Chapter 1. Purpose of and Need for Action

Document Structure

The Forest Service has prepared this final environmental impact statement (FEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This FEIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. This document is organized into two volumes.

Volume 1

Chapter 1. Purpose and Need for Action: The chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.

Chapter 2. Alternatives, including the Proposed Action: This chapter provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on issues raised by the public and other agencies. This discussion also includes mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.

Chapter 3. Affected Environment and Environmental Consequences: This chapter describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area.

Chapter 4. Consultation and Coordination: This chapter provides a list of preparers and agencies consulted during the development of the environmental impact statement.

References: This section provides a list of scientific literature used to inform the analysis.

Index: The index provides page numbers by document topic.

Volume 2

Appendices A through I: The appendices provide detailed information to support the analysis. Appendices include: a placeholder for a map packet (appendix A); proposed forest plan amendments (appendix B); project design features, best management practices (BMPs), and mitigation (appendix C); the implementation plan (appendix D); the adaptive management, biophysical and socioeconomic monitoring plan (appendix E); cumulative effects (appendix F); wildlife bridge habitat analysis (appendix G); glossary of terms (appendix H); and response to comments on the DEIS (appendix I).

Additional documentation, including the complete analysis for each resource, may be found in the project record located at the Coconino National Forest Supervisor's Office, 1824 South Thompson Street, Flagstaff, Arizona. All specialist reports are also posted on the 4FRI website at: http://www.fs.usda.gov/main/4fri.

Project Overview and Background

The Four-Forest Restoration Initiative (4FRI) is a planning effort designed to restore ponderosa pine forest resiliency and function across four national forests in Arizona including the Coconino, Kaibab, Apache-Sitgreaves, and Tonto (figure 2).

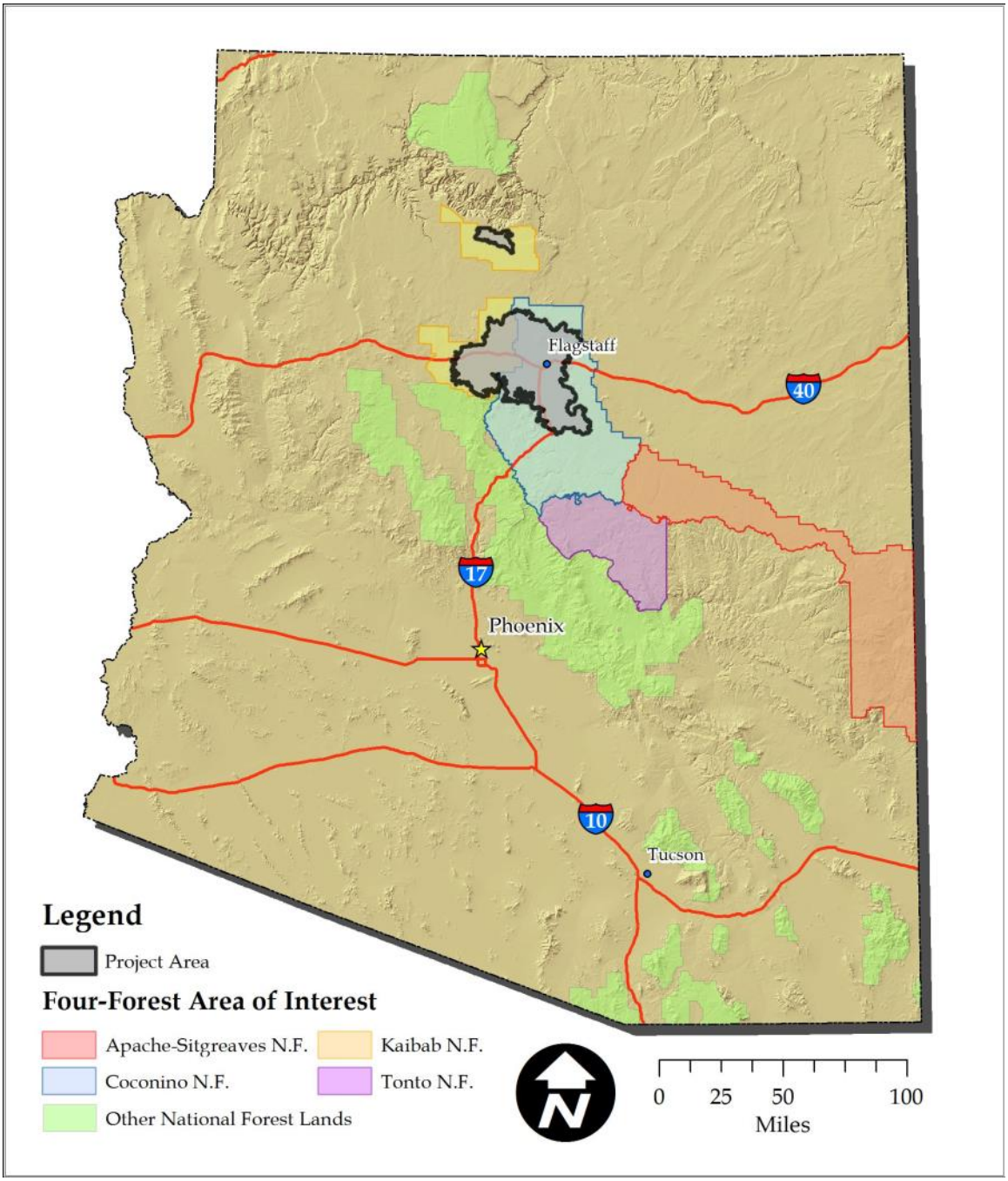

Figure 2. Four-Forest Restoration Initiative (4FRI) vicinity map

The EIS project area is approximately 988,764 acres and includes the Coconino National Forest (hereafter referred to as Coconino NF) and Kaibab National Forest (hereafter referred to as Kaibab NF) (figure 3). This analysis is independent of any preceding or subsequent environmental analysis that may occur across northern Arizona.

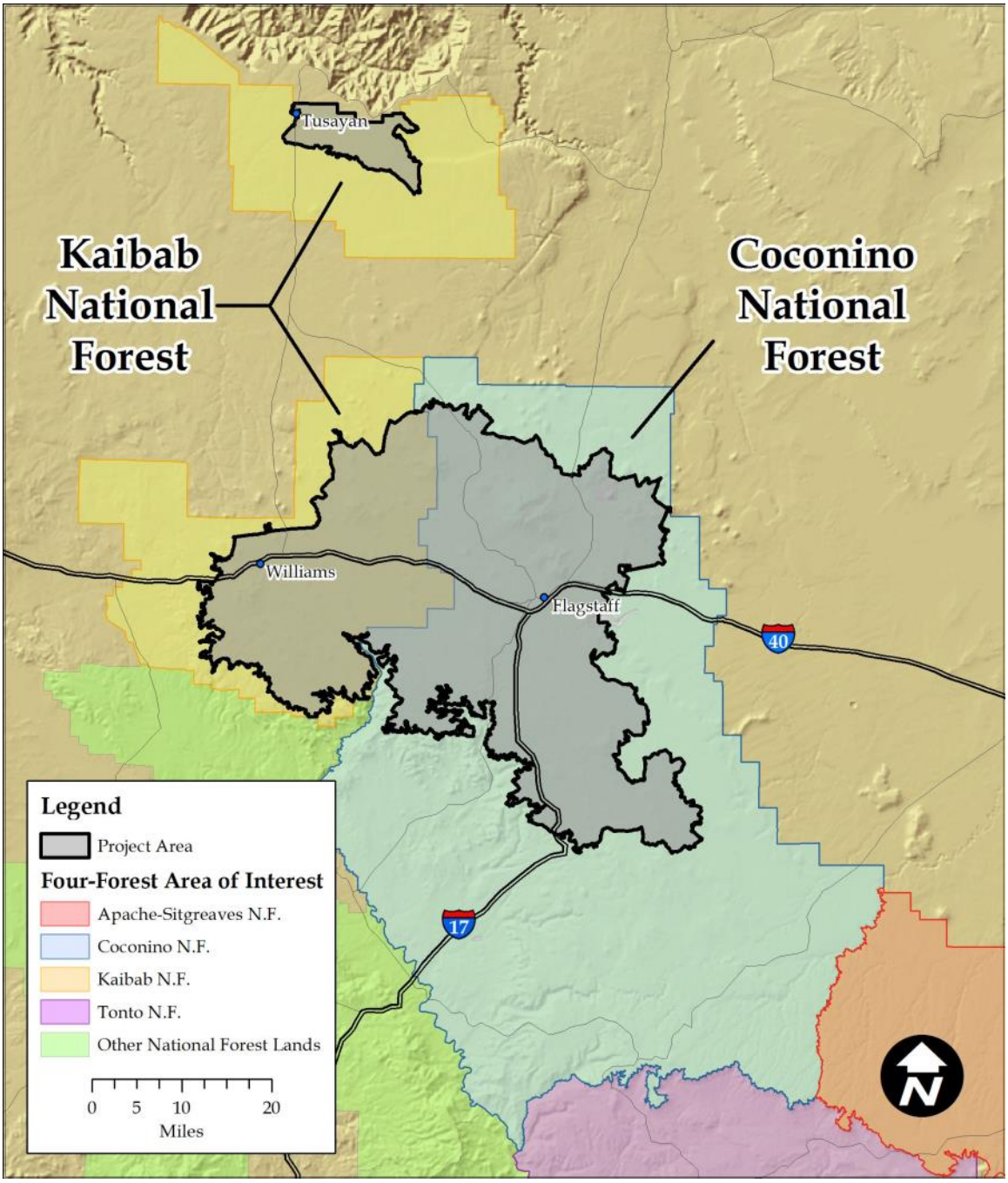

Figure 3. EIS project boundary on the Coconino and Kaibab National Forests

The Forest Service is proposing to conduct restoration activities on approximately 586,110 acres of the Coconino and Kaibab NFs. Of this total, approximately 355,707 acres would be treated on the Coconino NF and 230,402 acres would be treated on the Kaibab NF (alternative C, preferred alternative). Restoration actions would focus on the Flagstaff Ranger District with fewer acres included on the Mogollon Rim and Red Rock Ranger Districts of the Coconino NF. On the Kaibab NF, activities would occur on the Williams and Tusayan Ranger Districts (figure 4).

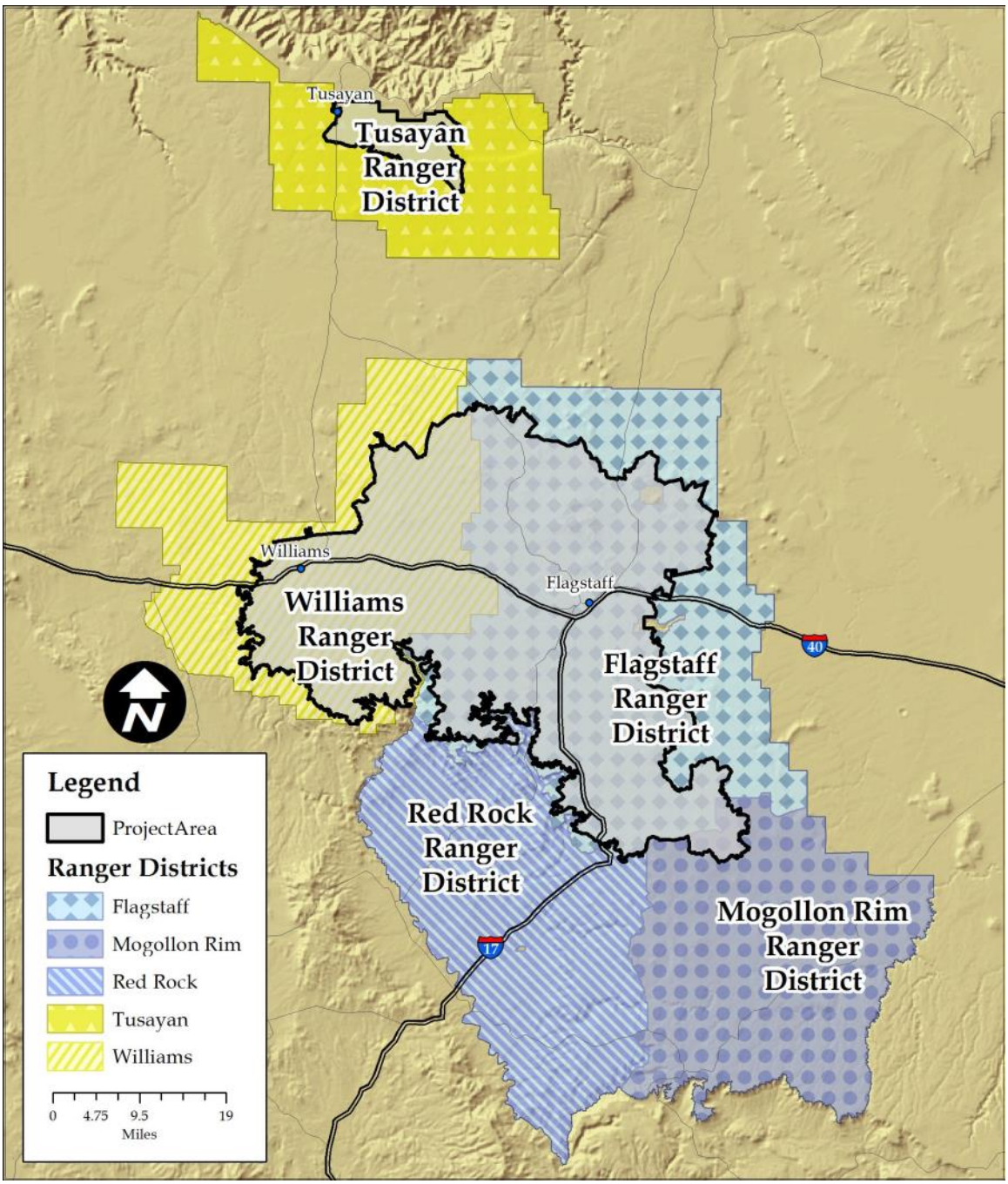

Figure 4. Restoration units (RUs) within the project area

Project Location

Within the 988,764-acre project area, approximately 390,000 acres were excluded from this proposal. Excluded areas include about 213,090 acres that are being analyzed in separate environmental analyses; approximately 30,000 acres that are located in special areas that include designated wilderness, inventoried roadless areas, wild and scenic rivers, and wilderness study areas; and over 145,000 acres that are non–Forest Service administered lands. The project area is entirely located within Coconino County.

Due to the size of the project, the Forest Service used a strategy developed by the 4FRI stakeholders and stratified the landscape into six restoration units (figure 5). A restoration unit (RU) is a contiguous geographic area that ranges from about 46,000 acres to 333,000 acres.

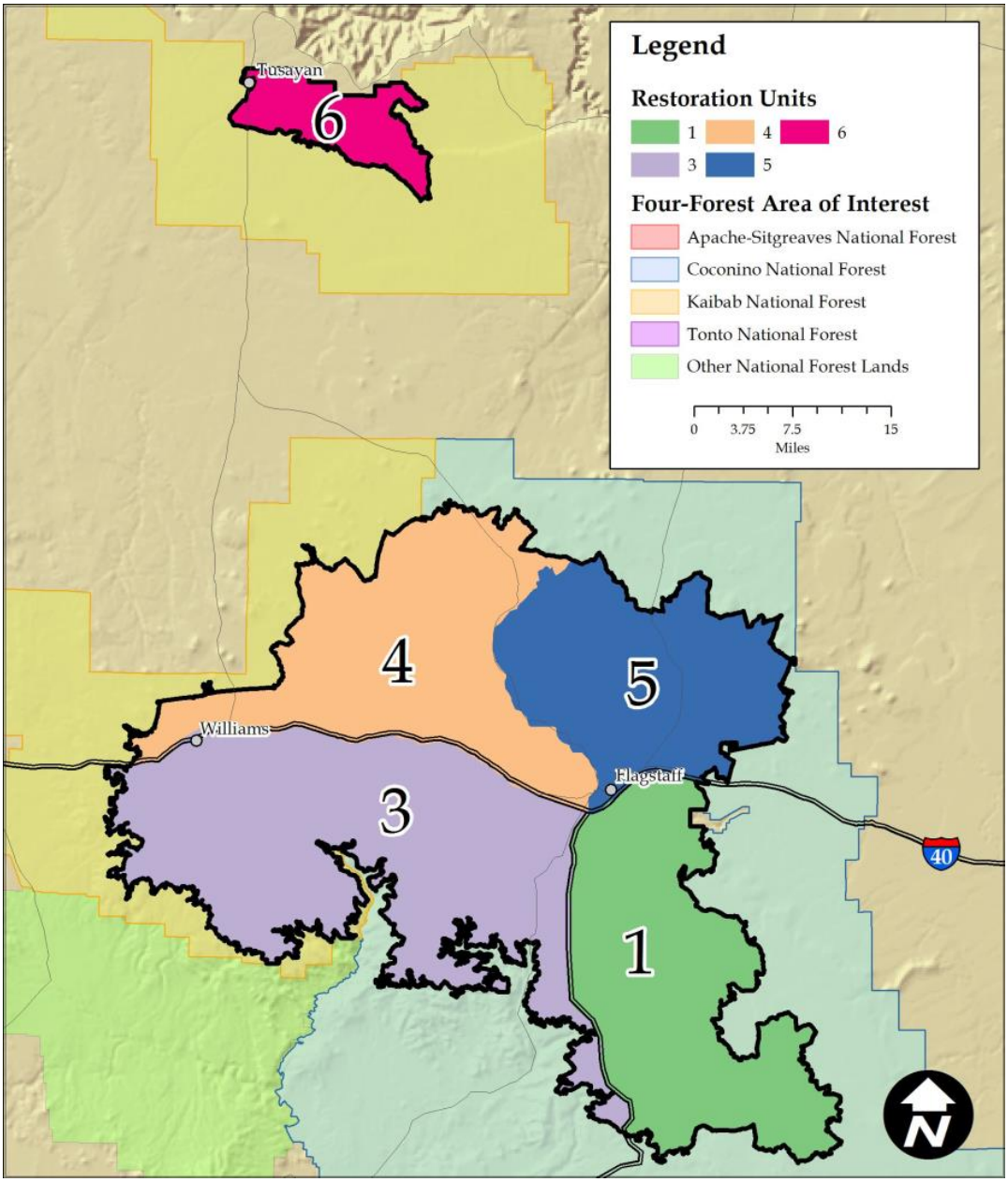

Figure 5. Restoration units within the project area

RU 1 includes portions of the Flagstaff, Mogollon, and Red Rock Ranger Districts (Coconino NF). RU 1 is generally located south of I-40 and east of I-17. RU 3 includes portions of the Williams Ranger District (Kaibab NF), Flagstaff, and Red Rock Ranger Districts (Coconino NF) and is generally located south of I-40 and west of I-17. RU 4 includes portions of the Flagstaff Ranger District and the Williams Ranger District. It is generally located north of I-40 and west of Highway 180.

Communities in the vicinity of the proposed treatments include Flagstaff, Munds Park, Mormon Lake, Tusayan, and Williams, Arizona. RU 5 is located north of the I-40 and east of Highway 180 and includes landmarks such as Mount Elden. RU 6 lies immediately south of and next to Grand Canyon National Park. RU 6 entirely encompasses the Tusayan Ranger District on the Kaibab NF. RU 2 is located west of I-17 and south of the Mogollon Rim (figure 5). RU 2 was removed from this analysis (and subsequent maps) because the vegetation is not contiguous pine.

The project area was further stratified into several subunits that range in size from 4,000 to 109,000 acres (figure 6, page 7). Both units (RU and subunits) are based on 6th-code watershed boundaries, State and national forest transportation systems, and national forest administrative boundaries. Each resource specialist determined how best to use the restoration units and subunits in their analysis. Some analysis scales were selected to meet forest plan requirements (see individual resource sections in chapter 3).

4FRI Background

The 4FRI proposal is a result of several years of planning and collaboration among interested parties, groups and organizations, and Federal, State, and local government agencies. The focus has been to restore forest landscapes and reduce the potential for severe fire effects in a manner that benefits the local economy. In 2007, the Arizona Forest Health Council completed the Statewide Strategy to Restore Arizona's Forests. The strategy's vision integrates knowledge and experience from science, community collaboration, and economics to identify the necessary steps to increase the rate and effectiveness of forest restoration across Arizona.

The communities that surround the four national forests engaged in the 4FRI project are economically and social diverse. Apache, Coconino, Gila, Graham, Navajo, and Yavapai counties have economic bases in consumptive industries, agriculture, tourism and services to retirees. With this diversity has come an increasingly divergent vision of how to manage public lands and how to respond to the threat of uncharacteristic wildland fires. While the stakeholders may not always agree, there is strength in having stakeholders who can provide a wide range of potential solutions when working with the Forest Service.

In February 2008, based on recommendations within the statewide strategy, the "Analysis of Small Diameter Wood Supply in Northern Arizona" report (Hampton et al. 2008) was completed. This process demonstrated a level of "social agreement" on how much, where, and under what basic parameters mechanical treatment, as one restoration tool, could be used to accelerate restoration of the 2.4 million-acre ecosystem. In 2008, the Kaibab NF launched the Kaibab Forest Health Focus, a science-based, collaborative effort to guide future landscape-level forest restoration efforts.

To further advance collaborative efforts and secure the necessary assistance, the Forest Service created a task force to work with the Forest Health Council. The purpose of the task force was to identify alternative approaches to accelerating forest restoration in northern Arizona. To move

into on-the-ground implementation as quickly as possible, stakeholders representing individuals, State and Federal agencies, local governments, the four national forests in northern Arizona, and the Forest Service's Southwestern Regional Office moved forward with the four-forest initiative.

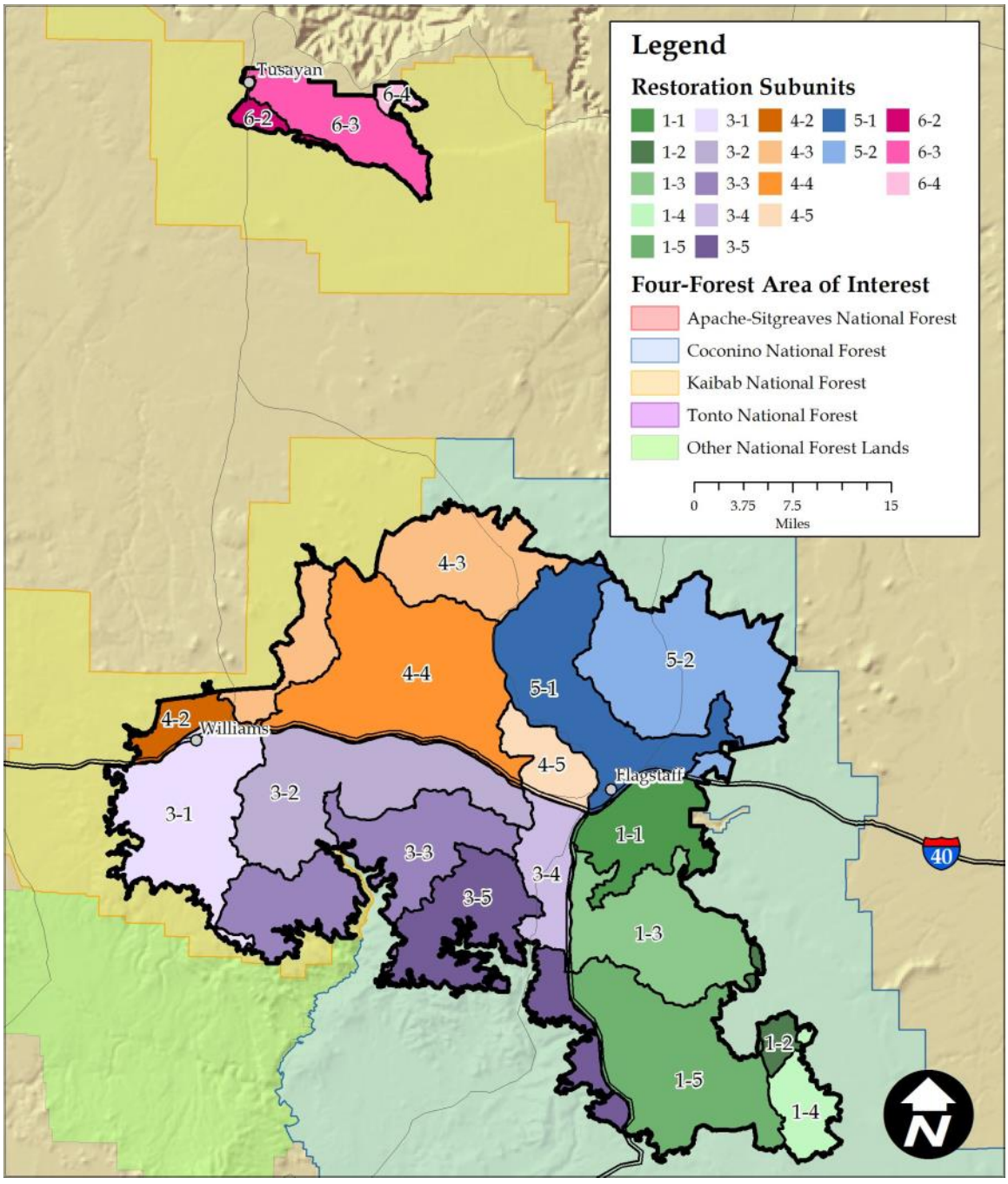

Figure 6. Restoration subunits within the project area

In 2009, Title IV of the Omnibus Public Land Management Act (P.L. 111-11) authorized funding for the Collaborative Forest Landscape Restoration (CFLR) Fund to support landscape-scale restoration on National Forest System lands. In 2010, the initiative received funding via the

CFLR Act. The CFLR Act objectives include reducing uncharacteristic wildfire and the associated management costs, supporting local and collaborative partnerships, supporting monitoring of restoration efforts, and supporting efforts that utilize forest products that benefit communities and offset treatment costs. Among other types of guidance, the CFLR Act requires that restoration treatments maintain or contribute to the development of old growth stands, maximize the retention of large trees, focus on small-diameter tree thinning, do not require the establishment of permanent roads, and require decommissioning of all temporary roads built for treatment purposes.

Also in 2010, stakeholders began refining their vision for ponderosa pine forest restoration. Stakeholders developed a comprehensive landscape restoration strategy for the Coconino NF and Kaibab NF, which documented existing conditions, potential treatment areas, and desired post-treatment conditions. The stakeholders also developed other products including the "Old Growth Protection and Large Tree Retention Strategy" (4FRI Stakeholders 2010). The Forest Service used the stakeholder's "Landscape Restoration Strategy for the First Analysis Area Report" (4FRI Stakeholders 2010) to inform the purpose and need and proposed action for this project. The large tree and old growth strategy was used to develop alternatives and the implementation plan.

While the 4FRI analysis has been in development, other broad-scale planning efforts have been underway. The Forest Service requires that the forest plans for individual national forests be revised every 10 to 15 years. Efforts began to revise the forest plans in 2006. In February of 2014 the Regional Forester for the Southwestern Region signed the Record of Decision for the Kaibab NF forest plan. The Coconino NF forest plan was issued in 1987. Although the Coconino NF forest plan is 25 years old, Congress has provided exemptions for older plans and the plan is being revised. The Coconino Draft Revised Plan and DEIS was released for comment in early 2014.

This 4FRI final EIS is consistent with the current Coconino NF forest plan as amended, including the project-specific amendments proposed in appendix B of this document. This final EIS is consistent with the revised Kaibab NF forest plan (USDA FS 2014). Consistency evaluations are included in each resource report. The record of decision for this project will further address consistency with the Kaibab NF revised forest plan.

Since the 4FRI EIS and plan revision documents have been developed essentially concurrently, consistent coordination and a great deal of alignment existed between the desired conditions and drivers of the three efforts. The timing of the release of the final Coconino NF documents will determine the description of how the 4FRI will achieve the consistency requirements. To the extent there is any inconsistency with a current or revised plan adopted prior to the final decision on the 4FRI project, appropriate project-specific plan amendments consistent with those proposed in appendix B of this document will be made at the time of the final decision.

Likewise, the Mexican Spotted Owl Recovery Plan was revised. The recovery plan was first issued in 1995. The Mexican Spotted Owl Recovery Plan, First Revision (USDI FWS 2012) was released in December 2012. While the FEIS uses terminology and recommendations specific to the former (1995) recovery plan, it was also designed to meet the criteria and recommendations of the 2012 recovery plan. Throughout the analysis process, there was continuous coordination with the U.S. Fish and Wildlife Service (FWS). The FWS has reviewed the project solely on the criteria of the 2012 Mexican Spotted Owl Recovery Plan and has determined the FEIS is in alignment with it and in compliance with the Endangered Species Act.

Purpose and Need for Action

The purpose and need for proposing an action was determined by comparing the objectives and desired conditions in the Coconino NF and Kaibab NF Land and Resource Management Plans (forest plans) to the existing conditions related to forest resiliency and forest function. Where plan information was dated or not explicit, local research and the best available science were used. The purpose and need also was developed using the landscape restoration criteria found in the Omnibus Public Land Management Act of 2009 (P.L. 111-11). The results of the comparison are displayed in narrative, tables, and photographs in this chapter.

The purpose of the project is to reestablish and restore forest structure and pattern, forest health, and vegetation composition and diversity to conditions similar to the natural range of variability. There is a need to increase forest resiliency and sustainability, protect soil productivity, and improve soil and watershed function. Resiliency increases the ability of the ponderosa pine forest to survive natural disturbances such as fire, insects and disease, fire, and climate change (FSM 2020.5). A key objective is to comply with the Omnibus Public Land Management Act of 2009 criteria for landscape-scale restoration, and achieve community, wildlife and forest protection while retaining as many large trees (greater than 16 inches d.b.h.) as possible.

The project is expected to move almost 600,000 acres toward comprehensive, landscape-scale restoration with benefits that include improved forest function and health, vegetation biodiversity, wildlife habitat, soil productivity, watershed function, and reduced risk of severe fire effects.

Existing and Desired Conditions

Forest Structure and Spatial Pattern

This analysis uses canopy density and openness; the relationship of vegetation structural stage (VSS) to age and size class and diversity; stand density and key habitat components; large trees; and old growth as criteria to describe existing and desired conditions for forest structure and spatial pattern in the project area.

Tree Density and Canopy Openness

A characteristic of historic southwest ponderosa pine forests was the grass/forb/shrub (interspace) interspersed among small groups of trees (Reynolds et al. 2013) This interspace typically comprised a large portion of the landscape (Woolsey 1911, Cooper 1960, White 1985, Pearson 1950, Covington et a1. 1997, Abella and Denton 2009). Low-severity fires occurred every 2 to 22 years and maintained an open canopy structure (Weaver 1951, Cooper 1960, Swetnam 1990, Swetnam and Baison 1990, Fulé et al. 1997a, Covington et al. 1997, Heinlein et al. 2005, Fulé et al. 2003). Typical historical tree groups ranged from 0.1 to 0.75 acre in size and were comprised of 2 to 72 or more trees per group (White 1985, Fulé et al. 2003, Covington et al. 1997, Reynolds et al. 2013). Reference conditions for openness ranged from 52 to 90 percent open (Reynolds et al. 2013). Others (including Fulé and Woolsey) have described historical ponderosa pine forests as having low tree-density, open, savanna-like stands consisting of groups of pine trees interspersed with grassy or shrubby openings (White 1985, Fulé et al. 2003, Woolsey 1911). For this analysis, the term “openness” is used to convey the percentage of the forested area that is grass/forb/shrub interspace. It is often used interchangeably with the term “canopy density.”

In contrast to having a ponderosa pine ecosystem consisting of groups of trees mixed with interspaces, approximately 74 percent of the ponderosa pine forest type within the project area is

departed from historical reference conditions.[4] Table 3 displays the existing percent of interspace (openness) in the project area by restoration unit.[5] Openness ranges from very open/open to closed. Stand data was used to generate figure 7 on page 11; the figure was updated in the FEIS to improve clarity.

Table 3. Canopy openness (classification percent of interspace) by restoration unit

Restoration Unit	Acres	Very Open (percent)	Open (percent)	Moderately Closed (percent)	Closed (percent)
1	144,114	1	14	28	57
3	129,225	1	14	25	60
4	134,278	4	22	35	39
5	59,033	11	57	23	9
6	41,189	2	30	39	29
All ponderosa pine	507,839	3	22	29	46

Overall, the desired condition is to reestablish nonforested openings that have been invaded by ponderosa pine since fire exclusion and reconfigure the forests toward their natural spatial pattern. At the fine scale, groups of trees would typically range in size from 0.1 acre to 1 acre.

Tree group size would exceed 1 acre as needed to respond to site-specific conditions including the presence of pre-settlement trees or mature and mid-aged trees that are developing old-tree characteristics. Tree groups in the mid-age and older structural stages (VSS 4, 5, and 6) would have canopies that provide moderate-to-closed conditions and where canopies are touching, or nearly touching, to provide connectivity for wildlife that are dependent on this type of habitat.

There would be a mix of very open, open, moderately closed, and closed canopy conditions at the landscape (ponderosa pine vegetation) scale. Moderate-to-closed canopy conditions would be widely distributed on the landscape. Habitat for goshawk and Mexican spotted owl, steep slopes, and buffers for resources such as bald eagle roosts, other raptor nests, caves, and special designations that would not be treated (including wilderness and most research natural areas) provide connectivity with moderate-to-closed canopy conditions. At the landscape scale (extent of ponderosa pine vegetation), openness would range from very open (up to 90 percent) within the savanna and grassland matrix to closed (as low as 10 percent) on the highly productive forest areas to achieve a heterogeneous condition across the landscape.

There is a need to use management strategies that move tree group pattern, interspaces, and canopy density toward the natural range of variation (sum of reference conditions) and provide a mix of open, moderately closed, and closed canopy conditions at the fine (group) to landscape (ponderosa pine vegetation) scale. There is a need to amend the Coconino NF forest plan to provide for grass/forbs/shrubs (interspace) interspersed among tree groups.

[4] Reference condition is defined as the condition due to site, ecology, and natural disturbance regime.

[5] Determining openness is best accomplished through aerial imagery analysis. At present, this analysis is only available for a small portion of the project area. In the absence of a detailed aerial imagery analysis it was determined that stand data was an appropriate substitute to classify the continuous canopy conditions that currently exist within the project area. Therefore, the current openness within the project area was determined using the canopy density measurements described in the silviculture specialist report.

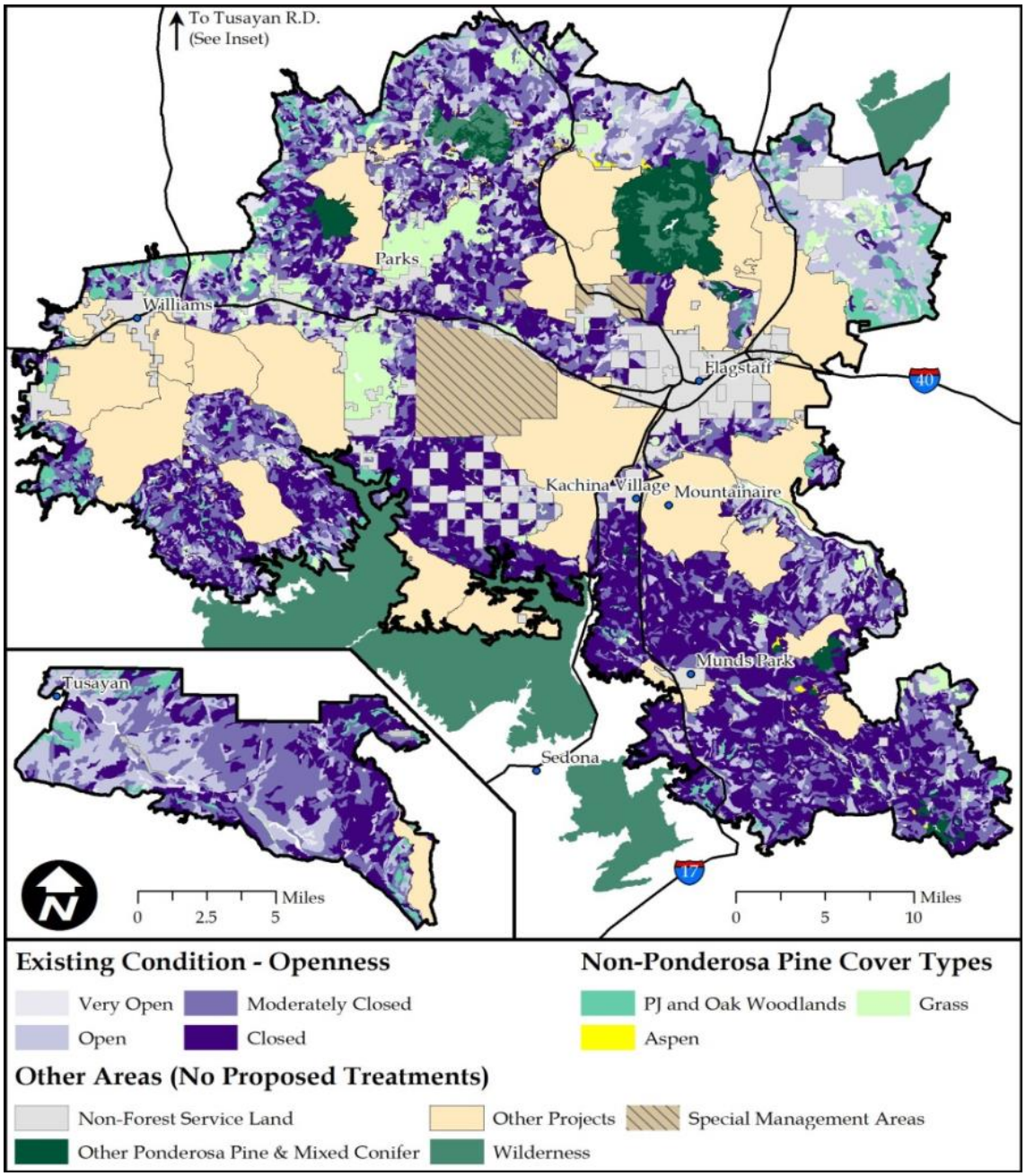

Figure 7. Existing canopy openness within the project area

Vegetation Structural Stage – Age and Size Class Diversity

Vegetation structural stage (VSS) is a method of describing forest age and tree size from seedlings to old forests. The VSS classification is based on the tree size class with the highest square foot of basal area and is an indication of the dominant tree diameter distribution. A group of trees with a single age class is considered even-aged while a group of trees with multiple age classes is uneven-aged.

Forest resiliency and diversity is dependent on the distribution of age and size classes and the capacity of an area. Currently, over 50 percent of the ponderosa pine type in the project area lacks

age and size class diversity and is in an even-aged structure. This has resulted in a homogenous landscape with reduced resiliency. Reduced resiliency is expressed as the increased potential for severe effects from wildfire, increased stand density-related mortality, reduced resiliency to bark beetle attack, increased dwarf mistletoe spread, and reduced understory productivity. Figure 8 displays a dense, even-aged forest structure that is common throughout the project area.

Figure 8. Even-aged forest structure common throughout the project area

Goshawk Habitat

The project area (minus excluded acres[6]) has approximately 367,452 acres of goshawk habitat outside of post-fledging family areas (PFAs). Forest plan direction for lands outside post-fledging family areas (LOPFA) is to have uneven-aged conditions with a diversity of VSS distributed across the landscape (see table 4). Diversity in age and size classes (VSS) represents specific habitat components that are needed for goshawk prey species. An imbalance potentially decreases the ability of goshawks to maintain their numbers over time.

Table 4. Existing VSS distribution within goshawk LOPFA habitat

Vegetation Structural Stage (VSS)	Even-Aged Stands Existing Percent of Area	Uneven Aged Stands Existing Percent of Area	Forest Plan Desired VSS Percent Distribution	Habitatwide Percent Distribution
1 – Grass/Forb/Shrubs	7	0	10	4
2 – Seedling/Sapling	0	2	10	1
3 – Young Forest	37	35	20	36
4 – Mid-age Forest	47	32	20	41
5 – Mature Forest	8	14	20	10
6 – Old Forest	1	17	20	8

[6] The project area boundary of 988,765 acres less excluded areas equals 588,716 acres

Even-aged stand conditions occur on approximately 56 percent (46 percent of all the ponderosa pine) of the LOPFA habitat with approximately 44 percent (54 percent of all ponderosa pine) in uneven-aged stand conditions (see silviculture report, table 80). Although the uneven-aged stand condition partially meets forest plan direction, the desired balance of VSS classes is lacking as displayed in table 4. In all stands, the young and mid-aged forest structural stages are surplus, and the grass/forb/shrub, seedling/sapling, mature, and old forest stages are deficit relative to forest plan direction. The desired condition is to move even-aged stands to an uneven-aged structure and move all stands toward the forest plan's VSS percent distribution. There is a need to increase grass/forb/shrub, seedling/sapling, and mature and old forest components.

Forest Structure – Post-fledging Family Areas (PFA)

There is approximately 30,014 acres of goshawk PFA habitat in 588,716 acres of the project area. PFAs consist of nest sites and adjacent habitat most likely to be used by fledglings during their early development. This category also includes dispersal PFAs (or dPFA) which is unoccupied suitable habitat within a 2 to 2.5-mile range of a PFA.

VSS 3 and 4 are over-represented and VSS 1, 2, 5 and 6 are deficit (table 5). Outside of nest stands, the desired condition is to have an uneven-aged forest structure that represents all age classes (USDA FS 1987). While the Kaibab NF forest plan no longer describes a desired distribution of VSS classes, VSS is still a useful concept for describing and managing for uneven-aged conditions over time.

Table 5. VSS distribution within goshawk PFA habitat

Vegetation Structural Stage (VSS)	Even-Aged Stands Percent of Area	Uneven-aged Stands Percent of Area	Coconino Forest Plan Desired Percent Distribution	Habitat Wide Percent Distribution
1 – Grass/Forb/Shrubs	3	0	10	2
2 – Seedling/Sapling	1	1	10	1
3 – Young Forest	35	34	20	34
4 – Mid-age Forest	52	39	20	47
5 – Mature Forest	8	15	20	11
6 – Old Forest	1	11	20	5

Stand Density and Key Habitat Components

One of the major factors affecting forest structure and development is inter-tree competition. High forest densities result in increased inter-tree competition. Measures of forest density include basal area, trees per acre, and stand density index. Basal area is the cross-sectional area of all trees, measured in square feet per acre, and trees per acre are simply a count of the total number of trees on an acre. Stand density index is a relative measure of stand density based on the number of trees per acre and the mean diameter (Reineke 1933). It is a good indicator of tree competition. Based upon established forest density/vigor relationships, density-related mortality from competition begins to occur once the forest reaches 45 to 50 percent of maximum stand density. Mortality is likely to occur at density levels over 60 percent of maximum stand density (Long 1985).

Table 6 displays that both stand density index and basal area are above the desired condition, which means much of the goshawk habitat is currently at risk from density-related tree mortality. The table also displays existing and desired conditions for snags and coarse woody debris, two key components of wildlife habitat. Approximately 588,716 acres within the project area is deficit in snags and does not meet desired conditions for coarse woody debris. The desired condition is to reduce the potential for density-related mortality and have stand densities at levels that facilitate forest health. Stand densities allow for overall forest development, tree vigor, and resilience to characteristic disturbances. In addition to stand density, there is a need to move toward forest plan desired conditions for snags, coarse woody debris, and forest structural stages that are currently in deficit.

Table 6. Existing and desired conditions for goshawk habitat components

Habitat Type and Acres	Basal Area Average		Stand Density Index Percent of Maximum		Snags > 18 in. d.b.h. per Acre		Coarse Woody Debris Total Tons per Acre	
	Existing	Desired	Existing	Desired	Existing	Desired	Existing	Desired
PFA (30,014)	107	70-80	56	25-40	0.4	2.0	3.9	5-7
LOPFA (367,452)	96	50-70	52	15-35	0.4	2.0	3.5	5.7

Mexican Spotted Owl Habitat

Forest Structure, Stand Density, and Key Habitat Components

Table 7 displays the existing and desired conditions for structural attributes and habitat components within Mexican spotted owl habitats. The components (which include stand density index, number of trees per acre, coarse woody debris, and snags) are indicators of nesting and roosting characteristics as outlined in the forest plans. These components are necessary to maintain a suite of prey species for Mexican spotted owls.

Based upon established forest density/vigor relationships, density-related mortality begins to occur once the forest reaches 45 to 50 percent of maximum stand density, and mortality is likely at density levels over 60 percent of maximum stand density (Long 1985). Table 7 on page 15 displays that all Mexican spotted owl habitats exceed the 60 percent-plus maximum stand density. In all Mexican spotted owl habitats, trees greater than 18 inches d.b.h. and large snags are deficit from forest plan and Mexican Spotted Owl Recovery Plan desired conditions and coarse woody debris requirements are met on less than 10 percent of the habitat.

The desired condition is to improve the quality of Mexican spotted owl nesting and roosting habitat by reducing the potential for density-related mortality and to move toward forest plan desired conditions for trees greater than 18 inches d.b.h., snags, and coarse woody debris. There is a need to implement uneven-aged management strategies that improve nesting and roosting habitat and reduce the potential loss of habitat. There is a need to amend the Coconino NF forest plan to allow treatments that would most effectively improve nesting and roosting habitat.

Table 7. Existing and desired conditions of Mexican spotted owl habitat components

Habitat Type	Basal Area		SDI (% of Maximum)		Trees ≥ 18 in. (per acre)		Snags ≥ 18 in. (per acre)		CWD >12 in. (tons per acre)	
	Existing	Desired	Existing	Desired	Existing	Desired	Existing	Desired	Existing	Desired
Restricted Target/ Threshold (8,692) acres)	162	150–170	85	≤55	16.3	≥20	0.5	≥2.0	1.2	≥ 1
Restricted Other (66,419 acres)	137	70–90	69	25–40	11.5	≥ 20	0.4	2.0	0.4	≥ 1
Protected (35,262 acres)	155	NA	78	≤ 55	15.0	NA	0.6	≥ 2.0	0.8	≥ 1

CWD = coarse woody debris

Forest Structure – Large Trees

The Omnibus Public Land Management Act[7] outlines criteria for landscape-scale restoration on National Forest System lands. The Act directs landscape restoration projects funded under this authority to focus on the removal of small diameter trees. Tables 4 through 7 (see previous pages) display that large trees (VSS 5 and 6) are currently under-represented within the project area. The desired condition is to balance community, wildlife, and forest restoration into treatment design. While some large trees would be removed to accomplish ecological objectives or public safety objectives around communities, there is a need to retain as many large trees (larger than 16,inches d.b.h.) as possible. There is a need to recognize the rarity and ecological and socio-political importance of large trees in the Southwest and to develop a process that addresses large tree retention during project implementation.

Forest Structure – Old Growth

The old growth standards for the Coconino NF state, "Until the forest plan is revised, allocate no less than 20 percent of each forested ecosystem management area to old growth as depicted in table 8. In the long term, manage old-growth in patterns that provide for a flow of functions and interactions at multiple scales across the landscape through time. Allocations will consist of landscape percentages meeting old-growth conditions and not specific acres." The old growth guideline for the Coconino NF state, "All analyses should be at multiple scales—one scale above and one scale below the ecosystem management areas" (USDA FS 1987, p. 70-1).

To be consistent with the Coconino NF forest plan, scales of analysis based on existing divisions of the landscape were developed specifically for this project. The smallest scale is represented at the stand level with stand size averaging less than 100 acres. The ecosystem management area (EMA) is the restoration subunit. Subunits range in size from 4,000 to 109,000 acres. The scale above the EMA is the restoration unit, which ranges in size from 46,000 to 335,000 acres.

In the Kaibab forest plan, the desired condition at the landscape scale (over 10,000 acres) is to have old growth occur throughout the landscape as a component of uneven-aged management

[7] Title IV, Section 4003, subpart c

with the location of old growth shifting on the landscape as a result of succession and disturbance (USDA FS 2014).

There are approximately 507,839 acres of ponderosa pine in the 4FRI project area. Of this total, 160,816 acres (36 percent) are the closest to meeting old growth conditions. Currently, all restoration units meet or exceed the 20 percent minimum Coconino NF forest plan requirement. Currently, the Kaibab NF has old growth occurring throughout the landscape (consistent with forest plan desired conditions). Approximately 31 percent (83,186 acres) of the Kaibab NF in the 4FRI treatment area has the desired older size classes and old growth components are well represented.

Table 8 displays acres of ponderosa pine old growth by restoration unit and national forest for all ponderosa pine within the 4FRI project area, as well as ponderosa pine (within the project area) that have been analyzed in separate vegetation analyses (see silviculture report). For the Coconino NF, the acres displayed in table 8 are the acres allocated and managed as old growth (consistent with forest plan direction). The acres listed in table 8 for the Kaibab NF represent the areas currently closest to having, or attaining the desired old growth components, dominated by trees in the largest size classes.

Table 8. Ponderosa pine old growth acres and percent by national forest and restoration unit

RU	Ponderosa Pine Total Acres (4FRI / Other Projects) Total		Ponderosa Pine Old Growth Acres (4FRI / Other Projects) Total		Ponderosa Pine Old Growth Percent	
	Coconino NF	Kaibab NF	Coconino NF	Kaibab NF	Coconino NF	Kaibab NF
1	(144,114 / 48,876) 192,990	This RU does not occur on Kaibab NF	(64,090 / 12,507) 76,597	This RU does not occur on Kaibab NF	40	This RU does not occur on Kaibab NF
3	(58,327 / 29,176) 87,503	(70,898 / 57,886) 128,784	(21,486 / 10,894) 32,380	(25,177 / 13,746) 38,923	37	30
4	(56,957 / 5,941) 62,898	(77,321 / 14,089) 91,410	(17,717 / 1,965) 19,682	(30,342 / 2,140) 32,482	31	36
5	(59,033 / 45,022) 104,055	This RU does not occur on Kaibab NF	(23,716 / 8,441) 32,157	This RU does not occur on Kaibab NF	31	This RU does not occur on Kaibab NF
6	This RU does not occur on Kaibab NF	(41,189 / 7,450) 48,639	This RU does not occur on Kaibab NF	(10,291 /1,490) 11,781	This RU does not occur on Kaibab NF	24
Total	(318,431 / 129,015) 447,446	(189,408 / 79,425) 268,833	127,009 / 33,807) 160,816	(65,810 / 17,376) 83,186	36	31

Most sites on the Coconino NF currently do not fully meet the minimum criteria for old growth conditions. However, the acres displayed in table 8 and table 9 are currently the closest to meeting old growth conditions. This approach is consistent with Coconino NF forest plan direction, which states: “strive to create or sustain as much old growth compositional, structural, and functional flow as possible over time at multiple-area scales…and seek to develop or retain

old-growth function on at least 20 percent of the naturally forested area by forest type in any landscape" (USDA FS 1987).

The old growth acreage percentage for ponderosa pine includes 100 percent of Mexican spotted owl protected habitat, 100 percent of Mexican spotted owl target/threshold habitat, 40 percent of Mexican spotted owl restricted habitat that is uneven-aged with low dwarf mistletoe infection, and 80 percent of Mexican spotted owl restricted habitat that is even-aged and mid-aged to old with low dwarf mistletoe infection. In goshawk habitat, the old growth acreage percentage for ponderosa pine includes 100 percent of goshawk nest stands, 40 percent of goshawk post-fledging family and foraging areas that are uneven-aged with low dwarf mistletoe infection, and 80 percent of goshawk post-fledging family and foraging areas that are even-aged and mid-aged to old with low dwarf mistletoe infection.

There are approximately 29,534 acres of pinyon-juniper within 588,716 acres of the project area. Of this total, 8,758 acres (68 percent) are closest to meeting old growth conditions as described by the Coconino NF forest plan. Currently, all restoration units meet or exceed the 20 percent minimum Coconino NF forest plan requirement. Currently, the Kaibab NF has old growth occurring throughout the landscape (consistent with forest plan desired conditions), with approximately 58 percent of the Kaibab NF in the 4FRI treatment area dominated by trees in the largest size-classes and having or attaining old growth components. Table 9 displays acres of pinyon-juniper old growth by restoration unit and national forest for all pinyon-juniper within the 4FRI project area as well as pinyon-juniper (within the treatment area) that have been analyzed in other vegetation analyses (see silviculture report). For the Coconino NF, the acres displayed in table 9 represent the acres allocated to old growth (per forest plan direction). For the Kaibab NF, the acres listed in table 9 represent the areas currently having, or attaining, the desired conditions associated with old growth.

Table 9. Pinyon-juniper old growth acres and percent by national forest

RU	Pinyon-Juniper Total Acres (4FRI / Other Projects) Total		Pinyon-Juniper Old Growth Acres (4FRI / Other Projects) Total		Pinyon-Juniper Old Growth Percent	
	Coconino NF	Kaibab NF	Coconino NF	Kaibab NF	Coconino NF	Kaibab NF
1	(1,141 / 2,135) 3,276	This RU does not occur on Kaibab NF	(611 / 447) 1,058	This RU does not occur on Kaibab NF	32	This RU does not occur on Kaibab NF
3	(832 / 0) 832	(3,201 / 3,533) 6,734	(356 / 0) 356	(1,747 / 2,245) 3,992	43	59
4	(42 / 0) 42	(7,123 / 0) 7,123	(42 / 0) 42	(4,116 / 0) 4,116	100	58
5	(8,771 / 0) 8,771	This RU does not occur on Kaibab NF	(7,302 / 0) 7,302	This RU does not occur on Kaibab NF	83	This RU does not occur on Kaibab NF
6	This RU does not occur on Kaibab NF	(2,206 / 550) 2,756	This RU does not occur on Kaibab NF	(1,452 / 110) 1,562	This RU does not occur on Kaibab NF	57
Total	(10,786 / 2,135) 12,921	(12,530 / 4,083) 16,613	(8,311 / 447) 8,758	(7,315 / 2,355) 9,670	68	58

Figure 9 displays the general locations of ponderosa pine and pinyon-juniper in the treatment area that are closest to meeting old growth conditions and components. In both ponderosa pine and pinyon-juniper, the desired condition is to allocate sites on the Coconino NF and manage for old growth components on the Kaibab NF. Where management occurs within ponderosa pine and pinyon-juniper cover types, there is a need to maintain the old growth characteristics and components.

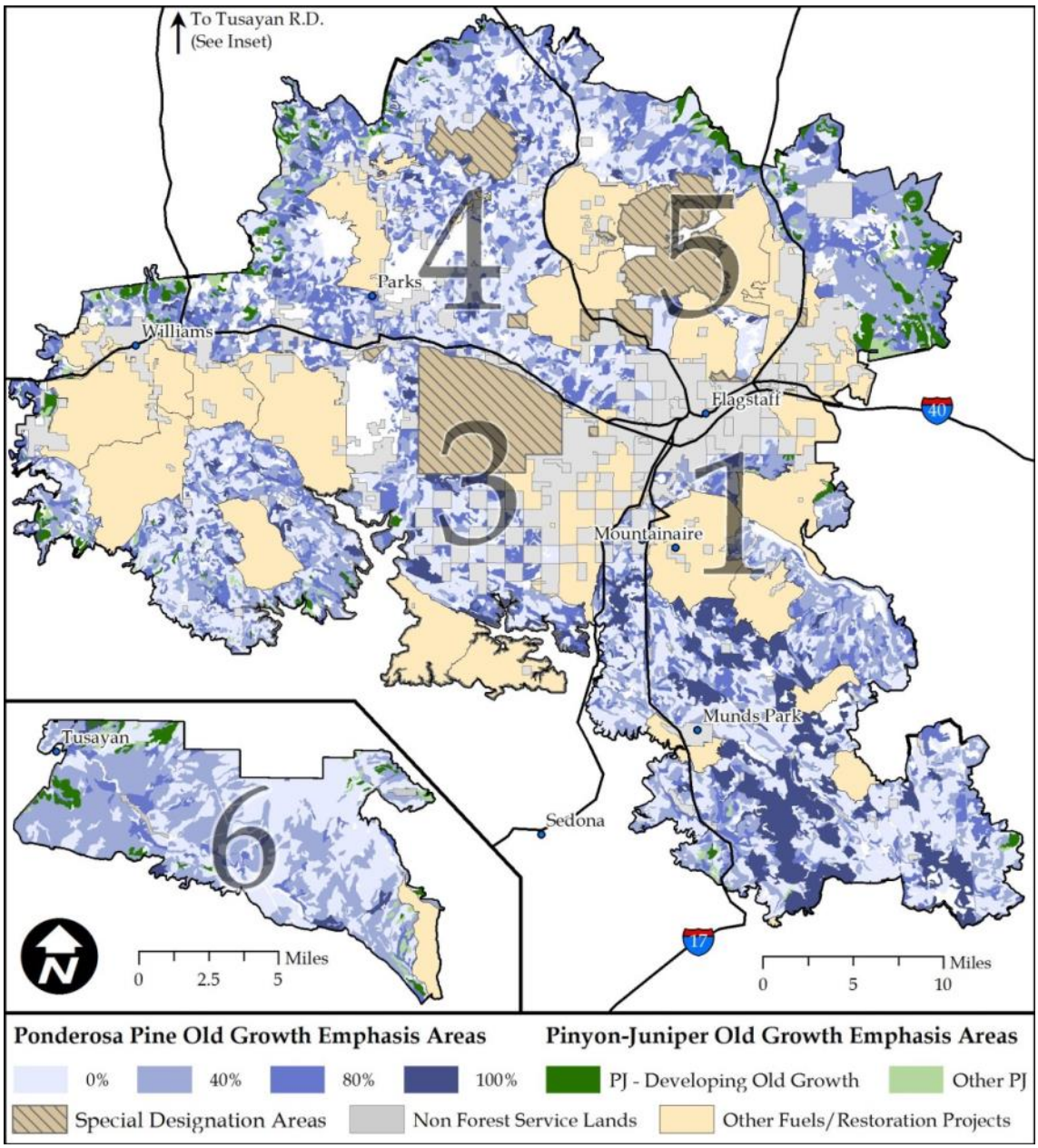

Figure 9. Ponderosa pine and pinyon-juniper that best meets old growth conditions

Forest Health – Insect and Disease

Bark Beetle

Forest health is defined by the vigor and condition of the forest stands (see previous discussion on stand density) and the presence of insects and disease that affect the sustainability of the forest. Ponderosa pine is attacked and killed by several different bark beetles in the genera *Dendroctonus* and *Ips*. Approximately 7 percent of the ponderosa pine in the project area has a low bark beetle hazard rating, while 21 percent has a moderate rating, and the remaining 72 percent has a high bark beetle hazard rating (table 10). Areas with a low or moderate hazard rating would be expected to be resistant to successful bark beetle attack and large-scale mortality.

Table 10. Existing ponderosa pine beetle hazard rating (percent of area in each RU)

Hazard Rating	RU 1	RU 3	RU 4	RU 5	RU 6	Analysis Area Acres / Percent of Total
Low	3	6	8	26	0	37,993 / 7
Moderate	12	11	27	46	25	106,131 / 21
High	85	83	65	28	75	363,775 / 72

Dwarf Mistletoe

Dwarf mistletoe infection in ponderosa pine is common throughout 588,716 acres of the project area. Mistletoe infected trees slowly weaken, experience growth loss, and eventually die (Lynch et al. 2008).

Approximately 66 percent of the area is not infected or has a low infection level (with less than 20 percent of the trees infected). Thirty-four percent of the area is moderately infected (20 to 50 percent of the trees infected) or heavily infected (50 to 80 percent of the ponderosa pine infected). The average range of infection is from 4 to 10 percent in the none/low infection level group and 33 to 42 percent in the moderate/high infection level group (table 11). Several stands have an extreme infection rating where 80 percent or more of the trees are infected.

Table 11. Existing dwarf mistletoe infection level by restoration unit (RU)

Infection Level Average Percent of Tree Infected	RU 1	RU 3	RU 4	RU 5	RU 6	Percent of Analysis Area
None/Low	53	57	74	92	82	66
None/Low	5	6	4	10	5	6
Moderate/High Percent of Area	47	43	26	8	18	34
Moderate/High	38	33	38	41	42	36
Extreme Percent of Area	<1	<1	<1	0	0	<1
Extreme Percent of Area	86	86	85	–	–	86

The desired condition is for a forest structure that would allow beetles and dwarf mistletoe to function at naturally occurring or historic levels. There is a need to manage insect and disease in a manner that reduces, but does not eliminate bark beetle or dwarf mistletoe to provide nesting, resting, foraging, and catching sites for birds and mammals, including Abert's and tassel-eared squirrels.

Vegetation Diversity and Composition

Gambel Oak

Vegetation diversity throughout 588,716 acres of the project area has declined. Gambel oak, a subtype within ponderosa pine, is important to many wildlife species as it provides important nesting and foraging habitat. A lack of fire led to increased stand densities of pine and resulted in Gambel oak becoming overtopped by ponderosa pine (figure 10) (Abella and Fulé 2008).

The desired condition is to develop and maintain a variety of oak size classes and forms where they occur. Oak should range from shrubby thickets and pole-sized clumps to large trees across the landscape to provide habitat for a large number and variety of wildlife species (Brown1958, Kruse 1992, Rosenstock 1998, Abella and Springer 2008, Abella 2008a, Neff et al. 1979, USDA FS 2014). There is a need to stimulate new growth, maintain growth in large-diameter trees, and use management strategies that provide for a variety of shapes and sizes across the landscape.

Figure 10. Ponderosa pine overtopping of Gambel oak in the Bar-M (Coconino NF) portion of the project area

Aspen

There are approximately 1,522 acres of aspen within 588,716 acres of the project area. Aspen is dying or rapidly declining on both national forests due to the combined effects of conifer encroachment (ingrowth), browsing by animals, insects, disease, severe weather events, and lack of fire disturbance (Lynch 2008, USDA FS 2008, 2009). A study by Fairweather et al. (2007) on the Coconino NF indicates that aspen on low-elevation dry sites (less than 7,500 feet) has sustained 95 percent mortality since 2000. Aspen mortality on these sites is expected to continue as many live trees currently have only 10 to 30 percent of their original crown. Figure 11 displays an unhealthy aspen stand within the project area. The desired condition is to maintain and regenerate aspen. Where possible, there is a need to stimulate growth and increase individual recruitment of aspen.

Figure 11. Aspen near Government Prairie, Kaibab NF

Grasslands

There are approximately 48,703 acres of montane/subalpine and Colorado Plateau/Great Basin grasslands within 588,716 acres of the project area. Only 2 percent of the Great Basin grasslands on the Coconino NF were historically composed of very large shrubs, closed canopies, and very large trees. Currently, this percentage is 19 percent (USDA FS 2009). Within montane/subalpine grasslands, conifer encroachment has increased from 0 to 33 percent (USDA FS 2009). On the Kaibab NF, conifers have invaded at least 8 percent of grasslands (USDA FS 2008).

Figure 12 displays conifer encroachment within the project area over a 100-year period. On both national forests, the desired condition for grasslands is to move toward the natural range of variation. Tree cover would range from 0 to 9 percent, grasses and forbs would dominate, and fire return intervals would average 10 years (Weaver 1951, Cooper 1960, Swetnam 1990, Swetnam and Baison 1996, Fulé et al.1997a, Fulé et al.1997c, Heinlein et al. 2005, Diggins 2010). Fire would function within in its natural fire regime across the landscape without causing loss to ecosystem function, human safety, lives, and values. When fire does occur, it typically replaces more than 75 percent of the dominant vegetation type (USDA FS 2009). There is a need to reduce or remove tree encroachment, which has decreased the size and function of landscapes that were historically grasslands.

Figure 12. Fern Mountain (Hart Prairie) Grassland circa 1880s (left); the same area circa 1980s (right)

Pine-Sage

Based on review of the project area, ponderosa pine trees are encroaching and shading out sage on about 5,261 acres. Without treatment, pine density is likely to increase and entirely shade-out the sage component. The desired condition is to restore the pattern within the pine-sage mosaic and manage fire to enhance sage. There is a need to remove post-settlement pine that is currently overtopping and shading sage. Figure 13 displays the post-treatment desired condition. This figure portrays an area just south of the town of Tusayan, Arizona approximately 6 years after a low-severity prescribed fire.

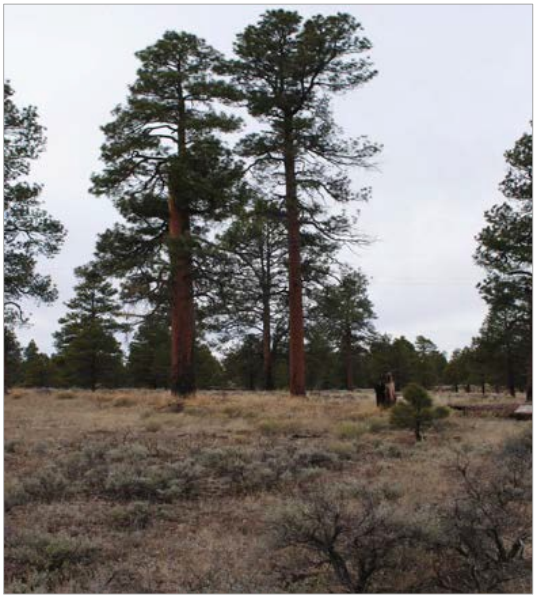

Figure 13. Post-treatment pine-sage desired condition (Kaibab NF)

Forest Resiliency

Fire Behavior

Currently, about 191,000 acres (38 percent) of the project area has crown fire potential. Crown fire generally produces 100 percent mortality in ponderosa pine by consuming the crowns of trees. Additional acres, primarily within or next to Mexican spotted owl habitat, are at risk from high-intensity surface fire that can result in high-severity effects. A high-intensity surface fire burning through this area could scorch the canopy sufficiently to cause widespread mortality (Van Wagner 1973). Figure 14 displays the current crown and surface fire potential within the project area. Figure 15 displays locations of potential resources at risk from fire.

Wildland-urban interface areas are spread across the project area and are located within or next to the communities of Flagstaff (RUs 1, 3, 4, 5), Williams (RUs 3, 4), Tusayan (RU 6), Parks (RUs 3, 4), Belmont (RUs 3, 4), and scattered developments such as Doney Park (RU 5), Munds Park (RU 1), and Kachina Village (RU 3). Although past fuel treatments have been implemented in the WUI closest to the major population centers, much of the landscape is still vulnerable to fire or to second order fire effects such as flooding, erosion, weed infestations, and damaged infrastructure.

In addition to wildland-urban interface, areas at risk include water resources, such as the Lake Mary, Rio de Flag, and Bill Williams watersheds. The Lake Mary and Rio de Flag watersheds are

a source of water for the city of Flagstaff, Arizona. The Bill Williams watershed provides water for the city of Williams, Arizona. Other resources at risk from crown fire include a diverse assemblage of wildlife that are known to occur or have habitat within or adjacent to the project area. Figure 15 provides a visual comparison between fire risk and some (not all) at-risk resources. Figure 15 displays the location of some resources at risk including the city of Flagstaff, the town of Tusayan, other lands outside national forest, watersheds, and Mexican spotted owl PACs, for reference with figure 14, which displays fire potential.

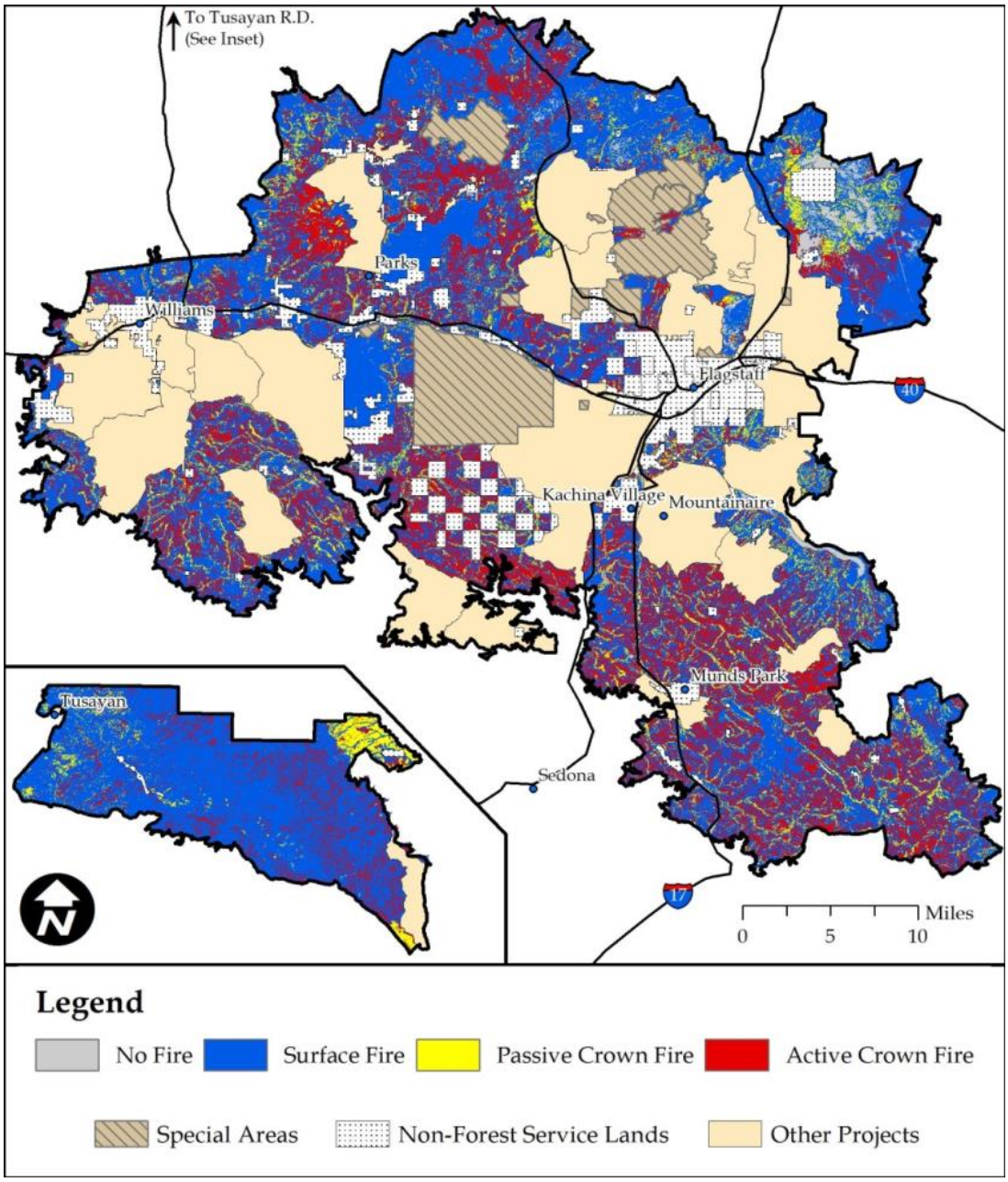

Figure 14. Current crown and surface fire potential in the project area

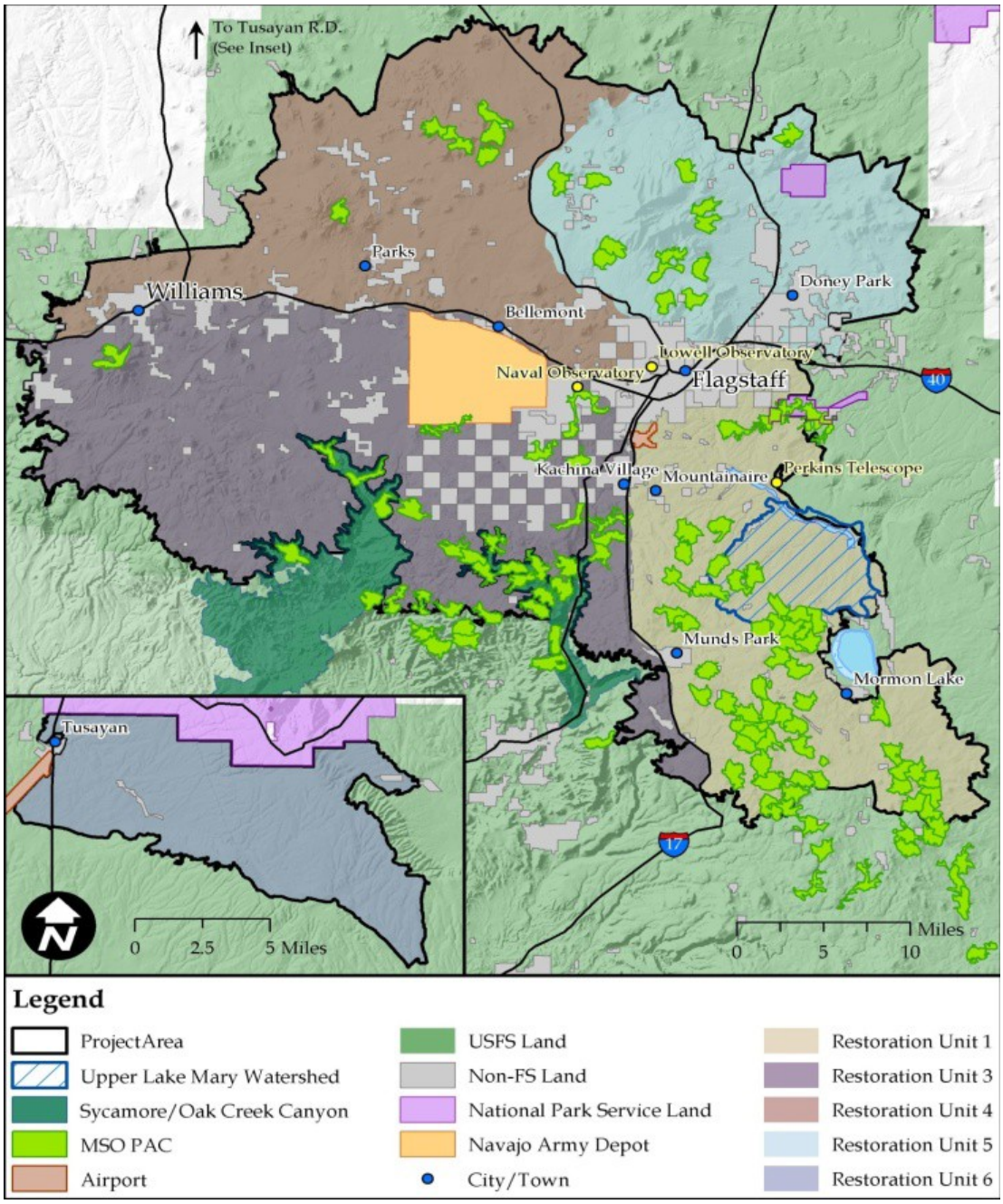

Figure 15. Locations of resources at risk (for reference with figure 14)

Canopy Characteristics and Surface Fuels Affecting Fire Behavior

Canopy bulk density and canopy base height are characteristics used to measure the potential for crown fire. Higher canopy bulk densities means that fire can easily move through the crowns of trees. Higher canopy bulk densities mean there are more fuels to burn. With more fuels, fire intensity can increase. Approximately 61 percent of the ponderosa pine in the project area has a canopy bulk density rating greater than 0.05 kg per cubic meter (kg/m^3). The desired condition in ponderosa pine is to reduce the potential for crown fire and have canopy bulk density below 0.05 kg/m^3. No more than 10 percent of the project area should have the potential for crown fire.

The canopy base height of a stand is the lowest height above the ground at which there is a sufficient amount of canopy fuel to spread fire vertically into the canopy (Scott and Reinhardt 2001). The lower the canopy base height, the easier it is for crown fire to initiate (Van Wagner 1977). Currently, canopy base heights in the project area average approximately 16 feet. To minimize the potential for crown fire initiation, the desired condition is to have average stand canopy base height above 18 feet. Table 12 summarizes existing and desired conditions for fire risk.

Table 12. Existing and desired fire potential in ponderosa pine in the project area

Evaluation Criteria	Existing Condition	Desired Condition
Potential crown fire (%)	38	Up to 10
Canopy Base Height (ft.)*	16	>18
Canopy Bulk Density (kg/m3)*	0.06	<0.050

*Stand average across the project area

Surface fuels (as analyzed for fire behavior and effects) include litter, duff, and coarse woody debris greater than 3 inches diameter. High surface fuel loading can result in high-severity effects because they can smolder in place for long periods, transferring more heat into soil and tree cambiums. Mechanical treatments generally do not remove surface fuels from a treatment area, so they remain a potential source of heat (fire effects) and emissions.

Currently, litter, duff, and coarse woody debris average 11 tons per acre. When averaged, the existing surface fuels do not exceed recommended surface fuel loading (Brown et al. 2003). However, there are areas that exceed desired surface fuel loadings. Most of these areas are near, or associated with, Mexican spotted owl habitat (see the fire ecology report).

Overall, the desired condition is to have fire maintain a mosaic of diverse native plant communities. In ponderosa pine, no more than 10 percent of the project area should be prone to crown fire under modeled conditions, with high-severity acres spatially distributed (Swetnam and Baison 1996, Roccaforte et al. 2008). In grasslands, no more than 3 percent should be prone to crown fire (in this analysis, crown fire in grasslands is a reference to crown fire in trees growing in the grasslands). In both vegetation types, when crown fire does occur, it should be mostly passive crown fire, occurring in single trees, groups, clumps, or areas where there has been mortality (e.g., from wind throw or insects). High-intensity surface fire should be rare with surface fuel loadings (including coarse woody debris, litter, and duff) ranging between 5 and 20 tons per acre (Brown et al. 2003).

Overall, the desired condition is to have fire function as a natural disturbance within the ecosystem without causing loss to ecosystem function or to human safety, lives, and values. Over time, conditions would allow managers to use fire to maintain the area as a functioning ecosystem. There is a need to reduce canopy bulk density and raise canopy base height to reduce the potential for crown fire. No more than 10 percent of the project area should have the potential for crown fire. To reduce the potential for high-severity surface fire, there is a need to maintain surface fuel loadings that meet desired conditions and reduce excessive surface fuel loadings in areas next to and within Mexican spotted owl habitat.

Fire Regime Condition Class

Fire regime condition class (FRCC) is a coarse-scale evaluation protocol developed to support planning and risk assessments (Schmidt et al. 2002, Hann et al. 2004). Fire regime condition class assessments determine how departed a landscape's fire regime is from its historic fire regime. It is scaled from 1 to 3, with 3 being the most departed and 1 being the least departed.

The fire regime is significantly departed from historical ranges on about 66 percent of the project area. The project area is classified as FRCC 3 (table 13). In FRCC 3, the risk of losing key ecosystem components is high. Approximately 25 percent of the project area is in FRCC 2, indicating the ecosystem is moderately departed from its historical range. The departure in fire frequency has resulted in dramatic changes to fire size, intensity, severity, landscape patterns, and vegetation attributes.

The desired condition is to have 100 percent of the project area in FRCC 1and 2. In FRCC 1 and 2, fire regimes would be within historical ranges and the risk of losing key ecosystem components would be low. Vegetation, fuels, and natural disturbances would be intact and functioning within historical ranges. There is a need to reduce the percent of ponderosa pine and grassland vegetation in FRCC 3 and move the fire regimes toward FRCC 1and 2.

Table 13. Existing and desired fire regime condition class for ponderosa pine

Fire Regime Condition Class (FRCC) Indicators	Existing Condition (% of total area)	Desired Condition (% of total area)
Vegetation Condition Class 1	14	100
Vegetation Condition Class 2	25	
Vegetation Condition Class 3	61	
FRCC of Treatment Area	3	1-2

Soil Productivity and Watershed Function

Soils

Approximately 85 percent of soils and strata (soil layers) in the 988,764-acre project area are in satisfactory soil condition and have the ability to resist accelerated erosion. Most strata in the ponderosa pine vegetation type currently are underneath a closed stand structure with high canopy covers and densities. This has reduced understory forage productivity although there is generally sufficient vegetative ground cover to reduce accelerated erosion. Due to the closed stand structure, most soils and strata are at risk from the relatively high potential for crown fire (about 86 percent in FRCC 2 and 3). This also poses a high risk of moderate or high burn severity effects to the watersheds under normal or extreme fire behavior conditions. Fires resulting in moderate or high burn severity pose substantial risk to soil productivity, watershed function, and downstream water quality in connected streamcourses where there are soils with moderate or high erosion hazard following storm events.

The desired condition is to protect long-term soil productivity by maintaining or improving soil condition and function (toward satisfactory). The vegetative ground cover would be adequate to protect against accelerated erosion, and would help maintain soil stability and vegetation productivity. Soil loss would be below tolerance, and no visible signs of excessive erosion would be present. Surface soil hydrologic function would be in satisfactory condition with well-aggregated, granular surface soil structure and tubular pores with sufficient porosity to effectively

infiltrate water. Soil nutrient cycling would be in satisfactory condition. Vegetative ground cover, including surface litter, plant basal cover, and herbaceous understory would approach natural conditions identified in "Terrestrial Ecosystem Survey Potential Plant Community Ecological Processes and Function" (USDA FS 1984).

Watersheds at the 6th Hydrologic Unit Code (6th-code) Scale

The project lies within 82 6th-code watersheds. The watershed condition framework protocol (USDA FS 2010a, 2010b) was used to classify watershed conditions at the 6th-code level including 12 watershed indicators. Overall, ponderosa pine vegetation types are dominated by functional-at-risk 6th-code watersheds (about 451,500 acres, or 46 percent of the analysis area); with several impaired watersheds (about 316,800 acres, or about 32 percent of the analysis area) and a few properly functioning watersheds (about 220,400 acres, or about 22 percent of the analysis area).

The desired condition is to have watershed function maintained or improved toward functioning properly. Watersheds would exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. Fire regime condition class and tree densities would be reduced and moving toward FRCC 1 (historical range). Soil and riparian condition and function would be improved and moving toward satisfactory and properly functioning.

Figure 16 is a photo of Babbitt Spring, which has an impaired function. Babbitt Spring is located in the Lake Mary watershed on the Flagstaff Ranger District (Coconino NF) and is an example of spring conditions within the project area. The headcut in the spring outflow, the encroachment of ponderosa pine into the spring site, and the lack of riparian vegetation normally associated with a functioning riparian site are indicators of impaired function.

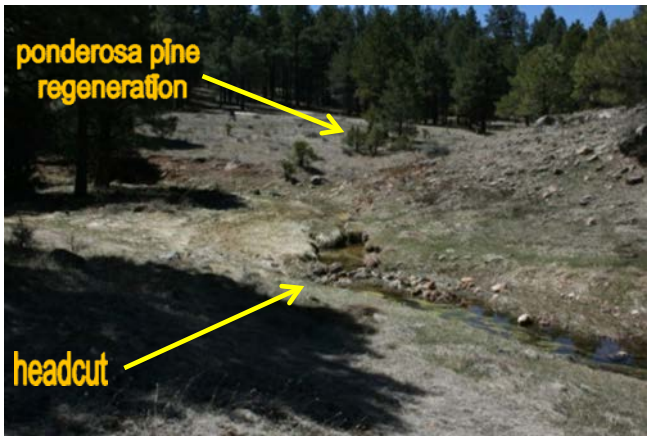

Figure 16. Example of a degraded (Babbitt) spring on the Coconino NF

Figure 17 displays Hoxworth Spring in a restored condition. This figure provides an example of successfully meeting restoration desired conditions. Vegetative composition and spring outflow has improved. Bank headcutting in the spring's outflow has been addressed and tree encroachment that affected spring function has been removed. The purpose of figure 18 is to display protective measures (fencing) that have been successfully used in the past to attain restoration desired conditions.

Figure 17. Example of Restored (Hoxworth) Spring

Figure 18. Example of protective measures for spring restoration

The desired condition for springs is to have the necessary soil, water and vegetation attributes to be healthy and functioning at or near potential. Water flow patterns, recharge rates, and geochemistry would be similar to historic levels and persist over time. Water quality and quantity would maintain native aquatic and riparian habitat and water for wildlife and designated beneficial uses, consistent with water rights and site capability. Plant distribution and occurrence would be resilient to natural disturbances (USDA FS 1987).

There is a need to improve the condition and function of 74 springs to sustain these features on the landscape. On some springs, this means maintaining and promoting existing vegetation. On others, there is a need to reduce tree encroachment, reduce the presence of noxious weeds, and limit the potential for future disturbance. On all springs there is a need to return fire, a natural disturbance process, to the system.

Ephemeral Streams

Ephemeral streams are those that flow only briefly during and following a period of rainfall. They are important for hydrological function of watersheds and provide important seasonal habitat for a variety of wildlife, in particular, migratory birds and dispersing amphibians. Ephemeral streams

are categorized as riparian or nonriparian. On the Coconino NF, approximately 32 miles of ephemeral streams are heavily eroded with excessive bare ground, denuded vegetation, and head cuts. Of the total miles, approximately 6 miles are riparian streams and 26 miles are nonriparian.

The Kaibab NF has approximately 7 miles (total) of degraded nonriparian streams. Figure 19 shows an active headcut and lateral bank cutting that resulted in accelerated erosion rates. This condition is common in the project area.

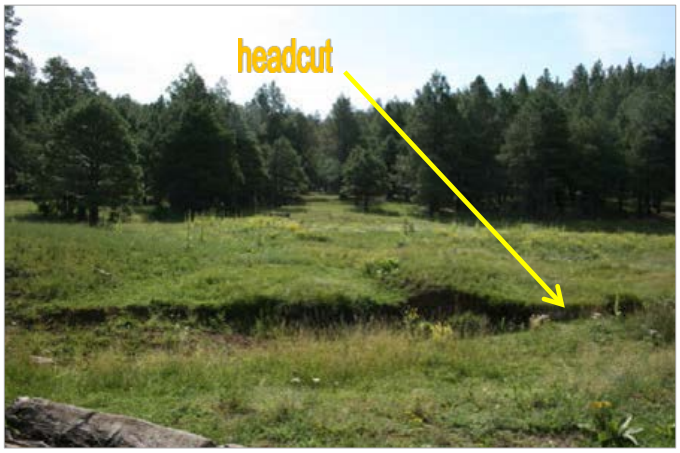

Figure 19. Example of a degraded ephemeral/riparian stream (Coconino NF)

The desired condition is to restore the functionality of ephemeral streams (USDA FS 1987). On some of the total miles of stream, there is a need to maintain and promote existing vegetation. On others, there is a need to reduce tree encroachment and the presence of noxious weeds, and to limit the potential for future disturbance. On all ephemeral streams, there is a need to return fire, a natural disturbance process, to the system.

The left photo in figure 20 is an example of a restored ephemeral stream. The figure displays what an ephemeral stream could look like immediately after recontouring treatments are completed. The right-hand photo displays what the restored ephemeral stream would look like about 1 year after treatment. This figure displays the desired condition for ephemeral stream restoration.

Figure 20. Example of a restored (Hoxworth Spring) drainage immediately after treatment (left photo) and 1 year after treatment (right photo)

Roads and Unauthorized Routes

The Coconino and Kaibab NFs have identified the needed road system for public and administrative motorized use through the Travel Management Rule process (see the transportation specialist report for details on forestwide transportation analyses). The Travel Management Rule process identified a need to decommission approximately 726 miles of existing system and unauthorized roads on the Coconino NF. On the Kaibab NF, approximately 134 miles of unauthorized roads (often referred to as user-created routes) were recommended for decommissioning.

The desired condition is to restore decommissioned road prisms to their natural condition (USDA FS 1987, 1988). Soils would be in satisfactory condition so that the soil can resist erosion, recycle nutrients, and absorb water. Understory species (e.g., grasses, forbs, and shrubs) diversity would be consistent with site potential and provide for infiltration of water and reduction of accelerated erosion. The understory would have a variety of heights of cool and warm season vegetation. Impacts to wildlife and habitat would be minimized.

About 2,787 miles of road (within the 988,764-acre project area) would be needed to implement the 4FRI Project. Of this total, approximately 2,267 miles are existing, open roads. However, portions of these existing roads have resource concerns, which require maintenance or reconstruction prior to using them. In some parts of the project area there are no existing roads that could provide access to treatments, or records and field review indicate the roads have been decommissioned in previous projects. For additional information, see the transportation inventory in the project record.

The desired condition is to minimize soil and vegetation disturbance from roads. There is a need to have adequate access to the project area for implementation while being consistent with the Omnibus Public Land Management Act of 2009 (which does not allow for the establishment of permanent roads). Adequate access includes using existing roads and temporarily creating roads that would be returned to their natural state (decommissioned) at the completion of project activities. Maintenance, reconstruction, and restoration actions would be designed to meet the site-specific condition as possible and practicable.

Decision Framework

The Coconino and Kaibab NF Supervisors are the Forest Service officials responsible for deciding whether to select the actions as proposed (alternative B); select one of the other action alternatives including alternative C, D and E; select an alternative that combines attributes from the alternatives; or select no action (alternative A). Their decision includes determining: (1) the location and treatment methods for all restoration activities, (2) design criteria, mitigation, and monitoring requirements, (3) the components that will be included in the monitoring and adaptive management plan, (4) the components that will be included in the implementation checklist and plan, (5) the estimated products or timber volume to make available from the project, and (6) consistency with the forest plans in place at the time of the decision and whether the Coconino NF forest plan would be amended.

Other Planning Efforts

See pages 7 to 8 for discussion on the relationship between the forest plans and the revised Mexican Spotted Owl Recovery Plan (USDI FWS 2012) to this analysis. Other restoration activities (actions on the national forests, or private, State, and other non-National Forest System

lands) that influence or are complementary to this analysis are addressed in cumulative effects analyses.

Relationship to the Forest Plans

The project was reviewed for consistency with direction in the current "Coconino National Forest Plan" (forest plan), as amended (USDA FS 1987), the "Land and Resource Management Plan for the Kaibab National Forest, as revised" (USDA FS 2014) and 36 CFR 219.17(b)(3).[8] Consistency evaluations can be found for each resource in chapter 3 of the this document and the project record. Appendix B provides details for the nonsignificant forest plan amendments that are proposed in alternatives B through D. With the proposed nonsignificant forest plan amendments, alternatives B, C, and D are consistent with the current 1987 Coconino NF forest plan direction. Alternative E is consistent with the current Coconino NF forest plan with one exception. Attaining no effect for heritage resources would not be possible unless 100 percent of the project area was surveyed and avoided.

With design features and mitigation, alternatives B through E are consistent with the Kaibab NF forest plan's objectives, desired conditions, standards, and guidelines. Movement toward desired conditions varies by alternative. Appendix D (implementation plan) documents how treatment design meets Coconino NF and Kaibab NF forest plan direction and desired conditions. See chapter 2 for additional discussion.

Management Direction

The project area includes 23 management areas as described in the Coconino National Forest Plan (pp. 46 to 206–113). Table 14 displays the management areas located within the project area, forest plan management area emphasis, and the relationship between each management area's approximate total acreage to the project. The management area direction for the Flagstaff/Lake Mary Ecosystem Analysis Area (FLEA) is displayed throughout the 10 management areas that make up the FLEA.

Kaibab NF Forest Plan

The revised forest plan for the Kaibab NF became effective in April of 2014. The 4FRI FEIS has been updated to reflect new management direction in the revised forest plan. On the Kaibab NF, the project area is within the ponderosa pine major vegetation type and the following management and/or designated areas: Wildland-urban Interface (60,273 acres), Grand Canyon Game Preserve (2,395 acres), Developed Recreation Sites (1,857 acres), Garland Prairie Management Area (402 acres),Bill Williams Mountain (20 acres), and 19 miles of the Arizona National Scenic Trail.

Table 14 displays the acreage associated with the management areas in the project area where the majority of restoration actions are proposed. Figure 21 displays the general location of the management areas in the project area.

For additional information, see chapter 4 of the Coconino National Forest Plan (pp. 98 to 206) and pages 85 to 107 of the revised Kaibab National Forest Land Management Plan where detailed descriptions of forestwide resource direction specific to the management areas is located.

[8] 36 CFR 219 is the Forest Service Planning Rule. This section of the Rule provides the transition language that allows this project to propose amendments to the Coconino NF forest plan using the provisions of the 1982 planning rule.

Table 14. Forest plan management areas (MA) within the project area

Forest Plan Management Areas within the Project Area*	Description	Forest Plan Emphasis	Forestwide MA Acres	MA Acres within Project Area	Acres / Percent of Forestwide MA Proposed for Treatment*
Coconino National Forest					
MA 3	Ponderosa pine and mixed conifer on less than 40% slope	Sustained yield of timber and firewood, wildlife habitat, grazing, high quality water, dispersed recreation	511,015	236,245	190,687 / 37
MA 8	PJ woodlands > 40 %	Firewood production, watershed condition, wildlife habitat, and livestock grazing	273,815	451	248 / <1
MA 10	Transition grassland/sparse PJ above Mogollon Rim	Range management, watershed condition, and wildlife habitat	160,494	8,544	8,011 / 5
MA 6	Unproductive timber lands	Wildlife habitat, watershed condition, grazing	67,146	12,115	11,628 / 17
MA 35	Lake Mary Watershed	Maintenance and/or improvement of soil condition and watershed function, reduced fire risk in urban/rural influence zone	62,536	59,301	35,994 / 58
MA 32	Deadman Wash	Grasslands, un-roaded landscape, grazing, hunting	58,133	11,659	11,380 / 20
MA 4	Ponderosa pine and MC above 40%	Wildlife habitat, watershed condition, and dispersed recreation	46,382	11,793	8,145 / 18
MA 33	Doney	Reduced fire risk in urban/rural influence zone, recreation, grasslands, scenic quality	40,530	25,779	14,024 / 35
MA 38	West	Reduced fire risk in urban/rural influence zone, recreation, scenic quality	36,298	36,134	19,538 / 54
MA 31	Craters	Restore natural grasslands, re-establish or maintain fire in pinyon-juniper woodland	29,940	8,969	8,969 / 30
MA 36	Schultz	Reduce wildfire risk, maintain watershed health and water quality	21,289	21,130	4,393 / 21

Forest Plan Management Areas within the Project Area*	Description	Forest Plan Emphasis	Forestwide MA Acres	MA Acres within Project Area	Acres / Percent of Forestwide MA Proposed for Treatment*
MA 37	Walnut Canyon	Reduce fire risk in urban/rural interface zone, progress toward desired forest structure including Mexican spotted owl and goshawk habitats	20,566	18,030	6,420 / 31
MA 12	Riparian and open water	Wildlife habitat, visual quality, fish habitat, watershed condition on the wetlands, riparian forest, and riparian scrub, dispersed recreation on the open water portions	20,490	653	609 / 3
MA 7	PJ woodlands < 40%	Firewood production, watershed condition, wildlife habitat, grazing	19,077	3,206	3,203 / 17
MA 13	Cinder Hills	OHV recreation opportunities and amenities, scenic integrity, geologic features	13,711	13,711	13,670 / 99
MA 9	Mountain grasslands	Livestock grazing, visual quality, wildlife habitat	9,049	7,102	5,385 / 60
MA 20	Highway 180 corridor	Scenic attraction, access to year-round recreation and Grand Canyon NP	7,608	6,213	4,237 / 56
MA 14	Oak Creek Canyon	Scenery, recreation, wildlife habitat, healthy streams, clean air and water, manage fire hazards and risk	5,388	7	7 / <1
MA 28	Schnebly Rim	Seasonal gateway, conserve winter range for deer, elk, turkey	5,090	2,455	2,455 / 48
MA 5	Aspen	Wildlife habitat, visual quality, sustain yield of firewood production, watershed condition, dispersed recreation	3,450	2,761	695 / 20
MA 34	Flagstaff	Reduce risk of catastrophic wildfire, recreation, scenic quality	1,781	1,675	1,417 / 80
MA 18	Environmental Study Areas (Griffith's Springs ESA)	Visual resource management, watershed condition, manage for low fire potential with fire re-established	1,577	1,577	325 / 21

Forest Plan Management Areas within the Project Area*	Description	Forest Plan Emphasis	Forestwide MA Acres	MA Acres within Project Area	Acres / Percent of Forestwide MA Proposed for Treatment*
MA 15	Developed recreation sites	Developed recreation	874	805	48 / 6
Kaibab National Forest					
Grand Canyon Game Preserve	Game preserve	Range of habitats for native and desired nonnative wildlife species, including predators	612,736	2,395	2,395 / <1
Wildland-urban Interface	Areas surrounding human development	Wildland fires are low intensity surface fires	389,720	117,272	60,273 / 51
Bill Williams Mountain	Multiple uses	High natural, cultural and economic value	17,745	17,745	20 / <1
Kendrick Mountain Wilderness	Designated Wilderness	Manage for natural processes	6,660	6,660	0/0
Developed Recreation Sites	Recreation sites, trailheads,	Developed Recreation	1,556	1,556	1,556 / 100
Arizona Bugbane Botanical Area	Designated Area	AZ bugbane habitat protection	490	490	0/0
Garland Prairie	Former proposed research natural area	Serves as reference for study of ecological changes	340	340	340 / 100
Arizona National Scenic Trail	Non-motorized scenic trail	Manage for high scenic values and primitive recreation settings	90 Miles	19 miles	19 miles / 21

*Acres based on alternative C. Acres and percentages are approximate as many mapping inconsistencies were found when we compared the management area boundary maps to vegetation stand data. Forest plan MA mapping was conducted at a very coarse scale whereas the numbers associated with our vegetation stand data is much more precise. The FLEA MA on the Coconino NF is comprised of MA 3, 4, 5, 8, and 9 which are included in the table.

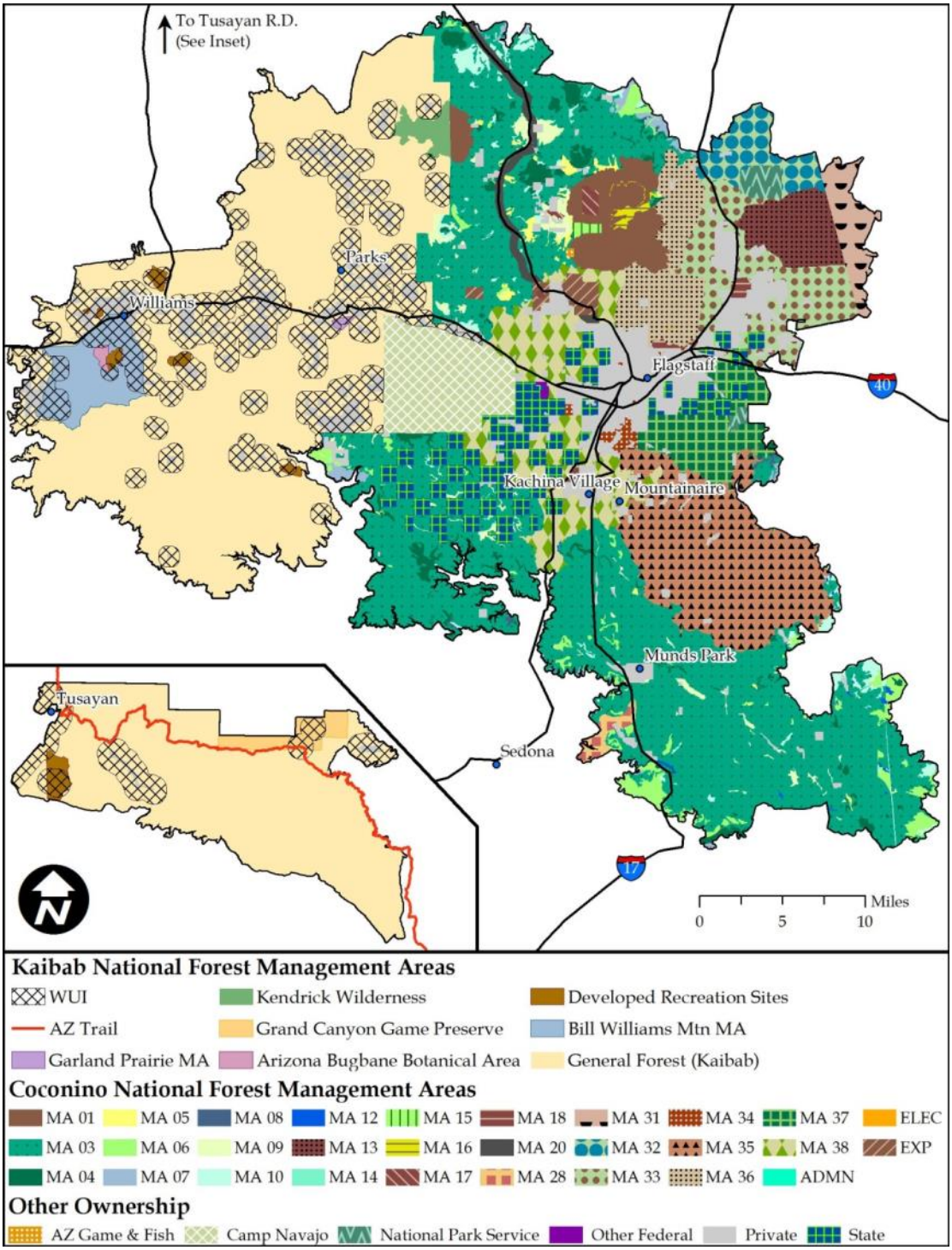

Figure 21. Forest plan management areas within the project area

Public Involvement

Collaboration

Collaboration has been integral to moving forward with a landscape restoration proposal. In 2010, stakeholders began refining their vision for ponderosa pine forest restoration across 2.4 million acres on four national forests in Arizona including the Apache-Sitgreaves, Coconino, Kaibab, and Tonto.

The 4FRI stakeholders developed a comprehensive restoration strategy for the Coconino and Kaibab NFs (4FRI Stakeholders 2010). The landscape strategy documented existing conditions, identified potential treatment areas, and desired post-treatment conditions. The Forest Service used the stakeholder's landscape strategy to inform the purpose and need and proposed action.

Scoping

The project was posted in the Coconino and Kaibab NF's Schedule of Proposed Actions in January of 2011 and the notice of intent to prepare an EIS was published in the Federal Register on January 25, 2011 (76 FR 4279–4281).

A draft proposed action was sent to the project mailing list (paper copies and electronic mail) consisting of 1,331 individuals, local governments, State governments, Federal and State agencies, and organizations. Fifty-four (54) responses were received through May 5, 2011. A scoping report that included a summary of the scoping process was posted on the 4FRI website on June 29, 2011 (http://www.fs.usda.gov/main/4fri).

In addition to a pre-scoping public meeting and workshop held on January 20, 2011, meetings and workshops were held on the Coconino NF on February 2, 2011, February 16, 2011, and February 24, 2011. A meeting and workshop was held on the Kaibab NF on February 9, 2011. The purpose of these meetings was to receive comments that would be used to develop a revised proposed action. The sixth public meeting was held at the Coconino NF Supervisor's Office on April 27, 2011 for the purposes of providing a project update. A seventh public meeting was held on June 7, 2011 for the purposes of receiving comments on edits made to the proposed action. On average, meeting and workshop attendance ranged from 10 to 20 participants.

A revised proposed action was sent to a refined mailing list (based on scoping responses) of 213 parties (169 electronic mail and 44 hard copy recipients) and a second 14-day informal scoping period began with the publication of a second revised notice of intent in the Federal Register on August 19, 2011 (76 FR 51936–51938). Not counting duplicates, 42 scoping responses (emails and letters) were addressed in content analysis (for the revised proposed action).

Prior to the onset of the August 19, 2011 comment period, an open house was held on August 17, 2011 at the Coconino NF Supervisor's Office. Six people attended the open house. During the comment period, an open house was held on August 25, 2011 at the Williams Ranger District (Kaibab NF). As part of coordination with local governments and residents, project updates were provided to the Coconino City Council and City of Flagstaff on September 12, 201l and again on December 5, 2011. The Tusayan and Camp Verde City Council received a project update on October 5, 2011.

The Sedona and Williams City Council was updated on October 25, 2011.Updates to local residents and communities were provided at the Mountainaire Community Picnic (at the

invitation of the Coconino County Supervisor) on September 17, 2011 and via an educational booth at the Flagstaff Festival of Science in September of 2011 and 2012.

In the fall of 2011, meetings were held with commenters to clarify comments received on the revised proposed action. This included hosting meetings to discuss comments on large trees on October 14, 2011 and on canopy cover (in relation to forest plan goshawk guidelines) on December 15, 2011 (Coconino NF Supervisor's Office).

In 2012, monthly public meetings were hosted from March through July to discuss the status of the environmental analysis. Draft (working) documents shared at the public meetings and made available on the 4FRI website (http://www.fs.fed.usda.gov/main/4fri/planning) included: issues, alternatives, draft forest plan amendments, cumulative effects, the scoping report (August 2011 scoping period), and version 5 of the modified large tree retention implementation strategy (alternative C). Only a sampling of the public involvement effort is included in this summary. See the project record for complete documentation. The project has been continuously posted on the Coconino and Kaibab NFs' Schedule of Proposed Actions since January of 2011 and public involvement and analysis-related documents have been posted on the 4FRI website, http://www.fs.usda.gov/main/4fri since January, 2011.

Public Review of the Draft Environmental Impact Statement

On February 26, 2013, a preview of the "Four-Forest Restoration Initiative, Coconino and Kaibab National Forests Draft Environmental Impact Statement" (DEIS) was posted on the project's website at http://www.fs.usda.gov/main/4fri/planning and interested parties were notified via e-mail or phone call. On March 29, 2013 a notice of availability was published in the Federal Register (78 FR 19261). The notice of availability began a 60-day public comment period. Documentation of the formal DEIS comment process is contained in the project record. A legal notice announcing the availability of the DEIS for review and comment was published in the Arizona Daily Sun on April 4, 2013 and posted to the project website.

The DEIS documented five alternatives that were considered but eliminated from detailed study (see chapter 2) and the environmental consequences associated with three action alternatives that would meet the purpose and need for action, and a no action alternative. Alternative C was identified as the preferred alternative.

On January 23, 2013, a public meeting focusing on the wildlife "bridge" habitat analysis was held in Pinetop, Arizona. Public meetings were held during the formal DEIS comment period on April 15, April 16, April 17, and May 15 of 2013.

Comments were received from individuals; tribal governments; Federal, State, and local agencies; organized interest groups; and businesses. Approximately 213 letters and emails were received on the DEIS. About 1,000 individual comments were received. The Forest Service analyzed comments to identify issues that required further or updated analysis and to identify analyses that required further clarification. Appendix I contains the Forest Service responses to comments received on the DEIS.

Cooperating Agencies

On March 11, 2011, the Arizona Game and Fish Department (AGFD) became a cooperating agency. AGFD provided a habitat specialist to assist with the wildlife management indicator species effects analysis.

Tribal Consultation

The following tribes and tribal chapters who have historic ties and an interest in the Coconino and Kaibab National Forests were consulted and include: Hopi, Kaibab Band of Paiute Indians, Navajo Nation including Coppermine, Coalmine, Naness, Lechee, Leupp, Bodaway, Cameron, Tuba City, Dilkon and Tolani Lake Chapters, San Juan Southern Paiute, White Mountain Apache, Yavapai-Apache Nation, San Carlos Apache, Hualapai, Yavapai- Prescott Indian Tribe, Havasupai, Tonto Apache, Pueblo of Zuni, Pueblo of Acoma, and Fort McDowell Yavapai Nation.

Consultation began September 10, 2009 with the Kaibab NF Supervisor sending an invitation to seven federally recognized tribes to discuss 4FRI and other national forest projects. On January 27, 2011, the forests sent a letter to tribes and tribal chapters providing information and seeking involvement and comments. Two written scoping responses were received. The White Mountain Apache responded on February 17, 2011 and indicated no concern with the project. A response from the Havasupai Tribe on March 7, 2011 asked for additional information on what the expected outcome of the proposals would be. The Hopi Tribe provided comments on treatments and the heritage survey strategy on March 21, 2011. On August 22, 2011, a second scoping letter was sent to the tribes. Tribes responded and provided additional input and voiced concerns during consultation meetings. Concerns include the following:

- Traditional cultural properties are at risk to catastrophic fire.
- Springs and plant collection areas are at risk to catastrophic fire.
- Overstocked stands are reducing the sunlight available for cultural and medicinal plants.
- Springs that are important to tribal ceremonies are drying up.
- A lack of low-intensity fire is reducing regeneration of plant collection areas.
- Smoke may affect some tribal communities.
- Tribes need access to sites for ceremonies and traditional gathering.
- Tribes are concerned with the preservation of cultural resources.

One written comment was received from the Hopi Tribe in response to the DEIS (see appendix I of this FEIS). Since consultation began in 2011, continuous updates on the project have been provided to tribes. The “Tribal Relations” section in chapter 3 of this FEIS and the tribal relations specialist report provides complete consultation documentation.

Tribes that had not participated in tribal consultation continued to receive information via email and hand-delivered mail. Information will continue to be shared unless a tribe asks specifically to not be informed.

Issues

Issues 1 to 4 were edited to reflect public comments on the DEIS related to canopy cover, post-treatment openness, and the conservation of old and large trees. In summary, this final environmental impact statement responds to four issues and evaluates five alternatives: the no action alternative (alternative A) required by the regulations, the proposed action (alternative B), and three alternatives (alternatives C, D, and E) to provide sharp contrast and comparison to the proposed action.

Two procedural concerns related to the range of alternatives and plan amendments were added to chapter 1 to highlight concerns raised by the public. Public concerns that are routine disclosures (see chapter 3) were not considered to be key issues. For example, consultation with the U.S. Fish and Wildlife Service on endangered species is a requirement. Therefore, comments that stated consultation needed to occur were not considered a key issue. Many public comments submitted during the scoping period suggested alternatives that were either considered in detail or eliminated from detailed analysis (see chapter 2).

Some comments were determined to be outside the scope of this analysis for one or more of the following reasons: they did not reflect a cause-and-effect relationship supported by scientific evidence; they were not relevant to the decision to be made; they were outside the Forest Service's authority; or they were already decided by law, regulation, or policy. The issues raised in these comments were dismissed from further consideration. Appendix I provides a summary of comments as well as individual responses to comments received on the DEIS.

Each specialist analyzed: (1) issues raised by the public (next section), (2) how the proposed alternatives addressed the purpose and need, (3) topics required by law, regulation or policy, and, (4) additional resource topics/concerns they felt were important for their resource (see specialist reports).

Issue 1: Prescribed Fire Emissions

Commenters stated emissions resulting from prescribed fire activities would occur continuously over a 10-year period. Emissions include but are not limited to radionuclide particles and mercury. Commenters were concerned that project emissions would degrade air quality and the health of northern Arizona residents, particularly residents of the Verde Valley and Snowflake, Arizona. There was a concern that emissions could degrade water quality. There was a concern that this project, when combined with prescribed fires that other national forests conduct, would negatively impact northern Arizona residents: Residents would experience constant smoke (an emission) over a long period of time; reduced visibility and air quality from smoke would negatively affect the quality of life for residents and would reduce tourism in the area; and the reduction of tourism would result in long- term impacts to the local and regional economy of northern Arizona. Commenters were concerned the volume of smoke and the emissions that are part of smoke could affect public health. An alternative was suggested that: (1) eliminates all use of prescribed fire, (2) eliminates most prescribed fire use and relies on other methods to dispose of biomass, and (3) improves coordination among all national forests that use prescribed fire in the vicinity of the Verde Valley and Snowflake is needed. Some felt there needs to be smoke-free periods for residents downwind of the project.

Response

An alternative that would eliminate all prescribed fire was considered but eliminated from detailed study as it did not adequately meet the purpose and need for restoring the fire-adapted southwestern ponderosa pine ecosystem. Alternatives B, C and E propose using prescribed fire across the entire project area and alternative C adds acres where prescribed fires would be used to restore additional acres of grasslands. Alternative D was developed to respond to the emissions issue by decreasing the acres proposed for prescribed fire by 69 percent (when compared to alternative B). This equates to removing fire on about 404, 889 acres. All action alternatives include design criteria aimed at reducing impacts to air quality (as practicable) and increasing coordination efforts among neighboring national forests. The fire ecology, air quality, recreation, and social-economics environmental consequences disclose the potential impacts to air quality, quality of life, the local and regional economy, and public health and safety.

The indicators used to evaluate this issue are:

- Quantitative emission modeling and qualitative interpretation to evaluate the potential for emissions (including mercury) within communities that are within or in close proximity to the project area;
- Modeling of principal pollutants including carbon monoxide (CO), nitrogen dioxide (NO_2), particulate matter less than 10 microns in size (PM 10), particulate matter less than 2.5 microns in size (PM 2.5), ozone (O_2), and sulfur dioxide (SO_2) pollutants that pose potential health hazards to evaluate compliance with the Clean Air Act as regulated by Arizona Department of Environmental Quality (ADEQ); and
- Social and economic evaluation of impacts to quality of life and tourism.

Issue 2: Conservation of Large Trees

Commenters were concerned that the "Old Growth Protection and Large Tree Retention Strategy" (also referred to as the "Large Tree Retention Strategy" or LTRS), which was developed by the 4FRI stakeholders, was not included in the proposed action. Large post-settlement trees, as defined by the stakeholders' socio-political process, are those greater than 16 inches d.b.h. The LTRS was designed to increase landscape heterogeneity and conserve biodiversity. Commenters stated the LTRS represents social agreement between parties that greatly enhances the chance for landscape restoration to succeed and reduces the risk of conflict. Commenters stated if the LTRS is not incorporated, the current social support for landscape-scale restoration may be withdrawn. Commenters stated that without the LTRS the project may remove too many large trees. There was also concern the removal of large trees may adversely impact nesting and roosting habitat and large woody debris that is important for wildlife.

Response

The vegetation analysis will evaluate how proposed treatments affect vegetation structural stages, including those trees that are 16 inches d.b.h. or larger. This analysis will be used to inform the wildlife effects analysis. Alternatives B (proposed action alternative) and D do not incorporate the LTRS. However, alternative C responds to this issue by incorporating the key components of the LTRS and focusing on ecological desired conditions. It identifies ecological conditions where large, post-settlement trees may (or should) be removed to move toward or meet desired conditions. The intent of the LTRS has been incorporated into alternative C and E's design criteria, the monitoring and adaptive management plan, and the project implementation plan. In

the FEIS, vegetation and wildlife evaluate how treatments may impact large trees as components of forest structure and wildlife habitat.

The indicators used to evaluate this issue are:

- Quantitative pre-treatment and post-treatment three-level analysis for Mexican spotted owls on the Coconino NF,
- Goshawk, old growth, and vegetation structural stage for goshawk habitat at the landscape scale (ponderosa pine vegetation type) to gauge movement toward restoration desired conditions, and
- Qualitative analysis of pre-treatment and post-treatment nonmarket social values that include large trees, public safety, and other biodiversity objectives that may conflict with the protection of large trees.

Issue 3: Post-treatment Canopy Cover and Landscape Openness

Commenters stated measuring canopy cover in goshawk habitat at the group level will not meet forest plan stand-scale canopy requirements. Commenters stated a reduction in canopy and large tree densities have never been analyzed under NEPA and NFMA and could have deleterious effects to goshawk, its prey species, and those wildlife species that are dependent on that cover; because natural openings would no longer be included within the vegetation structural stage (VSS) classification, it would result in significantly more lands being in an open condition or outside of the VSS 4 to 6 classifications. Commenters stated this could substantially increase the logging of mature and old trees and negatively affect wildlife, including goshawk and its prey species. Commenters stated the Forest Service has not adequately explained how using a silvicultural tool designed to project forest structure at the stand level can be accurately applied to model structure at smaller group scales (i.e., less than 1 acre). Commenters stated the Forest Service has not explained how restricting the retention of closed canopy forest structure to small tree groups will avoid negatively impacting canopy-dependent species.

Response

All action alternatives (B, C, D and E) are designed to be consistent with the direction in both forest plans including the canopy cover in VSS 4 to VSS 6 in the Coconino NF forest plan. The vegetation analysis addresses the inter-relationship between canopy cover and old and large trees.

To address post-treatment openness and canopy cover where the desired condition is to move toward an open ponderosa pine (savanna/grassland) reference condition, a nonsignificant forest plan amendment was developed for the Coconino NF in alternatives B, C, and D. The amendment describes how canopy cover will be measured and met at the group level, includes language that defines and describes interspaces, and describes the relationship between interspaces, openings, and VSS classes. It would also allow select acres to be managed for less than 40 percent canopy cover in VSS 4 to VSS 6 and less than 3 to 5 reserve trees per acre. Alternative E does not include forest plan amendments. Openings and canopy cover would follow current forest plan direction. Since neither forest plan provides specific direction on how canopy cover will be measured, it would be determined at the project level using the best available information.

The analysis discloses tree group stocking guides that would be used to meet tree group canopy cover requirements and evaluates the following within goshawk habitat: pre- and post-treatment

distribution of habitat structure, overall habitat structure (VSS class), forest density metrics, and openness.

Issue 4: Increased Restoration and Research

Commenters recommended additional acres of grassland restoration treatments in the vicinity of Government Prairie and the Garland Prairie Management Area on the Kaibab NF. Commenters noted the historic grasslands are being encroached upon by pine. The U.S. Fish and Wildlife Service (FWS) recommended increasing prescribed fire and restoration treatments within Mexican spotted owl protected habitat (to improve the quality of the habitat and be in alignment with the revised Mexican Spotted Owl Recovery Plan (USDI FWS 2012)).

Commenters, including the Arizona Department of Game and Fish, recommended adding research that evaluates the effect of residual tree groups and tree-less opening size on small mammals and bird species should be included in project of this scale. Commenters stated research that evaluates the impact of landscape-scale restoration actions should be incorporated via a paired watershed study. Commenters noted that outcomes from watershed and wildlife research can inform future restoration projects.

Response

Alternative C responds to comments and recommendations by including additional mechanical and/or prescribed fire treatments in the vicinity of Government Prairie and the Garland Prairie management area on the Kaibab NF. The intent is to move these areas closer to historic reference conditions. The alternative responds to recommendations from FWS to increase prescribed fire and mechanical treatments within Mexican spotted owl habitat. In alternative C, prescribed fire would be applied to 70 protected activity centers, including 54 core areas. In target threshold habitat, the desired basal area is adjusted to be in alignment with the revised Mexican Spotted Owl Recovery Plan. In alternative C, the mechanical treatment d.b.h. limit would be increased to 17.9 inches in Mexican spotted owl protected activity centers.

Alternative C adjusts vegetation (decreases acres) and prescribed fire (increases acres) treatments to incorporate two research opportunities. One study would evaluate the effect of residual tree groups and opening size on small mammals and bird species. The paired watershed study would evaluate water yield from landscape-scale restoration actions.

The indicators used to evaluate this issue are:

- Acres of grassland vegetation moving toward desired conditions
- Acres of improved Mexican spotted owl nesting and roosting habitat
- Qualitative assessment of alignment with the Mexican Spotted Owl Recovery Plan
- Potential change in water yield

Procedural Concerns

Range of Alternatives and Comparison of Alternatives

This procedural concern was raised in comments to the DEIS. There is a concern that the action alternatives proposed in the DEIS are virtually identical except for the variation in acreages. Some commenters stated there is no action alternative where a plan amendment would not take

place. Commenters stated it is not possible to understand the environmental effects and tradeoffs for resources that result from the amendments themselves.

Response

The phrase "range of alternatives" refers to the alternatives discussed in environmental documents. It includes all reasonable alternatives, which must be rigorously explored and objectively evaluated, as well as those other alternatives, which are eliminated from detailed study with a brief discussion of the reasons for eliminating them (40 CFR Section 1502.14).

The DEIS (pp. 8 to 104) included nine alternatives including no action, three action alternatives, and five alternatives that were considered but eliminated from detailed study. The alternatives responded to the issues received from the public (2011 Scoping Report, project record). In response to comments received on the DEIS, a fourth action alternative that would propose no forest plan amendments was analyzed in the FEIS. This increased the number of fully analyzed alternatives to five (four action alternatives and the no action alternative), and increased the number of alternatives considered but eliminated from detailed study to six.

Significant Forest Plan Amendments

Some commenters stated the DEIS (alternatives B through D) failed to support a finding that the plan amendments are nonsignificant. Some commenters stated the public cannot use the data in the analysis to determine the acres affected and to understand how these acres are related to other anticipated uses. Some commenters stated the proposed amendments are significant because they may bring about changes that may have an important effect on the entire land management plan or affect land and resources throughout a large portion of the planning area, see FSM 1926.52 (January 31, 2006).

Some commenters stated the plan amendments are significant because the Forest Service is including identical plan amendments in similar vegetation projects; therefore, providing direction that must be followed by other projects. Some commenters asked for examples of other projects with nonsignificant plan amendments. Some commenters suggested wording to improve clarity. The environmental cause-and-effect relationship is the perceived dramatic change in management for Mexican spotted owl that may result in harm to the owl.

Response

In the DEIS, three forest plan amendments were proposed for the Kaibab NF. The forest plan was revised in April of 2014. As a result, all forest plan amendments were removed in the FEIS. No forest plan amendments are needed on the Kaibab NF because the proposed actions are consistent with forest plan objectives, desired conditions, and standards and guidelines (FEIS, chapter 2, “Forest Plan Consistency” section).

Three nonsignificant amendments for the Coconino NF were evaluated in the FEIS. The amendments are authorized via 36 CFR 219, the Forest Service Planning Rule. Section 219.17(b)(3) of the Rule provides the transition language that allows this project to propose amendments to the Coconino NF forest plan using the provisions of the 1982 Planning Rule. The significance of each amendment was evaluated in accordance with Forest Service Manual (FSM) 1926.51 and FSM 1926.52.

The purpose of amendment 1 is to bring the selected alternative in alignment with the revised Mexican Spotted Owl Recovery Plan and defer monitoring to the FWS biological opinion that is specific to this project. Amendment 2 clarifies existing direction related to managing canopy cover and interspace in the forest plan. The purpose of amendment 2 is to bring the project into alignment with the best available science (Reynolds et al. 2013) that provides desired conditions for restoring fire-adapted ponderosa pine in the Southwest. Amendment 3 resolves a forest plan error related to the management of heritage resources and is specific to this project. The detailed significance analysis for each amendment is located in appendix B of this FEIS.

No amendment alters multiple-use forest plan goals and objectives, adjusts management area boundaries or management prescriptions. The changes in standards and guidelines are considered to be minor because they reflect the latest, best available science (Reynolds et al. 2013). The amendments bring the alternatives into alignment with the revised Mexican Spotted Owl Recovery Plan, although the degree of alignment varies by alternative. No amendment would alter the long-term relationship between levels of multiple-use goods and services originally projected for the Coconino NF. These outputs were specific to a planning period ranging from 10 to 15 years (as identified in 1987):

- Amendment 1: The amendment would affect 6,906 acres or 18 percent of Mexican spotted owl protected activity center habitat on the Coconino NF.
- Amendment 2 is a clarification amendment. The canopy cover portion of the amendment would generally affect 137,242 acres (15 percent) of all goshawk habitat on the Coconino NF. Managing 28,653 acres of ponderosa pine for an open reference condition would affect approximately 3 percent of all suitable goshawk habitats on the Coconino NF.
- Amendment 3 is specific to approximately 355,707 acres of proposed treatments in this project. In alternative C this would affect about 20 percent of the Coconino NF (which totals 1,821,495 acres).

For these reasons, the amendments would not result in an important effect to the entire land management planning area. Each amendment is a specific, one-time variance for this restoration project. The best available science for management in southwestern forests (RMRS GTR 310), and the (Coconino NF) forest plan revision process are affecting ongoing and future analyses. The plan amendments that are specific to this project do not impose direction on ongoing or future analyses.

Some commenters stated the plan amendments are significant because the Forests are including identical plan amendments in similar vegetation projects; therefore, providing direction that must be followed by other projects. The list of vegetation projects that were included in comments on the DEIS were reviewed. Overall, the forest plan amendments that have been proposed in other vegetation projects reflect the ongoing Coconino NF forest plan revision process, using the best available scientific information (Reynolds et al. 2013), and being compliant with the revised Mexican Spotted Owl Recovery Plan (USDI FWS 2012). A complete analysis of other proposed forest plan amendments by project is located in the project record.

Proposed Action Development

During the initial phase of scoping (January 2011 to June 2011), meetings and workshops were held for the purpose of refining the draft proposed action. We recorded many comments

requesting additional detail on what vegetation and prescribed fire treatments would look like once implemented. Many commenters provided input and recommendations on identifying and prioritizing resources and infrastructure at risk from high-severity fire. Treatment in these locations is reflected in the proposed action (and subsequent alternatives).

Another topic that emerged was the conservation of old trees. In response to recommendations, key concepts from the stakeholder-developed Old Tree Protection Strategy (OTPS) were incorporated into the purpose and need (4FRI Stakeholders 2011). Treatment design criteria and mitigation (which are consistent with the OTPS) was developed and the OTPS was made integral to the revised proposed action as an attachment (appendix E in the August 2011 proposed action document). An old tree implementation plan was developed and made part of the final proposed action alternative (and all subsequent alternatives).

As the analysis progressed, the need to better describe treatments within Mexican spotted owl protected activity centers (PACs) was raised by the U.S. Fish and Wildlife Service. In response, the language in the proposed action was revised to clarify that mechanical treatment was proposed in 18 select PACs and the use of prescribed fire was proposed in 72 PACs, excluding core areas.

As the proposed action was refined, the concept of adaptive management was incorporated into the proposal to provide flexibility to account for inaccurate initial assumptions, to adapt to changes in environmental conditions, and to respond to subsequent monitoring information that indicates that desired conditions are not being met (USDA FS 2011, 2012). With this objective in mind, vegetation treatments were designed to have a range of treatment types and intensities. Having a range of treatment options helps to implement a treatment that best responds to the site-specific resource condition and most effectively allows movement toward desired conditions.

Related documents that were part of the final proposed action alternative (and subsequent alternatives) include the implementation plan (appendix D) and the monitoring and adaptive management plan (appendix E) developed in collaboration with the 4FRI stakeholders. The purpose of the implementation plan is to ensure that actions taken under adaptive management are consistent with the predicted effects and the decision. The incremental changes to the proposed action and alternatives is documented in the project record and incorporated by reference in accordance with40 CFR 1502.21 (36 CFR 220.5(e)(1)).

Summary of Final Proposed Action

A summary of the final proposed action (alternative B) is presented here. See chapter 2, alternative B for additional details.

The Coconino and Kaibab NFs propose to conduct approximately 583,330 acres of restoration activities over approximately 10 years or until objectives are met. On average, 45,000 acres of vegetation would be mechanically treated annually. On average, 40,000 to 60,000 acres of prescribed fire would be implemented annually across the two national forests (within the treatment area). Up to two prescribed fires[9] would be conducted on all acres proposed for treatment over the 10-year period.

[9] A single prescribed fire may include burning piles and a follow-up broadcast burn. Prescribed fire would be implemented as indicated by monitoring data to augment wildfire acres, with the expectation that desired conditions would require a fire return interval of about 10 years.

Restoration activities would:

- Mechanically cut trees on approximately 384,966 acres. This includes: (1) mechanically treating trees up to 16 inches d.b.h. within 18 Mexican spotted owl PACs and, (2) using low-severity prescribed fire within 70 Mexican spotted owl PACs (excluding core areas).
- Apply prescribed fire on approximately 384,966 acres where mechanical treatment occurs.
- Use prescribed fire only on approximately 198,364 acres.
- Construct approximately 520 miles of temporary roads for haul access and decommission the roads when treatments are complete (no new permanent roads would be constructed).
- Reconstruct up to 40 miles of existing, open roads for resource and safety concerns (no new permanent roads would be constructed). Of these miles, approximately 30 miles would be improved to allow for haul (primarily widening corners to improve turn radiuses) and about 10 miles of road would be relocated out of stream bottoms. Relocated roads would include rehabilitation of the moved road segment.
- Decommission 726 miles of existing system and unauthorized roads on the Coconino NF.
- Decommission 134 miles of unauthorized roads on the Kaibab NF.
- Restore 74 springs and construct up to 4 miles of protective fencing.
- Restore 39 miles of ephemeral channels.
- Construct up to 82 miles of protective (aspen) fencing.
- Allocate and manage as old growth 40 percent of the ponderosa pine type and 77 percent of the pinyon-juniper woodland on the Coconino NF.
- Manage and develop uneven-aged stands with a representation of old growth components across most of the project area on the Kaibab NF.

No forest plan amendments would be needed on the Kaibab NF. The proposed actions are consistent with forest plan objectives, desired conditions, and standards and guidelines. Three nonsignificant forest plan amendments (see appendix B) would be required on the Coconino NF to implement alternative B:

Amendment 1 would add language to allow mechanical treatments up to 16 inches d.b.h. to improve habitat structure (nesting and roosting habitat) in 18 Mexican spotted owl PACs. The amendment would remove language that limits PAC treatments in the recovery unit to 10 percent increments and language that requires the selection of an equal number of untreated PACs as controls. The amendment would remove language referencing pre- and post-treatment population and habitat monitoring. Replacement language would defer final project design and monitoring to the U.S. Fish and Wildlife Service biological opinion specific to Mexican spotted owl for the project. The amendment, which is specific to restricted habitat in pine-oak, would add definitions of target and threshold habitat.

Amendment 2 would add the desired percentage of interspace within uneven-aged stands to facilitate restoration in goshawk habitat (excluding nest areas), add the interspace distance between tree groups, add language clarifying where canopy cover is and is not measured, allow 28,952 acres to be managed for an open reference condition, and add a definition to the forest plan glossary for the terms interspaces, open reference condition, and stands.

Amendment 3 would remove the cultural resource standard that requires achieving a "no effect" determination and would add the words "or no adverse effect" to the remaining standard. In effect, management would strive to achieve a "no effect" or "no adverse effect" determination

Figure 22 through figure 24 provide a coarse-scale overview of restoration treatment locations. Please refer to the description of alternative B (proposed action alternative) in chapter 2 for details that include tables and maps that display proposed treatments.

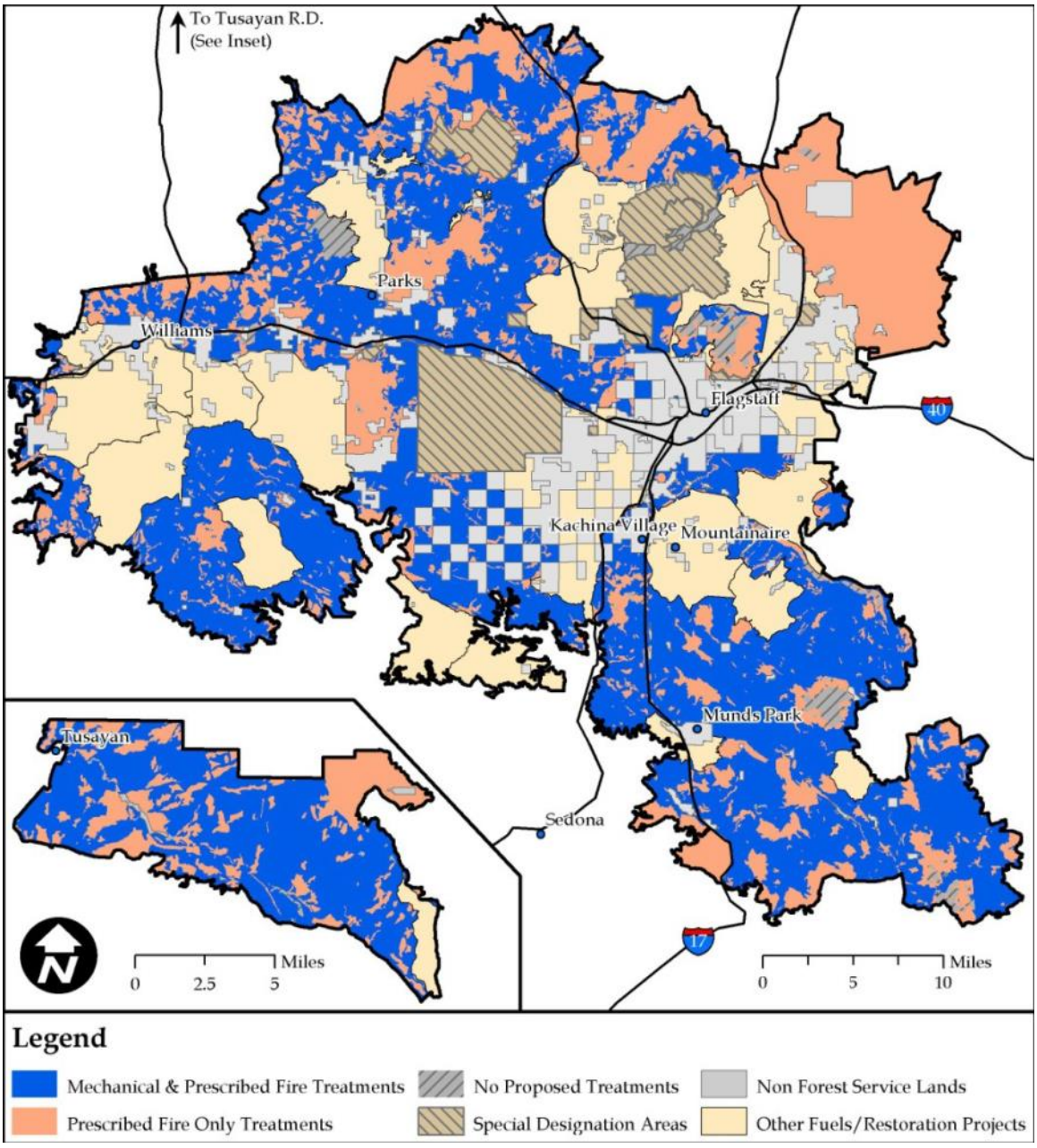

Figure 22. Final proposed action; general locations of mechanical and prescribed fire treatments

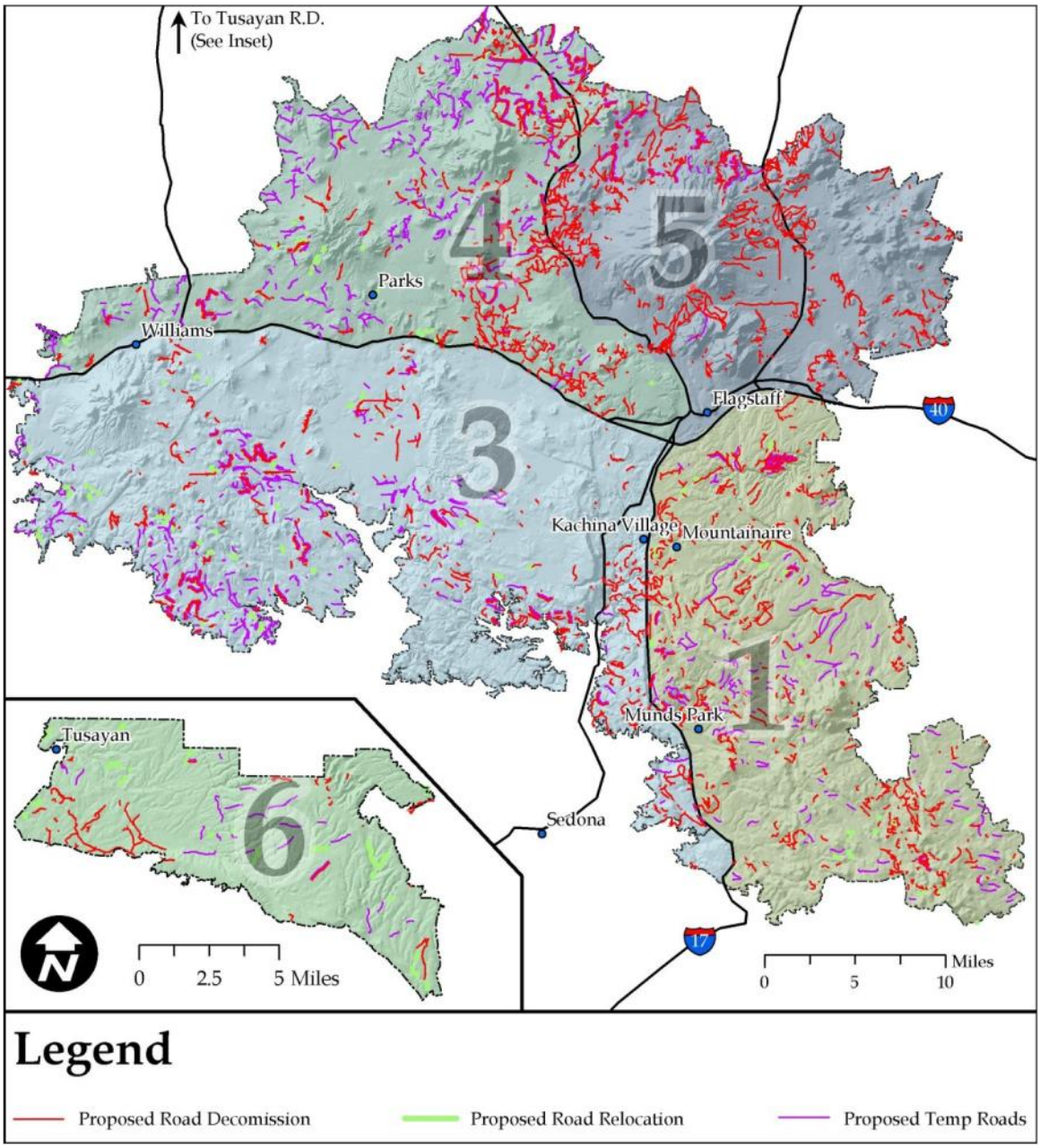

Figure 23. Final proposed action; general locations of road activities by RU

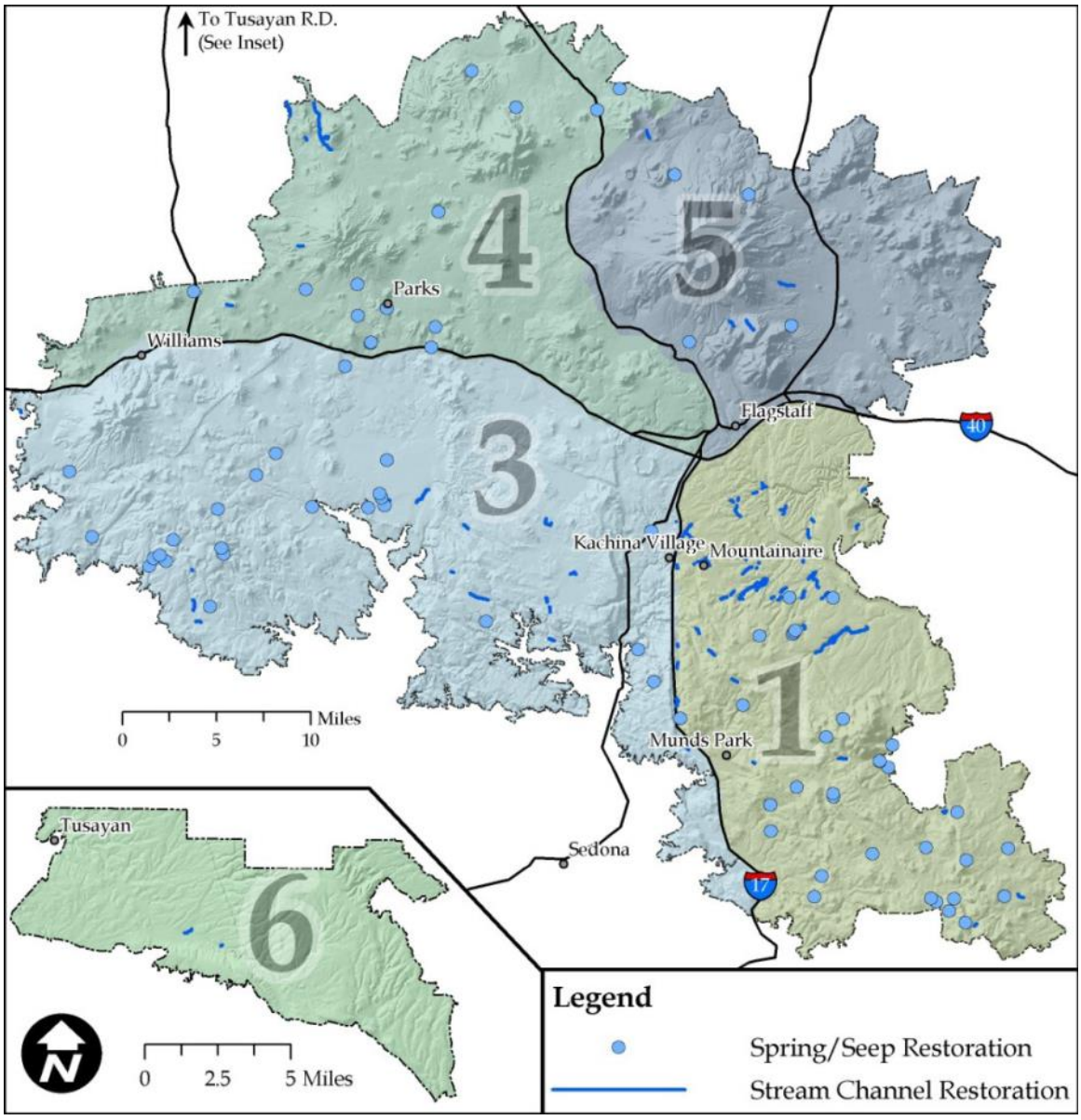

Figure 24. Final proposed action; general location of spring and ephemeral channel restoration actions by restoration unit (RU)

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