based management approach. The decision matrix gives guidance on the types of information to collect to identify the need for restoration treatments, identify potential restoration options and constraints, and prioritize projects for implementation.

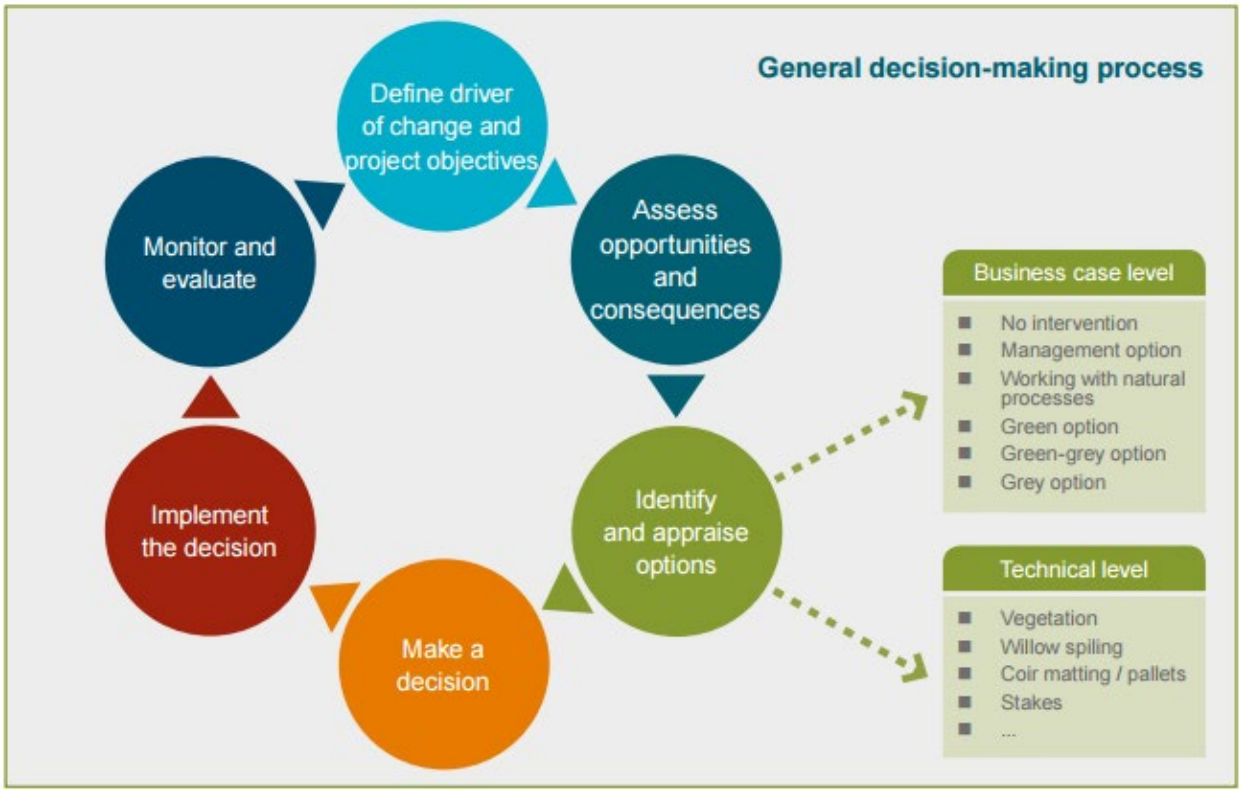

Figure D-7. Guidance for decision-making process (Roca et al. 2017)

Define project objectives and driver of change: The first step is identifying the primary goals for watershed management within a given area and issues that need to be addressed. An example for the Little Colorado River drainage might be the goal to increase habitat for Little Colorado spinedace with the objective to protect and enhance surface flow within drainages. Evaluation of the watershed conditions will allow managers to identify the main drivers that influence surface flow and subsequently identify potential sites where restoration activities may be needed.

Information such as management history, hydrology, and geology is needed to inform the existing baseline conditions and to understand underlying causes of degradation. Understanding the drivers of change or causes of degradation is necessary to help design the best approach and reach the most appropriate solution. Many times projects are also driven by opportunities, driven either by funding or adjacent projects, however all projects should contribute to the goals for the given watershed (Table D-7).

Key information that may be needed for managers and project designers to understand issues and restoration needs include:

- Site reconnaissance: IDT, partners, stakeholders walk the potential project area to identify areas of concern and potential causes of degradation. Things that the group would take note of include:
    - Landforms valley type (transport vs. depositional reaches), relic channels, floodplains, very old trees, distinct reach breaks

  - Occurrence of excess erosion or deposition, loss or change in species composition or density (plant or animal), loss of floodplain and in-channel roughness elements (large and coarse wood, vegetation, etc.)
  - Signs of manipulation (berms, ditches, skid roads, landings, unusually flat surfaces, hummocks, old or unauthorized roads, infrastructure, etc.)
- Research the history of an area.
  - Historic aerial photos, Forest Service photo archives, local historical societies, universities
  - Prior reports and local knowledge
  - Use information to piece together what happened to cause the degradation
- Characterize the past, current, and likely future trajectory of the area (for example, SEM or Rosgen stream type, spring type, riparian successional stage, or Proper Functioning Condition)
- Assessment and inventory (list in not inclusive as new protocols are developed all the time):
  - Valley and channel types (valley and channel gradients, entrenchment ratio, width to depth ration, sinuosity) for example Rosgen Level 1 and 2
  - Hydrology (flood, low flow, bankfull, regional curves, channel bed material, roughness) for example Rosgen Level 1 and 2
  - Sediment inputs (roads, fires, other land ownership, banks)
  - Riparian habitat and condition (existing, potential, and function)
  - Habitat connectivity (aquatic, terrestrial)
  - Forest resources (terrestrial and aquatic species, rare plants, weeds, etc.)
  - Springs Ecosystem Assessment Protocol (SEAP) evaluation (Springs Stewardship Institute) https://springstewardshipinstitute.org/protocols
- Determine potential cause(s) of the problem (human activity, animals, past management, or natural processes). Whenever feasible, manage the cause of the problem rather than its symptoms.
- Determine the baseline of the system to adequately assess all restoration treatments.
- Identify other drivers likely to impact the system over its lifetime (for example, growth, climate change).

Assess opportunities, consequences, and constraints: Identifying potential consequences of current condition (for example, bank or bed erosion) and the opportunities to improve site conditions should be assessed to inform the identification of measures and their prioritization. Constraints of a potential project also need to be identified such as accessibility, nearby land ownership, and roads that cannot be moved. Identification of constraints is beneficial to determining restoration opportunities, prioritization, and potential treatments to be used. Potential short and long-term consequences of potential treatments should also be identified. Finally, the scope of the potential activity needs to be evaluated to determine if it fits within the constraints of the effects analyzed in the Rim Country EIS

- Promote resilient ecological functions of the system being assessed.
- Integrate approaches to seek solutions that deliver multiple benefits whilst increasing resilience.
- All feasible options should be clearly set out and described in relation to the baseline.

  - Describe and assess key impacts to all stakeholders, both positive and negative for each restoration treatment.
- Determine restoration projects scope.
  - Start big and whittle down based on process drivers.
  - Find a downstream vertical grade control (start of a canyon reach, natural nick point, etc.)
- For springs (Springs Stewardship Institute): Evaluate condition and need for spring function and species use.
- Develop specific goals for restoration
  - Restore the site to as nearly natural and ecologically functioning a condition as possible
  - OR restore specific resources, characteristics or populations as desired by the manager
  - OR restore other desired future condition of the site
- Consider: Minimizing maintenance costs and activities
- For developed springs
  - Evaluate the water rights, water use needs and costs, irrigation schedule, and maintenance
  - Identify features to preserve in situ
  - Identify features to remove – old pipes, concrete, fencing, roads/trails, etc. in coordination with heritage specialists
- Consider the following questions from Beechie et al. 2008:

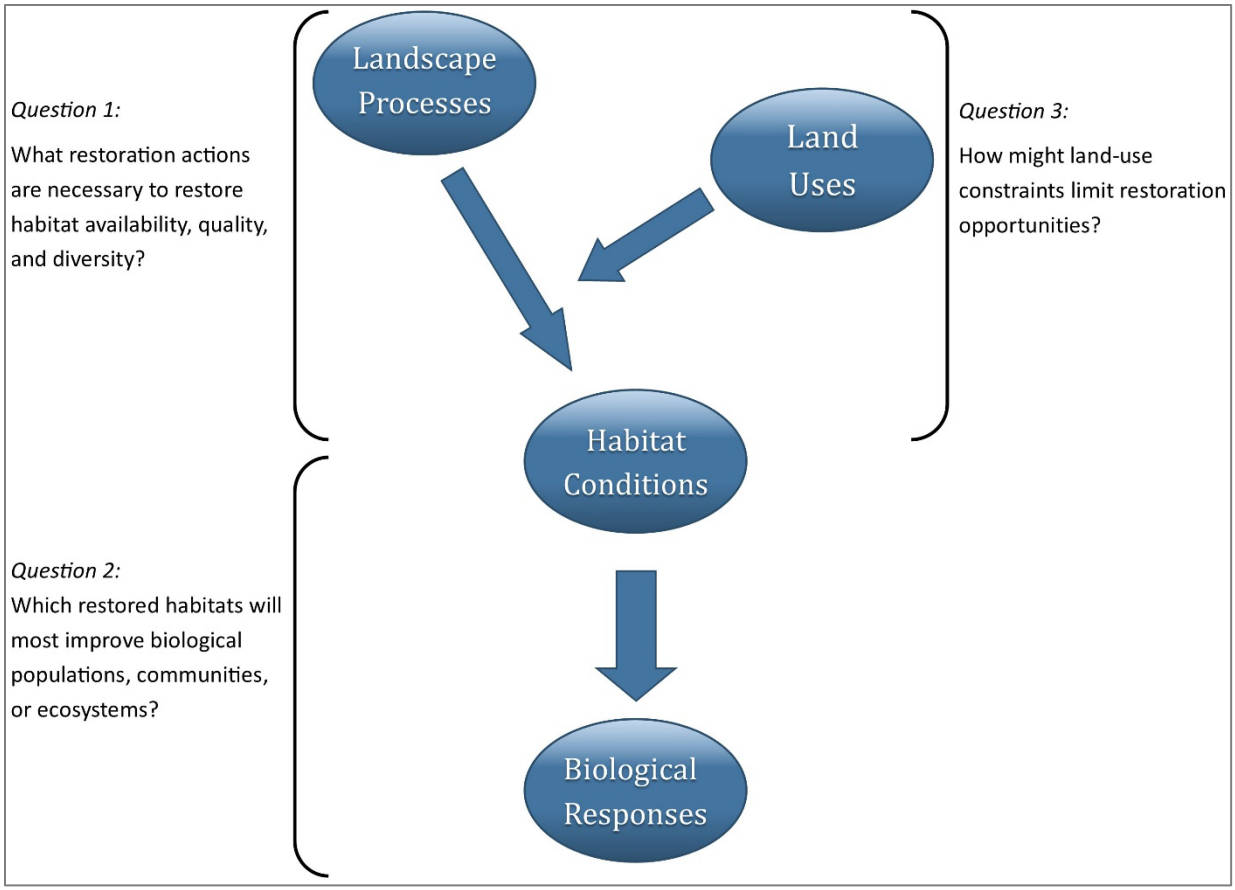

Figure D-8. Diagram of conceptual linkages and questions to be addressed in assessments used to identify and prioritize restoration actions (Beechie et al. 2008)

Identify and appraise options: A number of potential options should be considered and appraised in order to provide a robust basis upon which to make a decision on how to move forward. All feasible options and methods should be assessed and clearly described in relation to the baseline (no action) to provide decision makers and partners all the necessary information to base their decisions.

In addition, impacts of all options should be described and assessed. This includes impacts on all stakeholders, both positive and negative. Impacts should be screened for relevance and significance and can be assessed qualitatively or quantitatively where enough information is available to support the assessment.

In summarizing the results of the options, costs and benefits should be aggregated across relevant categories to provide a consist basis for assessment. Comparisons should be consistent and any uncertainties should also be described and addressed.

- Can the restoration treatment meet and fulfill the objectives for the project?
- What are the chances of success?
- Does it address the causes rather than the symptoms?

- Consider the consequences of taking no action, assess the risks, costs, and benefits of implementing each option.

No Treatment: allows the natural adjustment of a system and therefore is the most sustainable. Should be applied when natural processes are likely to constitute a natural solution to the problem and the system has the ability to adjust (all processes functioning and no anthropogenic constraints).

Management Option(s)/Restoration Activities: Based on addressing the causes of the problem. This option involves restoration treatments to improve existing conditions.

Prioritization

Restoration activities should be discussed within the ARRT and prioritized at the forest and district level in collaboration with partners.

There are many considerations that could be used to prioritize proposed locations and timing of aquatic and watershed restoration activities: immediate conservation needs and benefits for federally listed, candidate, or sensitive species, watershed condition framework planning, corresponding vegetation restoration activities (see Integration section above), and partner interest. In addition, opportunities may arise during proposed upland vegetation treatments in an area to efficiently accomplish beneficial aquatic restoration include, but are not limited to: thinning conifers along and within riparian areas, restoring incised channels, riparian planting, removing/obliterating unauthorized routes, and/or putting in drainage and closing level 1 system roads after all treatments are completed.

Prioritization of aquatic and watershed restoration projects will depend upon multiple site specific factors. Therefore, we list considerations when prioritizing activities rather than requirements.

Table D-3. Considerations for prioritizing where and when treatments are implemented

Treatment Consideration Prioritization Element	Considerations for prioritizing where and when implemented
Benefits to federally listed or candidate species	The presence of these species and improving their habitat could increase the prioritization of a project over a site that had none present.
Watershed Condition Framework and priority watersheds.	Areas or activities within existing Watershed Restoration Action Plans can increase opportunities to move watersheds into a higher condition class. Maintaining or improving watershed condition where feasible should be taken into consideration. Projects in priority watersheds should be considered.
Projects that improve impaired waters	Projects that improve water quality in ADEQ TMDL (water quality improvement plan) or 303b listed streams,
Vegetation restoration activities within the area.	Incorporating aquatic and watershed restoration activities in an area with other restoration treatments whenever possible is one way to create efficiencies with heavy equipment and personnel.
Partner Interest	Projects that already have partners or interested partners, particularly if funding is available, should be considered.
Wet meadows, cienegas, and other similar habitats.	These habitat types store water in upper watersheds and maintain baseflow to other aquatic habitats. They also cool water and can provide for lower stream water temperatures. Maintaining and improving these areas can have great downstream beneficial impacts.
Upper watershed vs. lower	Restoration in upper portions of watersheds can have beneficial impacts downstream such as reduced sedimentation, maintaining baseflow, and cooling stream temperatures. They will have a larger range of beneficial impacts than projects lower in a watershed.

Treatment Consideration Prioritization Element	Considerations for prioritizing where and when implemented
Issues that are new, easily treated, or could quickly spread.	Newer issues have not yet caused that much damage; restoration treatments of these are more cost and time effective as well as preventing more degradation. Projects such as these are 'low-hanging fruit' when compared to larger or more widespread issues. In addition, new infestations of noxious weeds or aquatic invasive plants are easier to treat early rather than after they spread.
Process versus form-based projects	Projects that enhance site conditions, but do not restore the processes that create habitat or site conditions are considered form-based. These types of projects can require more maintenance than projects that restore the processes that create and maintain habitat. Projects that restore processes may be more of a priority than those that address a specific issue rather than the larger problem.
Force account, contracted, and partner implementation	All three categories have merit, but may have differing financial or oversight costs. These should be considered differently amongst options and assessed. Prioritization may depend upon which category a project occurs in when weighed against work load, capacity, and financial considerations.
Potential to adversely affect cultural resources or tribal values	Seeps, springs, riparian areas and Emory oak groves may have tribal significance and could be sensitive for cultural resources. Input from tribes and heritage program staff should be solicited during project design and before project implementation.

Project Checklist and ARRT Review

A project checklist identified in the implementation plan will be used to ensure site specific aquatic and watershed restoration projects are consistent with the Rim Country analysis, project design criteria, and biological opinion as well as the associated forest Land Management Plan. These types of projects are also submitted to the Aquatic Restoration Review Team for review as described previously. Once the ARRT and appropriate line officer has approved the project, implementation can occur.

Implementation of Restoration Projects

Pre-implementation surveys will be conducted for federally-listed and sensitive species, rare plants, invasive species, and cultural resources in accordance with project design criteria, Rim Country Biological Opinion, and Rim Country SHPO consultation. If federally-listed, rare, or sensitive species, or cultural sites, are found during pre-implementation surveys or during activity implementation, the appropriate mitigation will be incorporated into activity design and Forest Service will coordinate with USFWS and SHPO. Any cultural resource findings will be coordinated with the State Historical Preservation Office.

Validation and Collaboration Period

Monitor and evaluate: Implementation and effectiveness monitoring should occur in order to show consistency with the Rim Country analysis, measure project success, and inform future projects. Project level monitoring should be part of site specific project documentation. It identifies if effects are within the scope of the analysis, if project design features are effective, as well as if project specific objectives were met. Monitoring also builds trust with partners, stakeholders, and the Aquatic Restoration Review Team as aquatic and watershed projects are implemented. Sharing of information provides transparency, which in turn builds trust and integrity. It also provides for project leaders to learn from one another as we move toward ecological restoration. Consider the following five criteria for measuring project success proposed by Palmer et al. 2005 and adapted to a broader view here.

1. A dynamic and ecological endpoint is initially identified and used to guide restoration.

2. The ecological conditions of the aquatic or watershed resource are measurably improved.

3. Through the use of natural fluvial and ecological processes, the restored aquatic or watershed system must be more self-sustaining and resilient to perturbations than pre-restoration conditions, so that minimal maintenance is needed.

4. The implementation of the restoration does not inflict lasting harm.

5. Pre- and post-project assessments are completed and the data are made available so that the restoration community as a whole can benefit from knowledge learned.

Restoration Assessment Framework

Aquatic and watershed condition-based management analyzed under Rim Country was defined using the tables that follow and align with the planning process outlined above.

Step 1: Once inventory and data collection have been completed to determine site specific existing condition and define resource issues, the first set of tables (Table D-4, Table D-5, Table D-6, Table D-7, Table D-8, Table D-9) should be used to identify what suite of methods are appropriate. These tables are broken out into the following specific categories for consistency: springs, wetlands, montane meadows, streams, roads/trails, and road-stream crossings.

Step 2: Use the methods tables (Table D-10, Table D-11, Table D-12, Table D-13) to determine potential alternatives for the project. Multiple methods may apply, but site specific conditions and constraints should assist in identifying and documenting potential methods (alternatives).

Step 3: Utilize circumstances table (Table D-14) and site specific information (stream gradient, distance from roads, slope) to determine if potential methods are excluded from use at the project location.

Tables for determining appropriate restoration methods based on existing condition, resource issues, and concerns.

Springs

Table D-4. Appropriate restoration methods based on existing condition, resource issues, and concerns for springs

Existing Condition (what, where, how much?)	Resource Issues and Concerns	See Methods for:
Surface flow impacted by drought, alteration of the source or outflow, springbox, diversion or piping.	Reduced surface and subsurface flows from human created diversions, piping and alterations reduce habitat for aquatic, wetland and riparian obligate species; plants and animals.	Improving spring outflows
Channeling or outflow channels are degraded leading to reduced surface and/or subsurface flow.	Reduced surface and subsurface flows result in reduced habitat for aquatic, wetland and riparian obligate species; plants and animals.	Improving spring outflows and/or form and function of stream channels and floodplains
Invasive or noxious plants are present and competing with native vegetation.	Native plants are outcompeted or overtaken, habitat degraded, loss or decline of native species.	Improving native riparian or aquatic vegetation
Developed spring is splitting flow from a failing springbox, diversion or piping.	Diversion of flow is dewatering the outflow and associated wetlands.	Improving spring outflows
Riparian or aquatic vegetation and proper soil function is adversely affected by recreation or overgrazing by livestock or elk.	Loss or decline of native and/or rare wetland, riparian, and aquatic plant species. Plant composition has low similarity compared to historic range of variability. Reduction or loss of habitat.	Improving native riparian or aquatic vegetation
User created trails or roads are adversely affecting wetland and associated vegetation.	Loss or decline of native and/or rare wetland, riparian, and aquatic plant species. Loss or decline of vegetative ground cover and increases in bare soil exposure. Soil compaction and subsequent accelerated erosion causing degradation of proper soil function and site productivity. Potentially leading to altered surface or subsurface flows. Reduction or loss of habitat.	Improving road or trail interactions with stream courses, springs, or other wetlands:
Spring is being encroached by upland species or undesirable native species.	Loss or decline of native and/or rare wetland, riparian, and aquatic plant species. Reduction or loss of spring habitat.	Improving native riparian or aquatic vegetation

Wetlands (marshes, potholes, wet meadows, and natural ponds)

Table D-5. Appropriate restoration methods based on existing condition, resource issues, and concerns for wetlands

Existing Condition (what, where, how much?)	Resource Issues and Concerns	See Methods for:
Wetland is adversely affected by invasive plant species	Loss or decline of native and/or rare wetland, riparian, and aquatic plant species. Plant composition has low similarity compared to historic range of variability. Reduction or loss of habitat.	Increasing presence, diversity, and/or abundance of native riparian or aquatic vegetation.
Encroachment by upland species or undesirable native species.	Encroachment is identified as an indicator of lowered water table, loss or decline of native and/or rare wetland, riparian, and aquatic plant species.	Increasing presence, diversity, and/or abundance of native riparian or aquatic vegetation.
Vegetation and soils may be compacted or denuded by excessive livestock or elk herbivory, unauthorized routes, etc.	Loss or decline of native and/or rare wetland, riparian, and aquatic plant species. Loss or decline of vegetative ground cover and increases in bare soil exposure. Soil compaction and subsequent accelerated erosion causing degradation of proper soil function and site productivity. Potentially leading to altered surface or subsurface flows. Reduction or loss of habitat.	Increasing presence, diversity, and/or abundance of native riparian or aquatic vegetation.
Evidence of incision, slumping, excessive soil erosion/sedimentation or other such issues that are draining the wetland.	Reduced surface and subsurface flows draining the wetlands, narrowing or loss of wetland, riparian, and aquatic plant species. Reduction or loss of habitat.	Improving form and function of stream channels and floodplains.
Poorly located or user created roads and trails causing degradation to soil function and site productivity.	Streams or wetlands have increased sedimentation, increased erosion, accelerated peak flows and loss or degraded vegetation from user created roads or trails.	Improving road or trail interactions with stream courses, springs, or other wetlands:

Montane Meadows

Table D-6. Appropriate restoration methods based on existing condition, resource issues, and concerns for montane Meadows

Existing Condition (what, where, how much?)	Resource Issues and Concerns	See Methods for:
Native vegetation is adversely affected by invasive plant species	Loss or decline of native plant species. Plant composition has low similarity compared to historic range of variability. Reduction or loss of habitat.	Increasing presence, diversity, and/or abundance of native riparian or aquatic vegetation.
Encroachment by upland species or undesirable native species.	Encroachment is an indicator of lowered water table, loss or decline of native plant species.	Increasing presence, diversity, and/or abundance of native riparian or aquatic vegetation.
Vegetation and soils may be compacted or denuded by excessive livestock or elk herbivory, unauthorized routes, OHV use, camping, etc.	Loss or decline of vegetation and ground cover, increases in bare soil exposure. Soil compaction and subsequent accelerated erosion causing degradation of proper soil function and site productivity. Potentially leading to altered surface or subsurface flows. Reduction or loss of habitat.	Increasing presence, diversity, and/or abundance of native riparian or aquatic vegetation.
Evidence of incision, slumping, excessive soil erosion/sedimentation or other such issues that are draining the meadow.	Reduced surface and subsurface flows draining the meadows. Reduction or loss of habitat.	Improving form and function of stream channels and floodplains.
Poorly located or user created roads and trails causing degradation to soil function and site productivity.	Increased sedimentation, erosion, and accelerated peak flows from user created roads or trails.	Reducing sediment inputs from road or trail interactions.

Unneeded Roads and Unauthorized Routes and Trails

Table D-7. Appropriate restoration methods based on existing condition, resource issues, and concerns for unneeded roads

Existing Condition (what, where, how much?)	Resource Issues and Concerns	See Methods for:
Poorly located or user created roads and trails causing excessive soil disturbance, erosion and soil compaction.	Soil compaction and erosion. Soil compaction and subsequent erosion causing increased sedimentation if road networks are connected to stream channels. Confinement of stream channel, degradation of wetlands, erosion into aquatic habitats, draining of wetlands, channel widening. Concentration of flows that were originally spread across a wide area via drainage capture by ditching or berms. Potential changes in peak flows. Adverse changes in energy dissipation or sediment transport that adversely affect the function of the active channel or flood plain dimension Some unauthorized routes are often used by tribal communities to access forest resources and areas of cultural significance. This should be considered before eliminating these access routes.	Improving road or trail interactions with stream courses, springs, or other wetlands and/or form and function of stream channels and floodplains.
Stream or wetland damage due to poorly located or user created roads within the floodplain, wet meadow, spring outflow, or other such wetland habitats.	Same as above.	Improving road or trail interactions with stream courses, springs, or other wetlands and/or form and function of stream channels and floodplains.

Road and Stream or Wetland Crossings

Table D-8. Appropriate restoration methods based on existing condition, resource issues, and concerns for road and stream or wetland crossings

Existing Condition (what, where, how much?)	Resource Issues and Concerns	See Methods for:
Road crossings are increasing sedimentation to streams, springs, wet meadows, and other wetlands. Road crossings are causing excessive soil erosion/sedimentation that may adversely affect downstream vegetation stability/productivity.	Abnormally large sediment inputs to aquatic systems degrading spawning habitat, reducing macroinvertebrate and algae food base. Loss or decline of native wetland vegetation and proper soil stability/productivity downstream from road crossing.	Improving road or trail interactions with stream courses, springs, or other wetlands:
Roads and associated stream crossings are adversely modifying flow across the landscape, such as concentrating flows into a culvert.	Alteration of flows/hydrology within a stream valley is causing channel incision.	Improving road or trail interactions with stream courses, springs, or other wetlands:
Road crossings are causing unwanted geomorphic changes to stream channels such as stream widening.	Roads may cause widening of channels which can cause increased stream temperatures, alterations to the channel, and degraded stream habitat. Undersize culverts may cause an increase in stream velocity causing scour and downcutting.	Improving road or trail interactions with stream courses, springs, or other wetlands:
Road crossing geometry is reducing sediment transport capacity and competency.	Alteration of sediment transport is causing long-term aggradation/degradation of the stream channel.	Improving road or trail interactions with stream courses, springs, or other wetlands:
Aquatic organism passage (where it is meant to exist) is completely or partially impeded due to lack of stream flow, perched culverts, degraded culverts or other such issues.	Aquatic organisms cannot pass part or all of the time impeding migration, genetic flow, distribution, and access to refuge habitats.	Improving road or trail interactions with stream courses, springs, or other wetlands:

Existing Condition (what, where, how much?)	Resource Issues and Concerns	See Methods for:
Roads are causing physical disturbance and soil compaction that results in adverse effects to stream and wetland plant communities	Roads may cause vegetation removal, soil cover loss and soil compaction that can lead to decreased diversity of native species, loss of ground cover, and invasion of exotic species.	Improving road or trail interactions with stream courses, springs, or other wetlands:
Need for frequent road maintenance that adversely affects aquatic and watershed resources.	Abnormally large sediment inputs to aquatic systems degrading spawning habitat, reducing macroinvertebrate and algae food base. Loss or decline of native wetland vegetation and proper soil stability/productivity downstream from road maintenance.	Improving road or trail interactions with stream courses, springs, or other wetlands

Streams (Channels, Floodplains and Riparian)

Table D-9. Appropriate restoration methods based on existing condition, resource issues, and concerns for streams

Existing Condition (what, where, how much?)	Resource Issues and Concerns	See Methods for:
Stream habitat complexity is lacking, in relation to all aquatic species life stages (such as rearing and juvenile habitat). --Most stream habitat is riffles or runs with little to no pool habitat and pool cover. Pool to riffle ratio is low. --Large woody debris and recruitment, if appropriate, is not present to create instream habitat complexity and cover. --Spawning habitat for various species (such as clean gravel bars, clean sand) are lacking. --Stream substrate is compacted or becoming cemented (tightly packed). Stream substrate is covered in fine sediment above natural levels.	Aquatic species need a variety of habitats to complete their life cycle. --Pool habitat is critical for resting habitat and thermal refugia for many species of fish --Lack of large woody debris contributes to poor stream habitat diversity. --Spawning habitat is essential to maintaining fish populations. --Cemented substrate affects habitat availability for small bodied fish, macroinvertebrate habitat, and spawning habitat. Decreased pool depth and cover	Improving form and function of stream channels and floodplains.
Stream temperatures are high or reaching thermal tolerance of aquatic species.	Many aquatic species in the southwest are living at the edge of their thermal tolerance; drought conditions or warming temperatures may make habitats unsuitable	Improving form and function of stream channels and floodplains.
Stream has or is currently incising and no longer connects with its floodplain or historic channels. Streambanks are incised or laterally unstable, and/or historic channels are abandoned.	Floodplain connection is critical for maintaining stream geomorphic function, stream habitat diversity, recharge of groundwater sources, and maintenance of riparian vegetation. Laterally unstable banks are causing high erosion and sedimentation rates that alter aquatic and riparian habitat quality. Sediment transport is also affected. Historic channels provide habitat for varying ages classes of species, dissipate flood flows, provide riparian and aquatic habitat.	Improving form and function of stream channels and floodplains and/or native riparian or aquatic vegetation
Stream is confined; it has been straightened or confined.	Artificially confined streams may not function properly. Confinement may cause incision or other issues due to changes in stream power and sediment transport. These areas often have issues during flood flows.	Improving form and function of stream channels and floodplains

Existing Condition (what, where, how much?)	Resource Issues and Concerns	See Methods for:
Stream width and depth ratio is inappropriate for stream type.	Overly wide streams may lack pools and habitat diversity and have higher stream temperatures than streams with a lower width depth ratio. Conversely, artificially confined streams may be not be able to dissipate stream energy.	Improving form and function of stream channels and floodplains
Hydrologic cycles are altered leading to reduced flood flows, or increased frequency of high flows (for example post fire flooding).	Aquatic and riparian species are adapted to certain hydrologic cycles which can be important to their life cycles. Flood flows are essential for maintaining properly functioning stream channels, floodplains and substrate distribution.	Improving form and function of stream channels and floodplains
Streams and associated floodplains are not dissipating flood water energy causing damage to streambanks. Meander pattern altered.	Altered channel roughness or meander pattern is causing excessive erosion, limiting energy dissipation from high flows, changes to channel morphology, altering stream habitat and floodplains.	Improving form and function of stream channels and floodplains
Water quality is poor due to turbidity, sedimentation, or factors other than temperature.	Poor water quality can cause a shift in macroinvertebrate and fish assemblages to more disturbance tolerant species. It can also alter primary or secondary productivity leading to changes in food availability.	Improving form and function of stream channels and floodplains.
Large woody debris is not present in channels or wetlands to reduce stream energy, provide cover, and create complex habitat.	Lack of large woody debris recruitment to streams may reduce roughness, cover, and habitat complexity.	Improving form and function of stream channels and floodplains
Riparian communities are not functioning at potential to support geomorphic and biotic needs of the aquatic community. --Leaf litter from riparian vegetation (allochthonous material) is lacking. --Existing riparian woody vegetation is lacking or out competed by conifers. --Floodplain vegetation has converted to upland species. --Riparian area is narrowing. --Soil compaction and accelerated soil erosion/sedimentation and bank instability.	Riparian communities (both woody and herbaceous) are essential to the health of instream aquatic systems. --Organic matter (leaves) provide nutrients and food source for macroinvertebrates, prey species for fish. --Loss or decline of riparian vegetation, stream shade, and bank stability. --Riparian vegetation aids in flood resilience, dissipation of flows (roughness), large woody debris and bank stability for stream systems. --Narrowing riparian area could indicate reduced water table, disconnected floodplain, or other constraints leading to loss of bank stability, shade, large woody debris, and possibly reduced flows. --Decreased soil function leading to stream bank soil instability and reduced site productivity of desirable native, riparian vegetation.	Improving form and function of stream channels and floodplains and/or improving native riparian vegetation

Methods Tables Described by General Type and the Resource Issues or Concerns they may Address

Table D-10. Methods for improving native riparian or aquatic vegetation

Methods	Resource Issues or Concerns Addressed
Removing tree(s), tree canopy, or shrub encroachment of upland species with hand thinning, mechanical thinning or prescribed fire.	Loss or decline of wetland, riparian, or aquatic plant species. Indicators of drying that can be associated with past land management practices
Remove and manage noxious or invasive plants using hand or mechanical methods, or herbicides, as described in forest weed management plans.	Loss or decline of native and/or rare wetland, riparian, and aquatic plant species. Protection or restoration of existing native biodiversity, erosion control, wildlife forage and habitat.
Plant native aquatic or riparian plant species by hand or mechanically, including seeding.	Loss or decline of native and/or rare wetland, riparian, and aquatic plant species, increased bank stability and leaf litter. Loss of site diversity and proper soil function.
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, remove/relocate roads or trails, create defined trails for recreation management using manual or mechanical tools. All added fencing will include bird diverters to protect birds.	Promote plant growth and vigor, reduce erosion and sediment inputs to aquatic systems, removal of riparian or aquatic stressors. Reduce ungulate grazing, excessive soil disturbance, OHV impacts, created trails, and dispersed camping causing resource damage. Reduce erosion, bank instability
Prescribed burning.	Natural disturbance leading to regeneration of riparian plant species, reduction in fuel loading and fuel corridors.

Table D-11. Methods for improving spring outflows

Methods	Resource Issues or Concerns Addressed
Improve or remove boxes or other infrastructure, using excavation, shovels, trackhoes, jackhammers, or concrete saw to restore natural spring function. Remove unneeded channels to consolidate spring outflow and increase habitat.	Spring developed for irrigation or livestock that is no longer needed and is compatible with existing water rights. Restoring natural spring function and flow
Split flow in developed springs to allow water above existing water rights to be released to spring outflows. Hand methods for fixing springboxes, piping, or diversions to split spring flow.	Drying of spring outflow, reduced aquatic and riparian vegetation, reduced habitat, reduced soil function, spring not functioning properly
Protect spring emergence zone and/or springbrook from direct ungulate disturbance through fencing.	Loss and/or degradation of wetland and riparian species from concentrated ungulate use of spring emergence zone and/or springbrook

Table D-12. Tools for improving road or trail interactions with stream courses, springs, or other wetlands

Methods	Resource Issues or Concerns Addressed
Obliterate roads restoring natural contours and vegetation using mechanical roads treatments.	For existing roads causing resource damage such as confining a stream, draining wetlands, loss or degradation of riparian or aquatic vegetation and habitat, and loss or degradation to proper soil function.

Methods	Resource Issues or Concerns Addressed
Close and restore unauthorized roads, trails, and dispersed camping areas using mechanical roads treatments.	For unauthorized roads, trails or recreational impacts causing resource damage such as confining a stream, draining wetlands, loss or degradation of riparian or aquatic vegetation and habitat, and loss or degradation to proper soil function.
Return ML 1 roads to closed status after use for restoration treatments by: removal of drainage infrastructure (for example culverts); reestablishment of road drainage through leadout ditches, water bars, rolling dips, and other means; removal of unstable fill; and placement of slash using mechanical roads treatments.	Erosion, sedimentation, degradation or loss of vegetation from ML 1 roads.
Armor downstream culvert outlets using mechanical roads treatments.	Increased erosion and scouring downstream of culverts, bank instability, and channel downcutting.
Upsizing culverts using mechanical roads treatments.	Streams scouring around culverts and over roads, increased erosion to streams or wetlands, reduced aquatic organism passage from road culverts. Potential impacts to channel soil stability and site productivity.
Installing or adding culverts or culvert arrays using mechanical roads treatments.	Loss of stream connectivity, channel width, erosion and sedimentation to streams, channelization and increased channel width due to roads. Potential impacts to channel soil stability and site productivity.
Maintaining Aquatic Organism Passage where it exists. Options for improving passage include installing bridge, replacing culvert, or removing crossing using mechanical roads treatments.	Decreased fish passage, habitat access, passage of high flows and bedload, and decreased channel complexity from road culverts.
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.	Loss or degradation of riparian vegetation or soil function, channel widening, increased erosion, sedimentation to aquatic habitats, increased bank instability from roads crossing streams or wetlands.
Install and replace bridges on ML1 and ML2 roads needed for mechanical offerings using mechanical roads treatments.	Decreased aquatic and terrestrial wildlife passage through culverts or under exiting bridges, deposition of stream bedload upstream of culverts, high flows are scouring channel and floodplain upstream, log jams are forming upstream of culverts or bridges.
Raise culverts where invert elevations have resulted in stream incision.	Restore natural flow paths and connection of flow to floodplain areas.
Install raised permeable roadbeds with or without culverts where roads cross areas of seasonal or perennial water inundation.	Restore natural flow paths.
Restore channels affected by road crossings using mechanical roads treatments.	Channel widening, erosion and sedimentation upstream or downstream of a road crossing. Loss or degradation of riparian vegetation and soil function.
Decommission or relocate ML1 and ML2 roads needed for mechanical offerings causing resource damage to springs, wetlands or streams using mechanical roads treatments.	Reduce sedimentation and erosion, improve vegetation and soil condition, restore stream banks, restore and improve aquatic and terrestrial habitat.
Developing footpath(s) on existing trails to prevent further erosion using hand or mechanical treatments.	Streams, springs, or wetlands have increased sedimentation, increased erosion, and loss or degraded vegetation and soil condition from user created trails.

Table D-13. Tools for improving the form and function of stream channels and floodplains

Methods	Resource Issues or Concerns Addressed
Large woody debris, log structures, log jams, yarding trees. Tree falling, transport and placement of trees and root wads from somewhere else, yarding over trees, helicopter wood, mechanical installation.	Floodplain connection is critical for maintaining stream geomorphic function, soil stability, stream habitat diversity, recharge of groundwater sources, and maintenance of riparian vegetation. Sediment transport is also affected. Lack of large woody debris recruitment to streams for reduces roughness, cover, and habitat complexity.
Weirs and Beaver Dam Analogs (BDAs) installed by hand or mechanical methods.	Floodplain connection is critical for maintaining stream geomorphic function, soil stability, stream habitat diversity, recharge of groundwater sources, and maintenance of riparian vegetation. Sediment transport is also affected.
Wicker, log and rock wires, vanes, or baffles, brush bundles and root wads using various methods and installed by hand or mechanically.	Lack of channel roughness or meanders is causing excessive erosion, changes to channel morphology, altering stream habitat and floodplains.
Boulder and log deflectors using mechanized installation.	Lack of channel roughness or meanders is causing excessive erosion, changes to channel morphology, altering stream habitat and floodplains. Lack of pool habitat or instream cover.
Hand girdling trees to provide for future large woody debris stream input.	Lack of large woody debris recruitment to streams for reduces roughness, cover, and habitat complexity.
Restoring meanders or adding stream length by induced meandering, recontouring the channel, plug and pond, other similar methods mechanically.	Artificially confined streams may not function properly. Confinement may cause incision or other issues due to increased stream power and sediment transport. These areas often have issues during flood flows
Channel reconstruction, realignment or floodplain reconnection using mechanical treatments.	Floodplain connection is critical for maintaining stream geomorphic function, soil stability, stream habitat diversity, recharge of groundwater sources, and maintenance of riparian vegetation. Sediment transport is also affected.
Flood plain creation, widening, or laying back incised stream banks using mechanical treatments.	Floodplain connection is critical for maintaining stream geomorphic function, soil stability, stream habitat diversity, recharge of groundwater sources, and maintenance of riparian vegetation. Sediment transport is also affected
Removing instream stock tanks and replacing with guzzlers, drinkers, etc. in the uplands using mechanical equipment.	Restore channel width, sediment, flow, and water source for downstream areas.
Zuni bowls, one rock dams or other similar methods using mechanical or hand treatments.	Slow overland flow or stream flow in small channels, reduce erosion and sedimentation.
Reconnection of historic side channels that should be functioning using mechanical equipment.	Floodplain connection is critical for maintaining stream geomorphic function, soil stability, stream habitat diversity, recharge of groundwater sources, and maintenance of riparian vegetation. Sediment transport is also affected.
Maintenance of existing structures using manual or mechanical equipment.	Structures that stabilize banks, create instream cover and channel roughness, etc. from the CCC era forward currently exist on the landscape.
Removing existing erosion control structures	Removing poorly placed or nonfunctional structures can improve channel form and function.

Circumstances Tables

In general, the tools all have specific circumstances where they would be more successful in moving the restoration project toward desired condition. Each system is unique and may have conditions where some tools would be ineffective, not needed, or potentially cause degradation rather than improving conditions. Listed below are the general circumstances under which each tool would apply or conversely, where they would

not apply. The generalized circumstances table is intended to provide general implementation guidance for the tools as well as to better define where these proposed activities could occur for Rim Country.

Characteristics that could be mapped such as stream gradient and road maintenance levels were used to greatest extent possible. However, some characteristics such as presence of ungulate impacts or presence of noxious or invasive plants cannot be defined using remote sensing techniques and will still need to be determined on site. Applicability based on stream gradient was determined using Rosgen stream types as well as literature on specific tools.

Table D-14. Generalized circumstances for when or where methods would or would not apply

Treatments/Methods	Circumstances where treatments would apply	Circumstances where treatments would not apply
Removing tree(s), tree canopy, or shrub encroachment of upland species with hand thinning, mechanical thinning or prescribed fire.	In low and medium gradient stream reaches where wetland, riparian, or aquatic plant species should be present.	In stream reaches where upland species are the dominant plant species. High gradient stream reaches.
Remove and manage noxious or invasive plants using hand methods or herbicides as described in forest weed management plans.	Anywhere that noxious or invasive plants are adversely affecting native riparian or aquatic vegetation.	Anywhere noxious or invasive plants do not occur.
Plant native aquatic or riparian plant species by hand or mechanically, including seeding.	In low and medium gradient stream reaches and all other wetland types where wetland, riparian, or aquatic plant species should be present.	High gradient stream reaches
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. All new fencing will include bird diverters.	In low and medium gradient stream reaches where wetland, riparian, or aquatic plant species should be present. Areas would also have to be reasonably close to road system for access and maintenance.	High gradient stream reaches, narrow or confined valleys.
Improve or remove spring boxes and other infrastructure, using excavation, shovels, trackhoes, jackhammers, concrete saws to restore natural spring function. Removing unneeded channels to consolidate spring outflow and increase habitat.	Low to moderate gradient stream reaches	-
Split flow in developed springs to allow water above existing water rights to be released to spring outflows. Hand methods for fixing springboxes, piping, or diversions to split spring flow.	Low to moderate gradient stream reaches	-
Protect spring emergence zone and/or springbrook from direct ungulate disturbance through fencing.	In areas where ungulate disturbance is impacting springs.	Where ungulate disturbance is not a causative factor.
Obliterate roads restoring natural contours and vegetation using mechanical roads treatments.	Where existing roads causing resource damage such as confining a stream, draining wetlands, loss or degradation of riparian or aquatic vegetation and habitat, and loss or degradation to proper soil function.	-
Close and restore unauthorized roads, trails, and dispersed camping areas using mechanical roads treatments.	For unauthorized roads, trails or recreational impacts causing resource damage such as confining a stream, draining wetlands, loss or degradation of riparian or aquatic vegetation and habitat, and loss or degradation to proper soil function.	-

Treatments/Methods	Circumstances where treatments would apply	Circumstances where treatments would not apply
Return ML 1 roads to closed status after use for restoration treatments by removal of drainage infrastructure (for example culverts), reestablishment of road drainage through leadout ditches, water bars, rolling dips, and other means, removal of unstable fill, and placement of slash using mechanical roads treatments.	Anywhere that ML1 roads are opened for use within Rim Country.	-
Armor downstream culvert outlets using mechanical roads treatments.	ML 2-4 roads where erosion is occurring from culverts.	-
Upsizing culverts using mechanical roads treatments.	ML 2-4 roads in areas where stream or overland flow had increased above the capacity of existing infrastructure.	-
Installing or adding culverts or culvert arrays using mechanical roads treatments.	ML 2-4 roads in areas where stream or overland flow had increased above the capacity of existing infrastructure.	-
Maintaining Aquatic Organism Passage where it exists if road crossing work needed. – Install bridge, replace culvert, or remove crossing using mechanical roads treatments.	Where roads and streams intersect on ML 2-4 roads	ML 1 and ML 5 road/stream crossings or intersections.
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 thinning using mechanical roads treatments.	Where ML 1-2 roads intersect with streams	ML 3-5 road and stream intersections
Install and replace bridges on ML1 and ML2 roads needed for mechanical offerings using mechanical equipment.	Where ML 1-2 roads intersect with streams	ML 3-5 road and stream intersections
Developing footpath(s) or tread on existing trails to prevent further erosion using hand or mechanical equipment	Where trails are within 250 feet from streams	Trails beyond 250 feet from streams.
Large woody debris, log structures, log jams, yarding trees. Tree falling, transport and placement of trees and root wads from somewhere else, yarding over trees, helicopter wood, mechanical installation.	Low to moderate gradient stream reaches and valleys, with wide to narrow floodplains.	High gradient stream reaches
Weirs and Beaver Dam Analogs (BDAs) installed by hand or mechanical methods.	Low to moderate gradient stream reaches and valleys (most viable at stream slopes of 0-3%), with wide to narrow floodplains.	High gradient stream reaches. BDAs are less viable at stream slopes of >3%.
Wicker, log and rock wires, vanes, or baffles, brush bundles and root wads using various methods and installed by hand or mechanically.	Low to moderate gradient stream reaches and valleys, with wide to narrow floodplains.	High gradient stream reaches.
Boulder and log deflectors using mechanized installation.	Low to moderate gradient stream reaches and valleys, with wide to narrow floodplains.	High gradient stream reaches
Hand girdling trees to provide for future large woody debris stream input.	Low to moderate gradient stream reaches and valleys, with wide to narrow floodplains.	High gradient stream reaches
Restoring meanders or adding stream length by induced meandering, recontouring the channel, plug and pond, other similar methods mechanically.	Low to moderate gradient stream reaches and valleys, with wide to narrow floodplains. Wetlands and wet meadows.	High gradient stream reaches
Channel reconstruction, realignment or floodplain reconnection using mechanical treatments.	Low to moderate gradient stream reaches and valleys, with wide to narrow floodplains.	High gradient stream reaches
Flood plain creation, widening, or laying back incised stream banks using mechanical treatments.	Low to moderate gradient stream reaches and valleys, with wide to narrow floodplains.	High gradient stream reaches
Removing instream stock tanks and replacing with guzzlers, drinkers, etc. in the uplands using mechanical treatments	Low to moderate gradient stream reaches and valleys.	High gradient stream reaches

Treatments/Methods	Circumstances where treatments would apply	Circumstances where treatments would not apply
Zuni bowls, one rock dams or other similar methods using mechanical or hand treatments.	Low to moderate gradient stream reaches and valleys.	High gradient stream reaches
Reconnection of historic side channels that should be functioning using mechanical treatments.	Low to moderate gradient stream reaches and valleys.	High gradient stream reaches
Maintenance of existing structures using manual or mechanical treatments.	Generally found in low to moderate gradient stream reaches and valley slopes.	High gradient stream reaches
Removing existing erosion control structures	Generally found in low to moderate gradient stream reaches and valley slopes.	High gradient stream reaches

Skidmore, P.B., C.R. Thorne, B.L. Cluer, G.R. Pess, J.M. Castro, T.J. Beechie, and C.C. Shea. 2011. Science base and tools for evaluating stream engineering, management, and restoration proposals. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-112, 255 p.

Section E - Management Direction, Desired Conditions, and Treatment Design

The following direction comes from a variety of sources including land management plans, recovery plans, and biological opinions. While it is the current direction, that may change in the future. As these documents are revised in the future, implementers should follow the revised direction.

Table D-15. Seasonal restrictions for wildlife species

Species	Seasonal Restriction	Restriction Summary	Notes from Design Features
Mexican Spotted Owl	March 1 to August 31	0.25 Mile Buffer from PAC	Timing restrictions may be waived on a case by case basis if protocol level surveys confirm non-nesting or an active nest is more than 0.25 mile from project work. Timing restrictions may also be waived if the district biologist, in coordination with USFWS determines actions within 0.25 mile will not disturb breeding birds.
Northern Goshawk	March 1 to September 30	0.25 Mile Buffer from nest	Timing restrictions may be waived if protocol surveys indicate non-breeding or infer absence. Timing restrictions may also be waived if the district biologist, in coordination with USFWS determines actions within 0.25 mile will not disturb nesting birds.
Bald and Golden Eagle Nests	January 1 to August 31	500-1,000 feet of nests	In bald and golden eagle breeding areas, mechanical treatments within 500-1,000 feet of bald or golden eagle nest trees or nest sites would only occur outside of the breeding season (January 1st to August 31st), unless the nest is determined to be inactive by the District Biologist in coordination with AGFD and FWS.
Bald Eagle Winter Roost	October 15 to April 15	500 feet of winter roost sites	Restrict project activities within 500 feet of known bald eagle winter roost sites from October 15 - April 15, unless, in coordination with AGFD and FWS, it is determined eagles are not using the winter roost at that time. If the Forest Service determines that thinning or temporary road construction must occur within 300 feet of a known bald or golden eagle winter roost, the Forest Service will coordinate with AGFD and FWS during project layout to ensure roost habitat is maintained.
Bat Colonies	April 15 to August 31	300 Foot Buffer from heavy mechanical Equipment	A 300-foot buffer for mechanical treatment with heavy equipment should be designated around known bat colonies (use AGFD Heritage Data Management System (HDMS) database). For treatments around cave entrances, sink hole rims and other karst features that are to occur during the maternity season (April 15 to August 31) or during monsoon season, coordination should occur with a wildlife biologist regardless of whether HDMS data indicates the occurrence of bat colonies or not.
Raptor Nests	Confer with Wildlife Biologist	Avoid Disturbance to Raptor nests	Protect active raptor nest sites from disturbance by project-related activities by restricting activities during nesting season as specified in the applicable Land Management Plan, or as determined by a local wildlife biologist. Known nest trees for any raptor species will be prepped, as needed, to avoid negative impacts to survival or successful reproduction, prior to implementing management activities, including prescribed fire.
Narrow-headed Gartersnake	November 1 to February 28	Do not disturb rocks/boulder piles in NHGS habitat	Disturbance of rock/boulder piles and large woody debris in narrow-headed gartersnake habitat or proposed critical habitat will be avoided to the greatest extent practical during their brumation/inactive period (November/December to February, depending on elevation).

Species	Seasonal Restriction	Restriction Summary	Notes from Design Features
Narrow-headed Gartersnake and Chiricahua Leopard frog	Coordinate with USFWS 6 months prior to implementation	Coordinate with partner agencies	Coordinate with AGFD, USFWS and the Forest Service district biologist early (at least 6 months prior to implementation within narrow-headed gartersnake and Chiricahua leopard frog occupied habitat to determine if surveys are required and to determine agreed upon, short-term care facilities for any Chiricahua leopard frog or narrow-headed gartersnakes found prior to or during implementation.
Chiricahua Leopard frog	3 day waiting period after Monsoon Rain event at occupied or dispersal CLF sites	No heavy mechanical equipment	Use of heavy mechanical equipment will cease for 3 days if a monsoon rain event occurs in leopard frog dispersal or occupied habitat or unless supported by a biologist and approved by a sale administrator or COR
Aquatic Species	Identify where and when timing restrictions might apply depending on species present.	Coordinate with partner agencies	Given the potential for multiple aquatic species to occur in a given location, Forest Service, U.S. Fish and Wildlife Service (USFWS), and Arizona Game and Fish Department (AGFD) biologists will cooperatively prioritize aquatic species of concern on a site-specific basis regarding timing restrictions for instream and riparian restoration activities. Work will occur during base-flow conditions, and on dry or frozen riparian soil conditions where possible.
Mexican Wolf	Denning: April 1 to July 31 Rendezvous sites: June 1 to September 30	1 mile radius from disturbance to a den or rendezvous site	Temporarily restrict human access and disturbance-causing land-use activities within a 1-mile radius around active Mexican wolf dens between April 1 and July 31, and around active rendezvous sites between June 1 and September 30. Exceptions include any authorized specific land use that was active and ongoing at the time Mexican wolves chose to locate a den or rendezvous site nearby. Coordinate with the Interagency Field Team (IFT) to determine current denning/rendezvous site locations.
Yellow-Billed Cuckoo	July 1 to September 30	Mechanical thinning/prescribed burning	The Forest Service would not conduct mechanical thinning and prescribed burning in potential cuckoo habitat during the height of the breeding season (July 1 – September 30), but thinning and prescribed burning could occur from May 15 – July 1, when cuckoos may be present. The FS will coordinate with the state and federal YBCU species leads to determine when potential habitat polygons require timing restrictions. Field visits assessing habitat, stream gradient, vegetation, and floodplain width in coordination with FWS will determine if and where timing restrictions should occur.

Mexican Spotted Owl Habitat

Protected Activity Center (PAC)

Vegetation Management Direction: Retain key forest species such as Gambel oak; retain key habitat components such as snags and large down logs; generally harvest conifers less than 18 inches in diameter only within those PACs treated to abate fire risk and implement burn only treatments in 100-acre nest cores as described in the Mexican spotted owl recovery plan.

Desired Conditions: Table C.2 (USDI 2012) lists guidance for minimum desired structural elements within PACs. Other key habitat components includes snags greater than 18 inches, down logs greater than 12 inch midpoint diameter, hardwoods, and an understory vegetation layer that includes shrubs and herbaceous species.

Strive for a diversity of patch sizes with minimum contiguous patch size of 2.5 acres with larger patches near activity center; mix of sizes toward periphery. Forest type may dictate patch size (such as mixed

conifer forests have larger and fewer patches than pine-oak forest). Strive for between patch heterogeneity. Horizontal and vertical habitat heterogeneity within patches, including tree species composition. Patches are contiguous and consist of trees of all sizes, unevenly spaced, with interlocking crowns and high canopy cover. Tree species diversity, especially with a mixture of hardwoods and shade-tolerant species. Diverse composition of vigorous native herbaceous and shrub species.

Opening sizes between 0.1 - 2.5 acres. Openings within a forest are different than natural meadows. Small canopy gaps within forested patches provide for prey habitat diversity. Openings should be small in nest/roost patches, may be larger in rest of PAC. Minimum canopy cover of 40 percent in pine-oak and 60 percent in mixed conifer. Measure canopy cover within stands.

Diversity of tree sizes with goal of having trees greater than or equal to 16 inches d.b.h. contributing 50 percent or more of the stand basal area.

PAC Mechanical Thin and Burn Treatment Design

Each PAC has 100-acre burn only area, called the core, around the known nest or roost sites.

Outside the 100-acre core burn only area, trees may be thinned and/or prescribed burns may be used to protect habitat, treat fuels and mitigate fuel hazards where feasible.

Prescribed Burning Objectives and Tactics

Prescribed burns may be used to treat fuels and mitigate fuel hazards where and when feasible by increasing tree canopy base height and reducing litter/duff cover and other surface fuel loading. Prescribed fires are designed to maintain and enhance desired Mexican spotted owl PAC habitat forest structure, tree densities, snag densities, and course woody debris levels.

- Course woody debris would be managed for 3 to 10 tons per acre, and downed logs greater than 12 inch midpoint diameter would be managed for three per acre. Averages are at the landscape-scale;
- One hundred-acre burn only area around the known nest or roost sites managed for low intensity fire and low forest severity to forest canopy;
- Outside the 100-acre core burn only area, treat fuels and mitigate fuel hazards with prescribed fire that produces low to moderate-severity fire effects;
- Other activities tied to prescribed burning include line preparation which includes fuel breaks. Logical fuel breaks include existing roads and minimal line construction would be used depending on road system density; and
- Prescribed burning includes following concurrence and consultation advice from USFWS.

Mechanical Thinning Objectives and Tactics

Use mechanized equipment to reduce and remove hazardous live and dead fuel loading.

Design tree thinning treatments to meet desired conditions. Retain and promote large hardwoods such as Gambel oak; other species may be felled to meet desired conditions.

Activity and residual slash may be removed, masticated, lopped and scattered or piled to burn in place in coordination with fire/fuels staff.

Snags greater than 18 inches would be managed for two or greater per acre in ponderosa pine and three or greater per acre in mixed conifer. Averages are at the landscape-scale.

Recovery Nesting/Roosting Habitat

Vegetation Management Direction: Use the Pre-implementation Compliance Review for the Regional Mexican spotted owl Recovery Strategy in appendix K to determine whether mechanical treatment is necessary. Mexican spotted owl recovery habitat is defined by the recovery plan and established through FWS consultation. Decision of Rim Country EIS determines where Mexican spotted owl recovery habitat stratification is located in the project area. Two types of forested recovery nesting/roosting habitat exist in the project area: mixed-conifer and pine-oak. Twenty five percent of mixed-conifer recovery habitat is managed for recovery nesting/roosting habitat. Ten percent of pine-oak recovery habitat is managed for recovery nesting/roosting habitat. Where possible, retain key forest species such as oak, snags and large down logs. Refrain from falling trees 18 inches d.b.h. and greater.

Desired Conditions: Table C.2 & C.3 of the Mexican Spotted Owl Recovery Plan (USDI 2012) lists guidance for minimum desired structural elements within recovery nesting/roosting habitat. Other key habitat components include snags greater than 18 inches, down logs greater than 12- inch midpoint diameter, hardwoods, and an understory vegetation layer that includes shrubs and herbaceous species. The following represents additional desired conditions from Table C.3 of the Mexican Spotted Owl Recovery Plan (USDI 2012):

- Basal area for pine-oak recovery nesting/roosting habitat at least 110 ft^2 basal area per acre;
- Basal area for mixed-conifer recovery nesting/roosting habitat at least 120 ft^2 basal area per acre;
- Basal area by the following size classes: at least 30 percent of the basal area in trees 12-18 in d.b.h. and at least 30 percent of the basal area in trees 18 in d.b.h. or greater;
- Density of 12 trees per acre of trees greater than or equal to 18 inches d.b.h.

Recovery Nesting/Roosting Habitat Mechanical Thin and Burn Treatment Design

Prescribed Burning Objectives and Tactics:

Prescribed burns will be used to treat fuels and mitigate fuel hazards where and when feasible by increasing tree canopy base height and reducing litter/duff cover and other surface fuel loading. Prescribed fires are designed to maintain and enhance desired recovery nesting/roosting habitat forest structure, tree densities, snag densities, and course woody debris levels.

Course woody debris would be managed for 3 to 10 tons per acre, and downed logs greater than 12 inch midpoint diameter would be managed for three or greater per acre. Averages are at the landscape-scale;

Use prescribed burning management to meet desired condition and mitigate fuel hazards with prescribed fire that produces low to moderate-severity fire effects;

Other activities tied to prescribe burning include line preparation which includes fuel breaks. Logical fuel breaks include existing roads; minimal line construction would be used depending on road system density;

Prescribed burning includes following concurrence and consultation advice from FWS.

Mechanical Thinning Objectives and Tactics:

Use mechanized equipment to reduce and remove hazardous live and dead fuel loading;

Design tree thinning treatments to meet desired conditions. Retain Gambel oak; remaining species may be felled to meet desired conditions;

Activity and residual slash may be removed, masticated, lopped and scattered or piled to burn in place in coordination with fire/fuels staff;

Where possible, manage for the sustainability of large oaks by removing ladder fuels and overtopping trees;

Snags greater than 18 inches would be managed for two or greater per acre in ponderosa pine and three or greater per acre in mixed conifer. Averages are at the landscape-scale;

Retain trees greater than 24 inches d.b.h.

Stands of recovery nesting/roosting habitat that are currently simultaneously meeting conditions in Table C.3 of the Mexican Spotted Owl Recovery Plan should not go below identified levels.

Recovery Foraging/Non-breeding Habitat

Vegetation Management Direction: Mexican spotted owl recovery habitat is defined by the recovery plan and established through FWS consultation. Decision of Rim Country EIS determines where Mexican spotted owl recovery habitat stratification in the project area. Two types of forested recovery foraging/non-breeding habitat exist in the project: mixed-conifer and pine-oak. These areas are mixed-conifer and pine-oak stands that are outside of PACs and recovery nesting/roosting habitat. Mexican spotted owl habitat management overrides other habitat management such as with northern goshawk habitat overlap. Manage to desired conditions in appendix C in the revised Mexican spotted owl recovery plan (USDI 2012).

Desired Conditions: Sustainable uneven-aged stand structure. Sustainable horizontal and vertical stand structure diversity. Sustainable amount of key habitat components such as snags greater than 18 inches, down logs greater than 12-inch midpoint diameter, shade, old age trees and hardwoods. When consistent with other resources objectives, improved forest health by an immediate reduction of risk of bark beetle attacks and/or reduction of dwarf mistletoe stand severity and landscape intensity to low to moderate levels.

Recovery Foraging/Non-breeding Habitat Mechanical Thin and Burn Treatment Design

Prescriptions should strive to maintain conditions for key habitat components (snags, logs, shade, and old trees) while achieving management objectives such as fuels reduction and ecosystem sustainability.

Prescribed Burning Objectives and Tactics:

Prescribed burns may be used to treat fuels and mitigate fuel hazards where and when feasible by increasing tree canopy base height and reducing litter/duff cover and other surface fuel loading. Prescribed fires are designed to maintain and enhance desired recovery foraging/non-breeding habitat forest structure, tree densities, snag densities, and course woody debris levels.

- Course woody debris would be managed for 3 to 10 tons per acre, and downed logs greater than 12 inch midpoint diameter would be managed for three per acre. Averages are at the landscape-scale;

- Use prescribed burning management to meet desired condition and mitigate fuel hazards with prescribed fire that produces low to moderate-severity fire effects;

- Other activities tied to prescribe burning include line preparation which includes fuel breaks. Logical fuel breaks include existing roads and minimal line construction would be used depending on road system density;

- Prescribed burning includes following concurrence and consultation advice from FWS.

Mechanical Thinning Objectives and Tactics:

Design tree thinning treatments to meet desired conditions. Retain Gambel oak; other tree species may be felled to meet desired conditions;

Silviculture objectives include improve and maintain forest health conditions, maintain and increase tree species diversity, improve understory grass/forb diversity, create and maintain a sustainable uneven aged forest environment and reduce tree densities to facilitate prescribed fire that produces low to moderate-severity fire effects.

Use mechanize equipment to reduce and remove hazardous live and dead fuel loading;

Manage for tree groups of dominate age classes stratified by young, mid-aged, and old-aged tree groups. Retain groups of dominate and codominant trees. Where age or size class diversity is not present, management activities should strive to encourage horizontal and vertical diversity.

In general, manage for tree groups with grassy openings or random tree spacing. Site level determination based on soil types, habitat type and regeneration rates shall confirm the proper determination to create or not create grassy openings. Stand level target basal area of 40 to 70 ft2 BA/acre in recovery foraging/non-breeding habitat for ecosystem resiliency; pine-oak stands could have group basal areas represent 40 to 110 ft2 BA/acre; mixed conifer stands could have group basal areas represent 40 to 135 ft2 BA/acre. Gambel oak, juniper, and pinyon species greater than 5-inch DRC may be considered as residual trees in the target group spacing and stocking. The objective is to manage for a sustainable range of density and structural characteristics.

Silviculture cutting systems include uneven aged thinning, intermediate thinning or stand improvement thinning. Soil types, current condition and historical reference conditions guide the type of silviculture cutting system.

In moderate and heavy dwarf mistletoe infection centers prescribe an uneven-aged thinning treatment that retains full stocking densities of trees. Retain the dominant and codominant trees with the least amount of mistletoe. Reduce the amount of mistletoe to the residual stand where mistletoe exist. Deferral may also be an option in severe dwarf mistletoe infections where mechanical thinning would place the stand further from desired conditions.

Activity and residual slash may be removed, masticated, lopped and scattered or piled to burn in place;

Where possible, manage for the sustainability of large oaks by removing ladder fuels and overtopping trees;

Snags greater than 18 inches would be managed for two per acre in ponderosa pine and three per acre in mixed conifer. Averages are at the landscape-scale;

Retain all trees greater than 24 inches d.b.h. unless the tree is considered a hazard to public safety

Northern Goshawk Habitat

Post-Fledging Family Area (PFA)

Vegetation Management Direction: northern goshawk habitat is stratified into nesting areas, post- fledging family areas and foraging areas. Northern goshawk foraging areas are managed in the general Ponderosa Pine and other forest desired conditions and do not pertain to this section. Nest areas are within post-fledging family areas. Northern goshawk post- fledging family areas, approximately 420 acres in size, and nest areas, 30 acres in size. These habitats are determined by historical nesting locations and are analyzed in the Rim Country EIS. Northern goshawk post- fledging family areas and nest areas could be identified in future surveys.

Management for northern goshawk post-fledging family areas are similar to the general Ponderosa Pine forest conditions, except post-family fledging areas generally are managed to contain 10 to 20 percent higher basal area in mid-aged to old tree groups. Nest area management needs to have dense canopies of mid-age and old trees. Use prescribed burning management to meet desired condition and mitigate fuel hazards with prescribed fire that produces low to moderate-severity fire effects. Other treatment to meet stand level objectives and desired conditions include silviculture management systems with the use of mechanize equipment and hand thinning.

Desired Conditions: northern goshawk post-fledging family areas may contain 10 to 20 percent higher basal area in mid-aged to old tree groups or random tree spacing than northern goshawk foraging areas and the surrounding 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.

Northern Goshawk Post Fledging Family Area Mechanical Thin and Burn Treatment Design

Prescribed Burning Objectives and Tactics:

Prescribed burns may be used to treat fuels and mitigate fuel hazards where and when feasible by increasing tree canopy base height and reducing litter/duff cover and other surface fuel loading. Prescribed fires are designed to maintain and enhance desired northern goshawk nest habitat forest structure, tree densities, snag densities, and course woody debris levels.

- Course woody debris would be managed for 3-10 tons per acre, and downed logs greater than 12 inch midpoint diameter would be managed for three per acre. Averages are at the landscape-scale;
- 30 acre nesting area around the known nest or roost sites are managed for prescribed fire that produces low to moderate-severity fire effects;
- Outside the 30 acre nesting area within the 420 acre post-fledging family area, treat fuels and mitigate fuel hazards with low intensity fire and moderate- to low-severity to forest canopy;

Other activities tied to prescribe burning include line preparation which includes fuel breaks. Logical fuel breaks include existing roads and minimal line construction would be used depending on road system density.

Mechanical Thinning Objectives and Tactics:

Design tree cutting treatments to meet desired conditions. Retain Gambel oak; all other species may be felled to meet desired conditions;

Silviculture objectives in northern goshawk post-fledging family areas include improve and maintain forest health conditions, maintain and increase tree species diversity, improve understory grass/forb diversity, create and maintain a sustainable uneven aged forest environment and reduce tree densities to facilitate low fire intensities that could occur during severe fire weather conditions. Maintain higher densities within mid aged and old aged trees;

In general, nest stands will receive a treatment as assigned by the decision tree. Use mechanize equipment to reduce and remove hazardous live and dead fuel loading.

Manage for uneven aged structure, stratified by young, mid-aged, and old-aged trees (grouped or random). Retain groups of dominant and codominant trees. Where age or size class diversity is not present, management activities should strive to encourage vertical diversity.

In general, tree group density would be managed at higher group densities within mid-aged and old aged tree groups when group selection treatments are implemented. Young tree groups are managed to maintain tree stocking necessary to provide for desired future mid age and old age group densities.

When group selection treatments are implemented, residual tree groups, on average, would range in size from 0.1 to 1 acre. Group size would vary within this range depending on site quality, existing stand structure, and pre-settlement tree evidence. Abiotic factors such as aspect, drainages and slope are other field determinations made for prescribing tree group sizes.

When group selection treatments are implemented, manage for tree groups with grassy interspaces. Site level determination based on soil types, habitat type and regeneration rates shall confirm the proper determination to create or not create grassy interspaces. Gambel oak, juniper, and pinyon species greater than 5-inch DRC may be considered as residual trees in the target group spacing and stocking. The objective is to manage for a sustainable range of density and structural characteristics.

Silviculture cutting systems include uneven aged thinning treatment with group selection or randomly spaced trees or stand improvement thinning. Soil types, current condition and historical reference conditions guide the type of silviculture cutting system.

In moderate and heavy dwarf mistletoe infection centers prescribe an uneven-aged thinning treatment that retains full stocking densities of trees. Retain the dominant and codominant trees with the least amount of mistletoe. Reduce the amount of mistletoe to the residual stand where mistletoe exist. Deferral may also be an option in severe dwarf mistletoe infections where mechanical thinning would place the stand further from desired conditions.

Mistletoe free trees within the dominant and codominant crown position would have priority for retention. Where age class diversity is not present, 1 to 10 suppressed and intermediate trees per group could be retained for vertical diversity.

Activity and residual slash may be removed, masticated, lopped and scattered or piled to burn in place in coordination with fire/fuels staff.

Where possible, manage for the sustainability of large oaks by removing ladder fuels and overtopping trees.

Snags greater than 18 inches would be managed for two per acre in ponderosa pine. Snag creation is not necessary. Select slow dying top killed trees that are greater than 18 inches d.b.h. for retention to promote snag recruitment. Averages are at the landscape-scale.

Northern Goshawk Post Fledging Family Area Mechanical Thin Silviculture Prescription

Prescriptions are developed based on silviculture systems and management schemes and include Uneven aged (UEA) and Stand Improvement (SI) thinning treatments. These stand level prescriptions would be used to reduce basal area to the desired condition, establish grass forb interspace between tree groups, thin tree groups, and establish regeneration when desired. When appropriate, tree groups and interspaces would occupy the following approximate percent of the area by treatment intensity as described in

Table D-16. Desired conditions for basal area and trees per acre and associated aggregation metrics for uneven-aged thinning and stand improvement treatments in ponderosa pine forest within PFAs

	Central Tendencies +/-		Aggregation Metrics		
Treatment	Basal Area	Idealized Trees per Acre	Tree Groups	Percent of Interspace	Interspace Width (feet)
UEA Thin - High Site (SI > 75)	70-90	54-74	75–90%	10–25%	25'–40'
UEA Thin - Moderate Site (SI 60-75)	55-75	43-61	60–75%	25–40%	40'–55'
UEA Thin - Low Site (SI <60)	40-60	34-49	45–60%	40–55%	55'–70'
Stand Improvement - High Site (SI >75)	60-80	46-65	75–90%	10–25%	25'–40'
Stand Improvement - Moderate Site (SI 60-75)	40-65	34-53	60–75%	25–40%	40'–55'
Stand Improvement - Low Site (SI<60)	30-50	22-41	45–60%	40–55%	55'–70'

Table D-17. Desired Conditions for basal area and trees per acre for uneven-aged thinning and stand improvement treatments in dry mixed conifer forest within PFAs.

	Central Tendencies +/-	
Treatment	Basal Area	Idealized Trees per Acre
UEA Thin - High Site (SI > 75)	80-120	62-98
UEA Thin - Moderate Site (SI 60-75)	65-90	50-74
UEA Thin - Low Site (SI <60)	50-70	38-57
Stand Improvement - High Site (SI >75)	70-100	54-82
Stand Improvement - Moderate Site (SI 60-75)	55-80	42-65
Stand Improvement - Low Site (SI<60)	40-60	34-49

Approximate interspace width between tree groups would average from 25 to 70 feet with a maximum width of 200 feet.

Table D-16 displays average interspace width depending on prescription for ponderosa pine and Table D-17 for dry mixed conifer forests.

When regeneration is deficit and desired to balance size classes, regeneration would occur as ingrowth into groups and interspace.

Desired regeneration needs to be large enough and to be resilient to low-severity fires. In general, ponderosa pines are resilient to low-severity fires after approximately 10 years of age. Where advanced regeneration is not present and desired, retain seed trees arranged in groups in openings greater than an acre in size. Treatments would strive to attain an overall average density of 30 to 90 square feet of BA per acre.

Stand Improvement treatments would be used to establish interspace between tree groups and thin tree groups within PFA even-age sites and/or stand dominated by young aged trees in order to provide desired forest structure over time. When appropriate, tree groups and interspaces would occupy the following approximate percent of the area by treatment intensity as described in Table D-16 and Table D-17.

Interspace width between tree groups would average from 25 to 70 feet with a maximum width of 200 feet. Table D-16 and Table D-17 display average interspace width depending on prescription. In many stands, desired conditions for stand improvement treatments can be achieved through non-commercial thinning and spacing guidelines. The main objective would be to create resiliency to fire while growing the stand to meet desired conditions into the future. Other objectives include reducing individual tree competition and selecting quality formed trees for retention.

Ponderosa Pine Forests

Outside of Mexican Spotted Owl Habitat and outside of Northern Goshawk PFAs

Vegetation Management Direction: Ponderosa pine forest pertaining to this section is stratified outside of Mexican spotted owl habitat and northern goshawk PFAs. Please refer to previous sections for Mexican spotted owl habitat and northern goshawk PFA for direction. Some northern goshawk foraging areas are managed in the general Ponderosa Pine.

Ponderosa Pine forest are managed for uneven-aged forest conditions. Uneven aged forest conditions include young, mid-aged and old aged trees. Use prescribed burning management to meet desired condition and mitigate fuel hazards with prescribed fire that produces low to moderate-severity fire effects. Other treatment to meet stand level objectives and desired conditions include silviculture management systems with the use of mechanize equipment including hand thinning.

Desired Conditions

Landscape-Scale

The ponderosa pine 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 on 10 percent or less of the landscape to provide structural diversity.

The forest arrangement consists of individual trees, small clumps, and groups of trees with variably-sized interspaces of grasses, forbs, and shrubs. Vegetation associations are similar to reference conditions. The size, shape, and number of trees per group and the number of groups per area vary across the landscape. Tree density may be greater in some locations, such as north-facing slopes and canyon bottoms.

The ponderosa pine forest is composed predominantly of vigorous trees, but declining, top-killed, lightning-scarred, and fire-scarred trees provide snags and coarse woody debris. Snags and coarse woody

debris are well distributed throughout the landscape. Ponderosa pine snags are typically 18 inches or greater in diameter and average 1 to 2 per acre.

Coarse woody debris, including logs, ranges from 3 to 10 tons per acre. Logs average 3 per acre within the forested area of the landscape.

Where it naturally occurs, Gambel oak is present with all age classes represented. It is reproducing to maintain or expand its presence on capable sites across the landscape. Large Gambel oak snags are typically 10 inches or larger in diameter and are well distributed.

Grasses, forbs, shrubs, needles, leaves, and small trees support the natural fire regime.

Old growth occurs throughout the landscape, in small, discontinuous areas consisting of clumps of old trees, or occasionally individual old trees. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).

Frequent, low to mixed severity fires, occurring approximately every 2 to 17 years.

Mid-scale

Ponderosa pine forest is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. The more biologically productive sites contain more trees per group and more groups per area, resulting in less space between groups. Interspaces typically range from 10 percent in more biologically productive sites to 70 percent in the less productive sites. Tree density within forested areas ranges from 20 to 80 square feet basal area per acre.

The tree group mosaic composes an uneven-aged forest with all age classes, size classes, and structural stages present. Occasionally, patches of even-aged forest structure are present (less than 50 acres). Disturbances sustain the overall age and structural distribution.

Fires burn primarily on the forest floor and do not spread between tree groups as crown fire.

Forest structure in the wildland-urban interface (WUI) may have smaller, more widely spaced groups of trees than in the non-WUI areas. In these areas, in order to protect values at risk, the flexibility is given for more open treatments that will result in post-treatment stand densities between 30-60 ft^2/acre of basal area.

Fine scale

Trees typically occur in irregularly-shaped groups and are variably spaced with some tight clumps. Tree crowns in the mid- to old-aged groups are interlocking or nearly interlocking.

Interspaces surrounding tree groups are variably shaped and composed of a grass, forb, and shrub mix. Some may contain individual trees or snags.

Trees within groups are of similar or variable ages and may contain species other than ponderosa pine. 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.

Where Gambel oak occurs, the majority are single trunk trees over 8 inches in diameter with full crowns.

Ponderosa Pine Forest Mechanical Thin and Burn Treatment Design

Prescribed Burning Objectives and Tactics:

Prescribed burns may be used to treat fuels and mitigate fuel hazards where and when feasible by increasing tree canopy base height and reducing litter/duff cover and other surface fuel loading. Prescribed fires are designed to maintain and enhance desired forest structure, tree densities, snag densities, and course woody debris levels.

A mix of prescribed fire intensities and severities to forest crowns would be used to meet desired conditions.

Other activities tied to prescribe burning include line preparation which includes fuel breaks. Logical fuel breaks include existing roads and minimal line construction would be used depending on road system density;

Mechanical Thinning Objectives and Tactics:

Design tree cutting treatments to meet desired conditions. Retain Gambel oak; other tree species may be felled to meet desired conditions;

Silviculture objectives include improve and maintain forest health conditions, maintain and increase tree species diversity, improve understory grass/forb diversity, create and maintain a sustainable uneven aged forest environment and reduce tree densities to facilitate lower fire severity. Maintain higher densities within mid aged and old aged tree groups;

Use mechanize equipment to reduce and remove hazardous live and dead fuel loading in coordination with fire/fuels staff to see if the amount and arrangement of fuel loading left behind is appropriate for prescribed burning as well as does not present a safety concern for wildfire;

Manage for uneven-aged structure stratified by young, mid-aged, and old-aged tree (grouped or random tree pattern). Retain groups of dominate and codominant trees. Where age or size class diversity is not present, management activities should strive to encourage vertical diversity;

In general, tree group density would be managed at higher group densities within mid-aged and old aged tree groups when group selection treatments are implemented. Young tree groups are managed to maintain tree stocking necessary to provide for desired future mid age and old age group densities;

When group selection treatments are implemented, residual tree groups, on average, would range in size from 0.1 to 1 acre. Group size would vary within this range depending on site quality, existing stand structure, and pre-settlement tree evidence. Abiotic factors such as aspect, drainages and slope are other field determinations made for prescribing tree group sizes;

When group selection treatments are implemented, manage for tree groups or random spaced trees with some tree groups removed to create grassy interspaces. Site level determination based on soil types, habitat type and regeneration rates shall confirm the proper determination to create or not create grassy interspaces. Gambel oak, juniper, and pinyon species greater than 5-inch DRC may be considered as residual trees in the target group spacing and stocking. The objective is to manage for a sustainable range of density and structural characteristics;

Silviculture cutting systems include group selection with intermediate treatments, intermediate treatments only or individual tree selection. Even aged cutting systems may be used to improve forest

health while meeting desired conditions. Soil types, current condition and historical reference conditions guide the type of silviculture cutting system;

In moderate and heavy dwarf mistletoe infection centers prescribe an uneven-aged thinning treatment that retains full stocking densities of trees. Retain the dominant and codominant trees with the least amount of mistletoe. Reduce the amount of mistletoe to the residual stand where mistletoe exist. Deferral may also be an option in severe dwarf mistletoe infections where mechanical thinning would place the stand further from desired conditions.

Activity and residual slash may be removed, masticated, lopped and scattered or piled to burn in place in coordination with fire/fuels staff;

Where possible, manage for the sustainability of large oaks by removing ladder fuels and overtopping trees;

Snags greater than 18 inches would be managed for two per acre in ponderosa pine. Snag creation is not necessary. Select slow dying top killed trees that are greater than 18 inches d.b.h. for retention to promote snag recruitment. Averages are at the landscape-scale;

Savanna prescriptions are scattered within ponderosa pine forest. These prescriptions would restore pre-settlement tree density and pattern using pre-settlement evidence as guidance. Generally, these areas are open with a reference condition of 10 to 30 percent of tree canopy;

Savanna prescriptions would retain all pre-settlement trees and the largest post-settlement trees that most closely resemble old trees in size and form as replacement trees adjacent to pre-settlement tree evidences at a 1:1 ratio. Some younger trees would also be retained to maintain uneven-aged structure.

Generally, savanna prescriptions manage for a range of 70 to 90 percent of the treatment area as interspace (grass/forb) between tree groups or individuals. Amount of interspace would vary within this range depending on reference conditions. Juniper and pinyon species in the seedling/sapling, young, and mid-aged stages would generally be removed except where needed as replacements for pre-settlement trees.

Ponderosa Pine Forest Mechanical Thin Silviculture Prescription

Prescriptions are developed based on silviculture systems and management schemes and include uneven-aged thinning and stand improvement treatments. These stand level prescriptions would be used to reduce basal area to the desired condition in Table D-18, establish grass forb interspace between tree groups, thin tree groups, and establish regeneration when desired. When appropriate, tree groups and interspaces would occupy the following approximate percent of the area by treatment intensity as described in D-17 for ponderosa pine.

UEA-High site, UEA-moderate site and UEA-low site represent uneven-age silviculture systems (group selection and individual tree selection). Individual trees within ponderosa pine stands may be highly aggregated or more randomly spaced, though high levels of tree aggregation are more commonly found on coarse-textured (basalt and cinder derived) soils and more randomly spaced trees are more common on sedimentary (limestone derived) soils (Rodman et al. 2017, Covington and Moore 1994). Post-treatment natural regeneration may be more prolific on sedimentary soils than on coarse textured soils. This should be considered when assessing desired post-treatment stand density and regeneration needs. These stand-level prescriptions would be used to reduce basal areas to the desired condition, establish grass forb

interspace between tree groups, thin tree groups, and establish regeneration when deficit and desirable. Tree groups and interspaces would occupy the following approximate percent of the area by treatment intensity as described in Table D-18.

Table D-18. Desired Conditions for basal area and trees per acre and associated aggregation metrics for uneven-aged thinning and stand improvement treatments in ponderosa pine forest outside of PFAs

	Central Tendencies +/-		Aggregation Metrics		
Treatment	Basal Area	Idealized Trees per Acre	Tree Groups	Percent of Interspace	Interspace Width (feet)
UEA Thin - High Site (SI > 75)	60-90	49-74	75–90%	10–25%	25'-40'
UEA Thin - Moderate Site (SI 60-75)	45-75	37-61	60–75%	25–40%	40'-60'
UEA Thin - Low Site (SI <60)	30-60	29-49	45–60%	40–55%	60'-100'
Stand Improvement - High Site (SI >75)	50-80	41-65	75–90%	10–25%	25'–40'
Stand Improvement - Moderate Site (SI 60-75)	35-65	29-53	60–75%	25–40%	40'–60'
Stand Improvement - Low Site (SI<60)	20-50	17-41	45–60%	40–55%	60'–80'

Approximate interspace width between tree groups would average from 25 to 100 feet with a maximum width of 200 feet. Table D-17 Displays average interspace width depending on prescription.

When regeneration is deficit and desired to balance size classes, regeneration would occur as ingrowth into groups and interspace.

Desired regeneration needs to be large enough and to be resilient to low-severity fires. In general, ponderosa pines are resilient to low-severity fires after approximately 10 years of age. Where advanced regeneration is not present and desired, retain seed trees arranged in groups in openings greater than an acre in size.

Uneven-aged thinning treatments would strive to attain an overall average density of 30 to 90 square feet of BA per acre.

Stand improvement treatments would be used to establish interspace between tree groups and thin tree groups within even-age sites and/or stand dominated by young aged trees in order to provide desired forest structure over time. Tree groups and interspaces would occupy the following approximate percent of the area by treatment intensity as described in Table D-18.

Interspace width between tree groups would average from 25 to 80 feet with a maximum width of 200 feet. Table D-18 displays average interspace width depending on prescription. In some stands, desired conditions for SI treatments can be achieved through non-commercial thinning and spacing guidelines. The main objective would be to create resiliency to fire while growing the stand to meet desired conditions into the future. Other objectives include reducing individual tree competition and selecting quality formed trees for retention.

Stand improvement treatments would strive to attain an overall average density of 20 to 80 square feet of BA per acre.

Dry Mixed Conifer Forests

Outside of Mexican Spotted Owl Habitat and Landscapes outside of Northern Goshawk PFAs

Vegetation Management Direction: Dry Mixed Conifer forest pertaining to this section is stratified outside of Mexican spotted owl habitat and northern goshawk PFAs. While little to none of this currently occurs on the landscape, direction for dry mixed conifer outside of Mexican spotted owl habitat and northern goshawk may be helpful during implementation. Please refer to previous sections for Mexican spotted owl habitat and northern goshawk PFA for direction. Some northern goshawk foraging areas are managed in the general Dry Mixed Conifer.

Dry Mixed Conifer forest are managed for uneven-aged forest conditions. Uneven aged forest conditions include young, mid-aged and old aged trees. Use prescribed burning management to meet desired condition and mitigate fuel hazards with prescribed fire that produces low to moderate-severity fire effects. Other treatment to meet stand level objectives and desired conditions include silviculture management systems with the use of mechanize equipment including hand thinning.

Desired Conditions

Landscape-Scale

The dry mixed conifer forest is a mosaic of conditions composed of structural states ranging from young to old trees. Forest structure and density are similar to ponderosa pine forest. Forest appearance is variable but uneven-aged and open. Sporadic areas of even-aged structure may be present on 10 percent or less of the landscape to provide structural diversity.

The forest arrangement consists of randomly spaced trees or small clumps and groups of trees with variably-sized interspaces of grass, forb, and shrub vegetation associations similar to reference conditions. Size, shape, number of trees per group, and number of groups per area are variable across the landscape, but generally smaller than in ponderosa pine forest. Where they naturally occur, groups of Gambel oak are healthy and maintained or increased. Tree density may be greater in some locations, such as north-facing slopes and canyon bottoms.

The dry mixed conifer forest is composed predominantly of vigorous trees, but declining, top-killed, lightning-scarred, and fire-scarred trees provide snags and coarse woody debris. Snags and coarse woody debris are well distributed throughout the landscape. Snags are typically 18 inches in diameter or greater and average 3 per acre.

Coarse woody debris, including logs, ranges from 5 to 15 tons per acre. Logs average 3 per acre within the forested area of the landscape. Southwestern white pine is present with the ability to reproduce on capable sites.

Grasses, forbs, shrubs, needles, leaves, and small trees support the natural fire regime. The larger proportion (60 percent or greater) of soil cover is composed of grasses and forbs as opposed to needles and leaves.

Old growth occurs throughout the landscape, in small, discontinuous areas consisting of clumps of old trees, or occasionally individual old trees. Other old growth components are also present including dead trees (snags), downed wood (coarse woody debris), and/or structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).

Frequent, low to mixed severity fires (fire regime I) occurring every 10 to 22 years are characteristic in this PNVT.

Mid-scale

The dry mixed conifer forest is characterized by a variety of size and number of tree groups depending on elevation, soil type, aspect, and site productivity. The more biologically productive sites contain more trees per group and more groups per area, resulting in less space between groups. Interspaces typically range from 10 percent in more biologically productive sites to 50 percent in less productive sites. Tree density within forested areas ranges from 30 to 100 square feet basal area per acre.

The mosaic of tree groups is composed of uneven-aged forest. All age classes and structural stages are present. Occasionally, there are small patches (less than 50 acres) of even-aged forest present. Disturbances sustain the overall age and structural distribution.

Fire burns primarily on the forest floor and does not spread between tree groups as crown fire.

Forest structure in the wildland-urban interface (WUI) may have smaller, more widely spaced groups of trees than in the non-WUI areas. In these areas, in order to protect values at risk, the flexibility is given for more open treatments that will result in post-treatment stand densities between 30-60 ft^2/acre of basal area.

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.

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.

Fine scale

Trees typically occur in irregularly-shaped groups and are variably spaced with some tight clumps. Tree crowns in the mid- to old-aged groups are interlocking or nearly interlocking providing for species such as red squirrel.

Interspaces surrounding tree groups are composed of a grass, forb, and shrub mix. Some may contain individual trees or snags.

Trees within groups are of similar or variable ages and one or more species. Tree group sizes typically are less than 5 acres, but often less than 1 acre, and at the mature and old stages consist of approximately 2 to 50 trees.

Where Gambel oak occurs, the majority are single-stemmed trees over 8 inches in diameter with full crowns.

Dry Mixed Conifer Forest Mechanical Thin and Burn Treatment Design

Prescribed Burning Objectives and Tactics:

Prescribed burns may be used to treat fuels and mitigate fuel hazards where and when feasible by increasing tree canopy base height and reducing litter/duff cover and other surface fuel loading. Prescribed fires are designed to maintain and enhance desired forest structure, tree densities, snag densities, and course woody debris levels.

A mix of prescribed fire intensities and severities to forest crowns would be used to meet desired conditions.

Other activities tied to prescribe burning include line preparation which includes fuel breaks. Logical fuel breaks include existing roads and minimal line construction would be used depending on road system density.

Mechanical Thinning Objectives and Tactics:

Design tree cutting treatments to meet desired conditions. Retain Gambel oak; other tree species may be felled to meet desired conditions;

Silviculture objectives include improve and maintain forest health conditions, maintain and increase tree species diversity, improve understory grass/forb diversity, create and maintain a sustainable uneven aged forest environment and reduce tree densities to facilitate prescribed fire that produces low to moderate-severity fire effects. Maintain higher densities within mid aged and old aged tree groups;

Use mechanize equipment to reduce and remove hazardous live and dead fuel loading in coordination with fire/fuels staff to see if the amount and arrangement of fuel loading left behind is appropriate for prescribed burning as well as does not present a safety concern for wildfire;

Manage for uneven-aged structure stratified by young, mid-aged, and old-aged tree (grouped or random). Retain groups of dominate and codominant trees. Where age or size class diversity is not present, management activities should strive to encourage vertical diversity;

In general, tree group density would be managed at higher group densities within mid-aged and old aged tree groups when group selection treatments are implemented. Young tree groups are managed to maintain tree stocking necessary to provide for desired future mid age and old age group densities;

When group selection treatments are implemented, residual tree groups, on average, would range in size from 0.1 to 1 acre. Group size would vary within this range depending on site quality, existing stand structure, and pre-settlement tree evidence. Abiotic factors such as aspect, drainages and slope are other field determinations made for prescribing tree group sizes;

When group selection treatments are implemented, manage for tree groups with grassy interspaces. Site level determination based on soil types, habitat type and regeneration rates shall confirm the proper determination to create or not create grassy interspaces. Gambel oak, juniper, and pinyon species greater than 5-inch DRC may be considered as residual trees in the target group spacing and stocking. The objective is to manage for a sustainable range of density and structural characteristics;

Silviculture cutting systems include group selection or individual tree selection. Even aged cutting systems may be used to improve forest health while meeting desired conditions. Soil types, current condition and historical reference conditions guide the type of silviculture cutting system;

In moderate and heavy dwarf mistletoe infection centers where regeneration would not meet the desired conditions, retain the dominant and codominant trees with the least amount of mistletoe. Mistletoe free trees within the dominant and codominant crown position would have priority for retention. Where age class diversity is not present, 1 to 10 suppressed and intermediate trees per group would be retained for vertical diversity.

Activity and residual slash may be removed, masticated, lopped and scattered or piled to burn in place in coordination with fire/fuels staff;

Where possible, manage for the sustainability of large oaks by removing ladder fuels and overtopping trees;

Snags greater than 18 inches would be managed for three per acre in dry mixed conifer. Snag creation is not necessary. Select slow dying top killed trees that are greater than 18 inches d.b.h. for retention to promote snag recruitment. Averages are at the landscape-scale;

Savanna prescriptions are scattered within ponderosa pine forest. These prescriptions would restore pre-settlement tree density and pattern using pre-settlement evidence as guidance. Generally, these areas are open with a reference condition of 10 to 30 percent of tree canopy;

Savanna prescriptions would retain all pre-settlement trees and the largest post-settlement trees that most closely resemble old trees in size and form as replacement trees adjacent to pre-settlement tree evidences at a 1:1 ratio. Some younger trees would also be retained to maintain uneven-aged structure;

Generally, savanna prescriptions manage for a range of 70 to 90 percent of the treatment area as interspace (grass/forb) between tree groups or individuals. Amount of interspace would vary within this range depending on reference conditions. Juniper and pinyon species in the seedling/sapling, young, and mid-aged stages would generally be removed except where needed as replacements for pre-settlement trees.

Dry Mixed Conifer Forest Mechanical Thin Silviculture Prescription

Prescriptions are developed based on silviculture systems and management schemes and include uneven-aged thinning and stand improvement treatments. These stand level prescriptions would be used to reduce basal area to the desired condition in Table D-18, establish grass forb interspace between tree groups, thin tree groups, and establish regeneration when desired. Random tree spacing using individual tree selection may be more common in the dry mixed conifer type than in ponderosa pine.

UEA-high site, UEA-moderate site and UEA-low site represent uneven-age silviculture systems (group selection and individual tree selection). These stand-level prescriptions would be used to reduce basal areas to the desired condition, establish grass forb interspace between tree groups, thin tree groups, and establish regeneration when deficit and desirable. Tree groups and interspaces would occupy the following approximate percent of the area by treatment intensity as described in Table D-19.

Table D-19. Desired Conditions for basal area and trees per acre for uneven-aged thinning and stand improvement treatments in dry mixed conifer forest outside of PFAs

	Central Tendencies +/-	
Treatment	Basal Area	Idealized Trees per Acre
UEA Thin - High Site (SI > 75)	70-120	57-98
UEA Thin - Moderate Site (SI 60-75)	55-90	45-74
UEA Thin - Low Site (SI <60)	40-70	33-57
Stand Improvement - High Site (SI >75)	60-100	49-82
Stand Improvement - Moderate Site (SI 60-75)	45-80	37-65
Stand Improvement - Low Site (SI<60)	30-60	29-49

Though the desired condition for dry mixed conifer is expressed in terms of basal area, some level of tree aggregation may be desired. When appropriate, interspace width between tree groups would be less than that for ponderosa pine forests, and average from 25 to 80 feet with a maximum width of 120 feet.

When regeneration is deficit and desired to balance size classes, regeneration would occur as ingrowth into groups and interspace.

Desired regeneration needs to be large enough and to be resilient to low-severity fires. In general, ponderosa pines are resilient to low-severity fires after approximately 10 years of age. Where advanced regeneration is not present and desired, retain seed trees arranged in groups in openings greater than an acre in size.

Treatments would strive to attain an overall average density of 30 to 120 square feet of BA per acre in the dry mixed conifer forest type.

Stand improvement- low site, stand improvement-moderate site and stand improvement-high site represent treatments used to establish interspace between tree groups and thin tree groups within even-age sites and/or stand dominated by young aged trees. Random tree spacing using individual tree selection may be more common in the dry mixed conifer type.

When desired to improve forest structure, interspace width between tree groups would average from 25 to 80 feet with a maximum width of 120 feet. Table D-18 displays desired condition for basal area for the stand improvement treatment, depending on prescription. Some stands, desired conditions for stand improvement treatments can be achieved through non-commercial thinning and spacing guidelines. The main objective would be to create resiliency to fire while growing the stand to meet desired conditions into the future. Other objectives include reducing individual tree competition and selecting quality formed trees for retention.

Aspen Stands or Inclusions in Mixed Conifer Forests

Vegetation Management Direction: Management activities that kill or stress overstory trees may be used because they mimic natural disturbances and enhance aspen regeneration. Aspen restoration efforts may include removing conifer competition and fencing to exclude ungulates.

Desired Conditions: Aspen is successfully regenerating and recruiting into older and larger size classes. Size classes have a natural distribution, with the greatest number of stems in the smallest classes. Coniferous species comprise less than 10 percent of the overstory.

Landscape-Scale

Areas of aspen occur and shift across the forested landscape. They are successfully regenerating and being recruited into older and larger size classes. Size classes have a natural distribution, with the greatest number of stems in the smaller size classes.

Mid-scale

Aspen may compose 10 to 100 percent of the area depending on disturbance (for example, fire, insects, silvicultural treatments) in multistoried patches.

As an early seral species, aspen reproduction and recruitment benefit from low-severity surface fires.

Aspen Mechanical Thin and Burn Treatment Design

Inclusions of aspen remnants within portions of other forested areas would be regenerated by removing all post-settlement conifers from within 100 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.

Treatments for aspen clones would meet desired conditions. Silvicultural cutting treatments include weeding other coniferous trees to reduce competition and protection of regeneration through jackstraw, fencing, and coppice cutting and planting.

Each clone would be evaluated as to need for fencing or creation of other barriers to reduce ungulate browsing of regenerating aspen.

Prescribed burns may be used where and when feasible to treat fuels, mitigate fuel hazards, and to produce effects that stimulate aspen suckering and regeneration, and growth of native herbaceous vegetation. Inclusions of aspen remnants within portions of ponderosa pine stands could be regenerated by prescribed burning to stimulate suckering.

Prescribed burns are designed to reduce post-settlement conifer stocking within 100 feet of the aspen clone and disturb the site with sufficient intensity to encourage aspen regeneration.

Piñon-juniper Woodlands

Vegetation Management Direction: Manage for uneven-age conditions to sustain a mosaic of vegetation densities (overstory and understory), age classes, and species composition well distributed across the landscape. Provide for reserve trees, snags, and down woody debris.

Desired Conditions: Mosaic of young and mature, species diverse patches of trees interspersed with interspace across the landscape to promote the growth grasses and herbaceous understory species. Mature patches would be structurally diverse, containing large live and dead standing trees as well as trees with dead or broken tops, gnarls, and burls. The structure and composition reflects the natural range of variation.

Landscape-Scale

A mix of desired species, ages, heights, and groupings of trees create a mosaic across the landscape.

In persistent PJ woodlands, tree canopy cover is closed (greater than 30 percent), shrubs are sparse to moderate, and herbaceous cover is patchy.

PJ savanna is open in appearance with trees occurring as individuals or in small groups and ranging from young to old. Overall, tree canopy cover is 10 to 15 percent, but may range up to 30 percent.

Snags, averaging one to two per acre, and older trees with dead limbs and tops are scattered across the landscape. Coarse woody debris averages 2 to 5 tons per acre.

Old growth includes old trees, dead trees (snags), downed wood (coarse woody debris), and/or structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).

Fire is less frequent and more variable than in the savanna due to patchiness of ground cover. The fires that do occur are mixed to high severity.

Mid-scale

Grass and forb cover is maximized, based on site capability, to protect and enrich soils.

Piñon-juniper Woodland Mechanical Thin and Burn Treatment Design

Prescribed Burning Objectives and Tactics:

Prescribed burns may be used to treat fuels and mitigate fuel hazards where and when feasible by increasing tree canopy base height and reducing litter/duff cover and other surface fuel loading. Prescribed fires are designed to maintain and enhance desired forest structure, tree densities, snag densities, and course woody debris levels.

Prescribed fire intensity and severity to forest crowns would be used to meet desired conditions.

Other activities tied to prescribed burning include line preparation which includes fuel breaks. Logical fuel breaks include existing roads and minimal line construction would be used depending on road system density.

Mechanical Thinning Objectives and Tactics:

Design tree thinning treatments to meet desired conditions. All tree species may be felled to meet desired conditions;

Silviculture objectives include creating woodland conditions to facilitate future prescribed fire desired conditions. Other objectives would improve and maintain forest health conditions, maintain and increase tree species diversity, improve vigor in pinyon pine species and improve understory grass/forb diversity;

Use mechanize equipment and fuelwood activities to reduce and remove hazardous live and dead fuel loading;

In general, manage for tree groups with grassy interspaces to meet desired conditions;

Silviculture cutting systems may include group selection with intermediate treatments, intermediate treatments only or individual tree selection. Even aged cutting systems may be used to improve forest health while meeting desired conditions. Soil types, current condition and historical reference conditions guide the type of silviculture cutting system;

Activity and residual slash may be removed, masticated, lopped and scattered or piled to burn in place in coordination with fire/fuels staff;

Savanna prescriptions within woodland the landscape would restore pre-settlement tree density and pattern using pre-settlement evidence as guidance. Generally, these areas are open with a reference condition of 10 to 30 percent of tree canopy;

Savanna prescriptions would retain all pre-settlement trees and the largest post-settlement trees that most closely resemble old trees in size and form as replacement trees adjacent to pre-settlement tree evidences at a 1:1 ratio. Some younger trees would also be retained to maintain uneven-aged structure.

Generally, savanna prescriptions manage for a range of 70 to 90 percent of the treatment area as interspace (grass/forb) between tree groups or individuals. Amount of interspace would vary within this range depending on reference conditions. Juniper and pinyon species in the seedling/sapling,

young, and mid-aged stages would generally be removed except where needed as replacements for pre-settlement trees.

Grasslands

Vegetation Management Direction: Reduce conifer encroachment within grasslands as identified by mollisol soils.

Desired Conditions: Restore historic grassland/forest edge as indicated by existing pre- settlement conifers and evidence of pre-settlement conifers.

Landscape

Perennial herbaceous species dominate and include native grasses, grass-like plants (sedges and rushes), and forbs, and in some locations, a diversity of shrubs.

Herbaceous vegetation and litter provide for and maintain the natural fire regime.

In montane/subalpine grasslands fire return interval ranges from approximately 2 to 400 years, depending on the adjacent forested Forest type.

Landscapes associated with montane/subalpine grasslands vary from natural appearing where human activities do not stand out (high scenic integrity) to unaltered where only natural ecological changes occur (very high scenic integrity).

Mid-scale

Woody (tree and shrub) canopy cover is less than 10 percent.

Prescribed Burning Objectives and Tactics:

Prescribed burns may be used to treat fuels and mitigate fuel hazards where and when feasible by increasing reducing tree densities to desired conditions. Prescribed fires are designed to maintain and enhance grassland conditions.

Prescribed fire intensity and severity to tree crowns would be used to meet desired conditions.

Other activities tied to prescribed burning include line preparation which includes fuel breaks. Logical fuel breaks include existing roads and minimal line construction would be used depending on road system density;

Mechanical Thinning Objectives and Tactics:

Design tree thinning treatments to meet desired conditions. All tree species may be felled to meet desired conditions;

Silviculture objectives include creating woodland conditions to facilitate future prescribed fire desired conditions. Other objectives would improve and maintain forest health conditions, maintain and increase tree species diversity, improve vigor in pinyon pine species and improve understory grass/forb diversity;

Use mechanized equipment and fuelwood activities to reduce and remove hazardous live and dead fuel loading;

In general, manage for tree groups with grassy interspaces to meet desired conditions.

Silviculture cutting systems may include group selection with intermediate treatments, intermediate treatments only or individual tree selection. Even aged cutting systems may be used to improve forest health while meeting desired conditions. Soil types, current condition and historical reference conditions guide the type of silviculture cutting system;

Activity and residual slash may be removed, masticated, lopped and scattered or piled to burn in place in coordination with fire/fuels staff.

Treatments are designed to promote and reestablish the historic meadow edge as defined by pre-settlement trees and evidences and the current forest structure of young trees encroaching on the edge of the grassland.

Tree group arrangement, size, and density are a function of existing pre-settlement trees and evidence. Retain all pre-settlement trees and the largest post-settlement trees that most closely resemble old trees in size and form as replacement trees adjacent to pre-settlement tree evidences at a 1:1 ratio.

Section F – Density Management and the Relationship between Treatment Intensity, Tree Group Density, and Overall Average Density

Table D-20. Group basal area to achieve desired stand level basal area across a range of post treatment basal area value

		Average Group BA to Achieve Overall BA of:					
% Area in Interspace	Total % Treed Area	40 ft^2/ac	50 ft^2/ac	60 ft^2/ac	70 ft^2/ac	80 ft^2/ac	90 ft^2/ac
10	90	44	56	67	78	89	100
15	85	47	59	71	82	94	106
20	80	50	63	75	88	100	113
25	75	53	67	80	93	107	120
30	70	57	71	86	100	114	129
35	65	62	77	92	108	123	138
40	60	67	83	100	117	133	150
45	55	73	91	109	127	145	164
50	50	80	100	120	140	160	180
55	45	89	111	133	156	178	200
60	40	100	125	150	175	200	225
65	35	114	143	171	200	229	257

Table D-21. Trees per acre targets across a range of group basal area and group quadratic mean diameter values

Group	Group Basal Area																													
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	204	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	236	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

Coding Key:
Gray 1 (with stippling) = SDI zones 1 and 2 (15 to 35% of maximum SDI) This is considered the lower range of stocking.
White (no stippling) = SDI zone 3 (36 to 45% of maximum SDI) This is considered the middle range of stocking.
Gray (no stippling) = SDI zone 4 (46 to 55% of maximum SDI) This is considered the upper range of stocking.
White (with stippling) = SDI zone 5 (>56% of maximum SDI) Tree groups should not be managed within this zone.
Note: SDI "zones" are explained in the Silviculture Specialist Report

Section G. Arizona Game and Fish Department Aquatic Restoration Priority Treatment Table

Table D-22. AGFD Aquatic Restoration Priority Treatment Table for the Rim Country DEIS

Location Name	Treatment Recommendation	Main Species Targeted & Other Species Benefitted	Comments
Campbell Spring	Headwater Meadow/Spring Restoration	Northern Leopard Frog & Other Spring associated wildlife (canyon treefrogs, etc.)	Road is impacting Campbell Spring habitat; if roads are already closed through TMR, improve closure signage on the ground; rehab to return to vegetated state
Jones Spring	Headwater Meadow/Spring Restoration	Northern Leopard Frog & Other spring associated wildlife	Jones Springs and perennial stream stretch below springs should be restored, livestock should be excluded; if roads are already closed through TMR, improve closure signage on the ground; rehab to return to vegetated state
Chevelon Canyon Creek	Headwater Meadow/Spring Restoration	Little Colorado Spinedace	Forest thinning and burning activities should minimize sediment and ash inputs to stream channels in this watershed
Foster Spring	Headwater Meadow/Spring Restoration	Northern Leopard Frog & Other spring associated wildlife	Foster Spring restoration and protection (a livestock fence is needed to protect sensitive riparian habitat and species, provide water to livestock outside sensitive riparian habitat)
Potato Lake	Headwater Meadow/Spring Restoration	-	-
Dines Tank	Headwater Meadow/Spring Restoration	-	-
Dane Spring	Headwater Meadow/Spring Restoration	Restore wet meadow and spring habitat for native species including frogs and fish & Spinedace downstream	Restore wet meadow and spring habitat for native species including frogs and fish
General Springs	Headwater Meadow/Spring Restoration	Restore wet meadow and spring habitat for native species including frogs and fish	Restore wet meadow and spring habitat for native species including frogs and fish
Immigrant Spring	Headwater Meadow/Spring Restoration	Restore wet meadow and spring habitat for native species including frogs and fish	Restore wet meadow and spring habitat for native species including frogs and fish
Kehl Spring	Headwater Meadow/Spring Restoration	Restore wet meadow and spring habitat for native species including frogs and fish	Restore wet meadow and spring habitat for native species including frogs and fish
Pivot Rock Spring	Headwater Meadow/Spring Restoration	Restore wet meadow and spring habitat for native species including frogs and fish	Restore wet meadow and spring habitat for native species including frogs and fish
Whistling Spring	Headwater Meadow/Spring Restoration	Restore wet meadow and spring habitat for native species including frogs and fish	Restore wet meadow and spring habitat for native species including frogs and fish
Willow Spring	Headwater Meadow/Spring Restoration	Restore wet meadow and spring habitat for native species including frogs and fish	Restore wet meadow and spring habitat for native species including frogs and fish

Location Name	Treatment Recommendation	Main Species Targeted & Other Species Benefitted	Comments
Upper Buck Spring	Headwater Meadow/Spring Restoration	Restore wet meadow and spring habitat for native species including frogs and fish	Restore wet meadow and spring habitat for native species including frogs and fish
Lower Buck Spring	Headwater Meadow/Spring Restoration	Restore wet meadow and spring habitat for native species including frogs and fish	Restore wet meadow and spring habitat for native species including frogs and fish
Pieper Hatchery Spring	Headwater Meadow/Spring Restoration	Chiricauhua leopard frog & Other native aquatic species	Restore spring habitat for frogs and other native species
Bear Springs	Headwater Meadow/Spring Restoration	Chiricauhua leopard frog & Other native aquatic species	Restore spring habitat for frogs and other native species
Poison Spring	Headwater Meadow/Spring Restoration	Chiricauhua leopard frog & Other native aquatic species	Restore spring habitat for frogs and other native species
Pine Spring	Headwater Meadow/Spring Restoration	Chiricauhua leopard frog & Other native aquatic species	Restore spring habitat for frogs and other native species
Schneider Spring	Headwater Meadow/Spring Restoration	Restore wet meadow and spring habitat for native species including frogs and fish	Restore wet meadow and spring habitat for native species including frogs and fish
Barbershop Canyon Creek	Headwater Meadow/Spring Restoration	-	Upper Barbershop
East Fork Woods Canyon	Headwater Meadow/Spring Restoration	-	Upper East Fork Woods Canyon
Poverty Draw/Poverty Spring	Headwater Meadow/Spring Restoration	-	-
Willow Creek	Headwater Meadow/Spring Restoration	-	-
Woods Canyon Creek	Headwater Meadow/Spring Restoration	-	-
East Clear Creek	Headwater Meadow/Spring Restoration	-	See East Clear Creek Strategy (1999); Region 2 centric
Black Canyon Creek	Headwater Meadow/Spring Restoration	-	-
Thompson Creek	Headwater Meadow/Spring Restoration	-	-
Hart Canyon	Headwater Meadow/Spring Restoration	-	-
Fairchild Draw	Headwater Meadow/Spring Restoration	-	R1
Beaver Creek, including Beaver Park	Headwater Meadow/Spring Restoration	-	-
Cienega Draw	Headwater Meadow/Spring Restoration	-	-

Location Name	Treatment Recommendation	Main Species Targeted & Other Species Benefitted	Comments
Alder Creek	Headwater Meadow/Spring Restoration	-	-
Beaver Creek (Turkey Creek tributary)	Headwater Meadow/Spring Restoration	-	-
Gentry Creek	Headwater Meadow/Spring Restoration	-	-
Houston Draw	Headwater Meadow/Spring Restoration	-	-
Pius Farm Draw	Headwater Meadow/Spring Restoration	-	-
Quaking Aspen Canyon	Headwater Meadow/Spring Restoration	-	-
Turkey Creek	Headwater Meadow/Spring Restoration	-	-
Brown Creek	Headwater Meadow/Spring Restoration		-
Double Canyon	Headwater Meadow/Spring Restoration	-	-
Long Tom Cabin	Headwater Meadow/Spring Restoration	-	-
Coldwater Spring	Headwater Meadow/Spring Restoration	Native aquatic species	-
Jones Crossing	Headwater Meadow/Spring Restoration	Native aquatic species	-
Wiggins Crossing	Headwater Meadow/Spring Restoration	Native aquatic species	-
East Clear Creek/Miller Creek Confluence	Headwater Meadow/Spring Restoration	Native aquatic species	-
Potato Lake Draw	Headwater Meadow/Spring Restoration	Native aquatic species	-
Merritt Draw	Headwater Meadow/Spring Restoration	Native aquatic species	-
Bill McClintock Draw	Headwater Meadow/Spring Restoration	Native aquatic species	-
Miller Canyon	Headwater Meadow/Spring Restoration	Native aquatic species	-
East Miller Canyon	Headwater Meadow/Spring Restoration	Native aquatic species	-

Location Name	Treatment Recommendation	Main Species Targeted & Other Species Benefitted	Comments
Crackerbox Canyon Upper E, W	Headwater Meadow/Spring Restoration	Native aquatic species	-
Leonard Canyon Creek	Headwater Meadow/Spring Restoration	Native aquatic species	-
West Fork Leonard Canyon Creek	Headwater Meadow/Spring Restoration	Native aquatic species	Upper West Leonard
West Bear Canyon	Headwater Meadow/Spring Restoration	Native aquatic species	Upper West Bear
Candy Spring	Headwater Meadow/Spring Restoration	-	Candy Spring is a potential RACH stocking location; spring dredging and spring box restoration are needed prior to the release of RACH
Little Green Valley	Headwater Meadow/Spring Restoration	-	Little Green Valley meadow
Foster Spring	Headwater Meadow/Spring Restoration	-	Frogs and other spring associated wildlife use for hibernation& dispersal in summer; this spring should be restored and livestock should be kept outside of sensitive riparian habitat
	Other	Bebb's Willow	Re-build elk exclosure fence
East Bear Canyon	Stream restoration	Little Colorado Spinedace	Protect stream from siltation from Forest treatments
Houston Draw	Other	LC Spinedace or Apache trout	Restore flow by increasing exclosure, erosion control, streambed restoration
Miller Canyon	Headwater Meadow/Spring Restoration	LC Spinedace	Protect water flow/ and protect from siltation from forest treatments
Miller Canyon	Headwater Meadow/Spring Restoration	LC Spinedace	Protect/increase flow, protect stream from siltation from forest treatments
Webber Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
Bray Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
Sycamore Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
Chase Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
Dude Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
Bonita Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
Ellison Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
Horton Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species

Location Name	Treatment Recommendation	Main Species Targeted & Other Species Benefitted	Comments
Dick Williams Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
Christopher Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
Gordon Canyon Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
Haigler Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
Unnamed tributary of Chase Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
East Verde River	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
Mail Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
Willow Springs Canyon	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
Show Low Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
General Springs Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
East Fork Leonard Canyon Creek	Stream restoration	-	-
Pine Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
East Verde River	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
East Verde River	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
Canyon Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species
Tonto Creek	Stream restoration	Aquatic species	Perennial water. Protect for aquatic species