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4FRI Rim Country Project

Final Environmental Impact Statement

Volume 2



Cover photo: Storm on the Rim, Apache-Sitgreaves National Forests

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Chapter 3. (Continued) Affected Environment and Environmental Consequences

This chapter summarizes the physical, biological, social, and economic environments of the project area and the effects of implementing each alternative on that environment. Only summaries are provided here for each resource area. All specialist reports in their entirety are incorporated by reference and are available on the 4FRI Rim Country webpage at: www.fs.usda.gov/goto/4FRIRimCountry.

Air Quality

Affected Environment

Nuisance Smoke

"Nuisance Smoke" is defined in the Arizona State Implementation Plan as "Amounts of smoke in the ambient air which interfere with a right or privilege common to members of the public, including the use or enjoyment of public or private resources" (Arizona Regional Haze State Implementation Plan, 2011, Appendix A-10, page 35).

Nuisance smoke often results in public reports or complaints about smoke. Nuisance smoke can range from people seeing smoke on the horizon, to persons who are concerned about possibly being exposed to smoke, and to people being affected by smoke exposure and breathing smoke. The State of Arizona's Smoke Management Program is tasked with overseeing the documentation and investigation of smoke complaints and with verifying the severity of smoke impacts and the potential for or actual occurrence of exceedances of the health standards.

Public tolerance for smoke, in addition to law, regulation, or policy, effectively sets a social limit to how many acres are treated with wildland fire and prescribed fire. The ADEQ and other agencies respond to public inputs by trying to minimize impacts, even when they are well within legal limits. Community public relations and education coupled with pre-burn notification greatly improve public acceptance of fire management programs. The general public will tolerate several days in a row, and several weeks a year, but even the most supportive and educated have tolerance limits (Kleindienst 2012). To maintain public support for prescribed burns and the beneficial use of wildfires, land managers must be responsive to the public's tolerance thresholds.

Public acceptance of smoke varies greatly from year to year. Acceptance of smoke from prescribed fires and beneficial wildfires is high following seasons with high profile, high-severity wildfire events, and during extremely dry years when the threat of large, high-severity incidents is elevated. Conversely, acceptance wanes during wetter years when the threat of uncharacteristic fires is low, despite climatology in milder years being more favorable for achieving desired fire effects, especially in areas highly departed from natural or reference conditions (Kleindienst 2012).

Air Quality Health Standards

National Ambient Air Quality Standards

The Clean Air Act, which was last amended in 1990, requires the EPA to set National Ambient Air Quality Standards (40 CFR part 50) for pollutants considered harmful to public health and the

environment. The Clean Air Act identifies two types of national ambient air quality standards. Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

The EPA has set National Ambient Air Quality Standards (NAAQS) for six principal pollutants, which are called "criteria" air pollutants and they include carbon monoxide (CO), lead, nitrogen dioxide, ozone, particulate matter less than 10 microns in size (PM10), particulate matter less than 2.5 microns in size (PM2.5), and sulfur dioxide.

Periodically, the standards are reviewed and may be revised.[1] The current standards are listed in Table 1. The project is in a NAAQS non-attainment area.[2] The Payson area in Gila County is in moderate non-attainment for particulate air pollution (PM10 1987). In addition, there are several non-attainment areas to the south and southwest outside of the project area (EPA 2021).

Pollution from distant, large population centers in Arizona and California affects the air quality in the area. Large dust storms that occur in the Phoenix valley can produce large amounts fugitive dust that have also been known to affect air quality in northern Arizona, but these events are generally limited to a few days a year. Ozone levels are increasing, and are trending up in northern Arizona (Kleindienst 2012). Natural background ozone concentrations are naturally high in the West; transport from industry and large urban areas in Arizona and California and other non-local sources also contributes significantly (Tong and Mauzerall 2008; Koo et al. 2010). Under certain weather conditions, smoke from wildfires has the potential contribute to the formation of ozone. As yet, data on how much ozone is created from the precursor pollutants emitted in wildland fire smoke, or prescriptive criteria to deter ozone creation are not available.

[1] (1) In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m3 as a calendar quarter average) also remain in effect.

(2) The level of the annual NO2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

(3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

(4) The previous SO2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO2 standards or is not meeting the requirements of a State Implementation Plan call under the previous SO2 standards (40 CFR 50.4(3)). A State Implementation Plan call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

[2] Nonattainment Areas are designated by EPA based upon air quality monitoring data or modeling studies that indicate an area violates, or contributes to violations of the NAAQS. States are required to submit a State Implement Plan, which defines the strategies used to control air pollution in order to bring air quality into attainment. After air quality improves and no longer violates the NAAQS, EPA may re-designate the area as attainment and these areas are known as maintenance areas. The Clean Air Act and EPA regulations impose requirements for Federal agencies to work with State and local governments in nonattainment and maintenance areas to ensure that federal actions conform to the initiatives established in the applicable State Implementation Plan. These regulations are defined under the Clean Air Act General Conformity Rule.

Wildland fires produce carbon monoxide, PM2.5, PM10, nitrogen oxides, and sulfur dioxide criteria air pollutants. The U.S. Air Quality Index is the EPA's index for reporting air quality to the public. The AQI is divided into six categories. EPA establishes an AQI for five major air pollutants regulated by the Clean Air Act. Each of these pollutants has a national air quality standard set by EPA to protect public health:

- ground-level ozone
- particle pollution (also known as particulate matter, including PM2.5 and PM10)
- carbon monoxide
- sulfur dioxide
- nitrogen dioxide

The ADEQ displays real time particulate monitoring data for monitoring stations near the Rim Country Project at this website: https://www.phoenixvis.net/PPMmain.aspx

Table 1. AQI basics table for ozone and particulate pollution

Daily AQI Color	Levels of Concern	Values of Index	Description of Air Quality
Green	Good	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Yellow	Moderate	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Orange	Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Red	Unhealthy	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Purple	Very Unhealthy	201 to 300	Health alert: The risk of health effects is increased for everyone.

Figure 1, Figure 2, Figure 3, Figure 4, and Figure 5 show AQI information for all monitored criteria air pollutants from 1995-2020 in Apache, Coconino, Gila, Navajo, and Yavapai Counties. The figures show improving air quality conditions in the counties except for Gila County that is impacted by emissions from copper mining operations and transport pollutants from the Phoenix metropolitan area. In addition, except for Gila County, most of the air pollution impacts occur from approximately March-September when ground level ozone levels are highest (EPA 2021c).

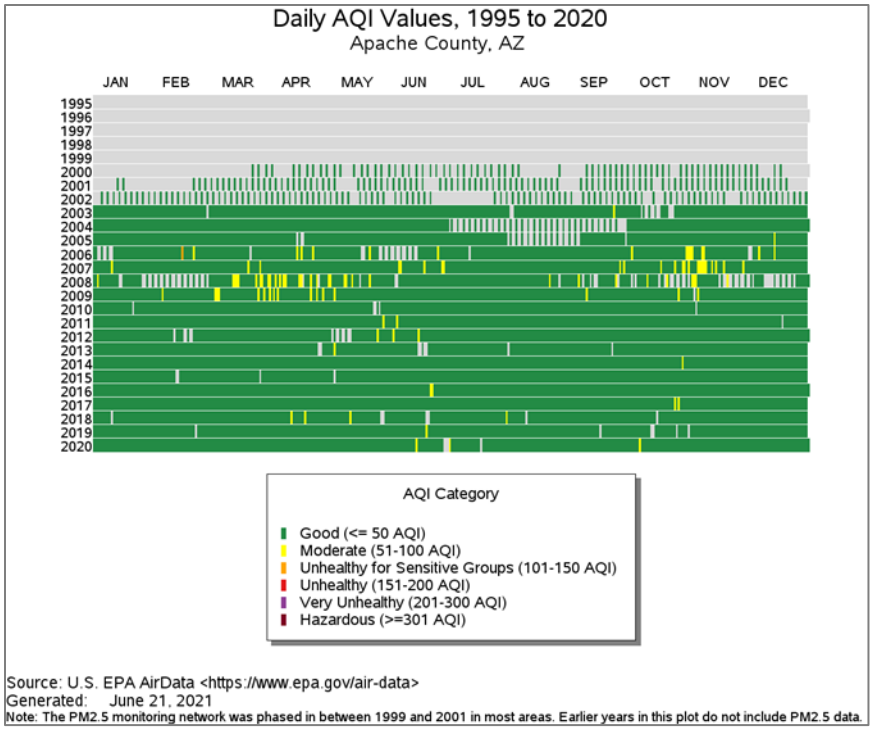


Figure 1. Apache County AQI values 1995-2020

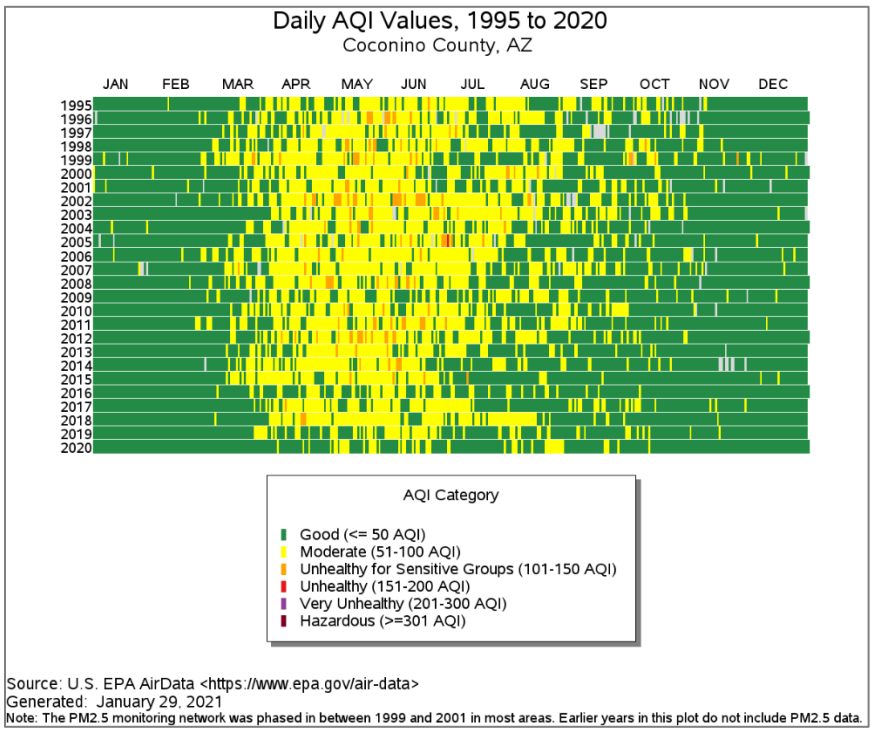


Figure 2. Coconino County AQI values 1995-2020

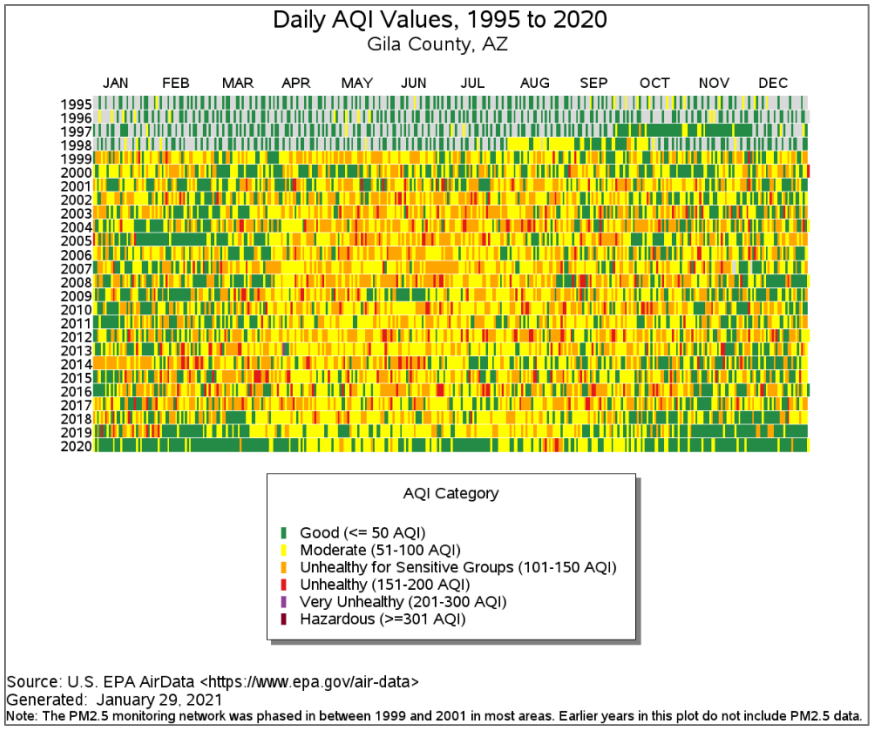


Figure 3. Gila County AQI values 1995-2020

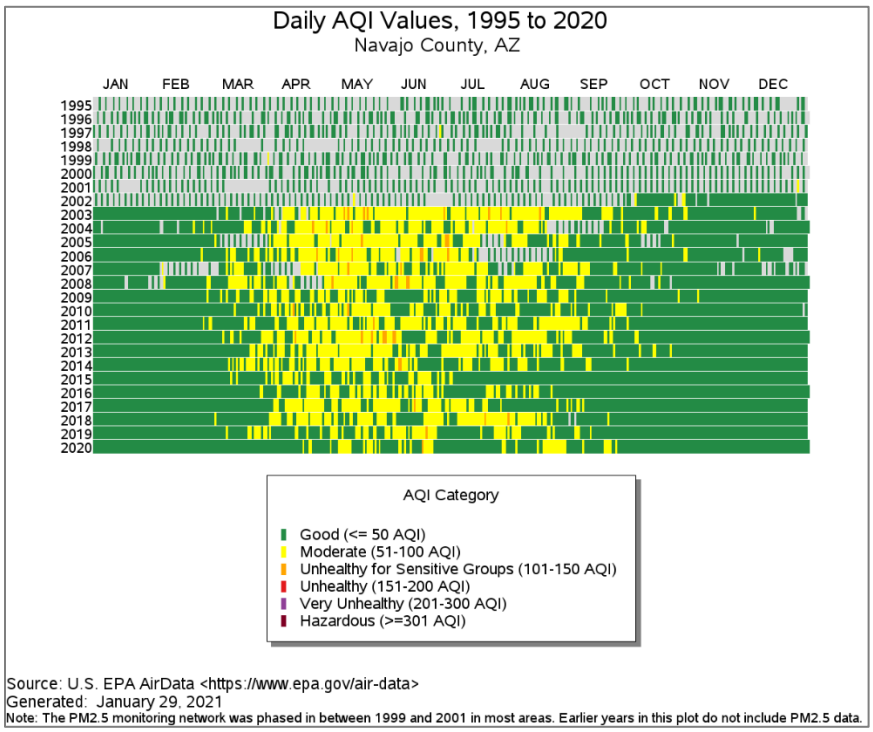


Figure 4. Navajo County AQI values 1995-2020

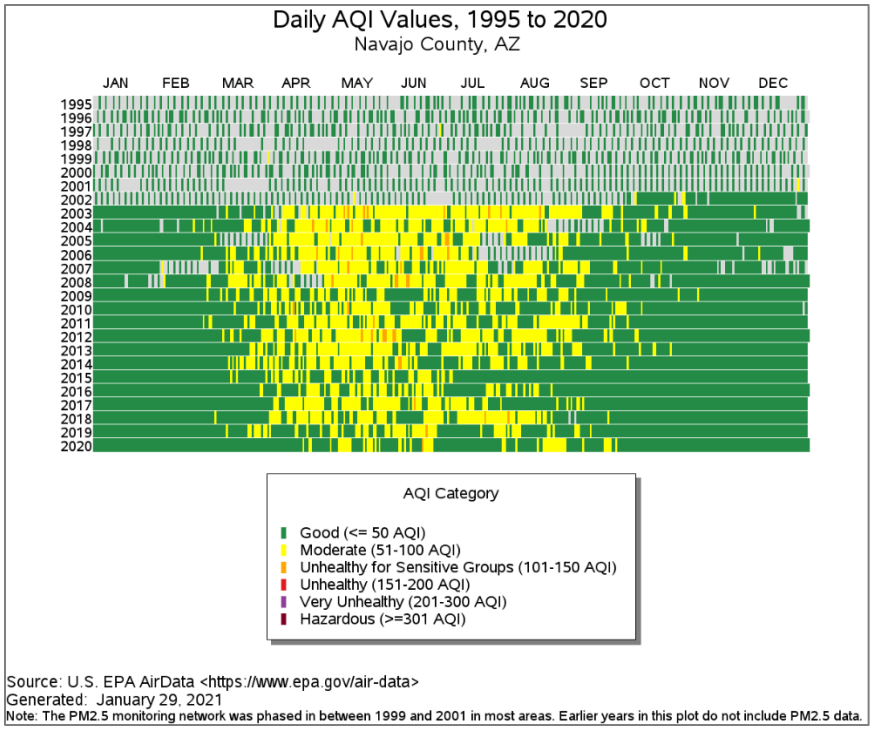


Figure 5. Yavapai County AQI values 1995-2020

Smoke Sensitive Areas

The Regional Haze State Implementation Plan for Arizona defines 'sensitive receptors' as "population centers such as towns and villages, campgrounds and trails, hospitals, nursing homes, schools, roads, airports, mandatory Class I Federal areas, where smoke and air pollutants can adversely affect public health, safety, and welfare" (Arizona State Implementation Plan, Appendix A-10 page 36). Several smoke sensitive areas, or sensitive receptors lay within the airsheds of the areas proposed for treatment (Table 2). These areas may have smoke sensitive receptors including hospitals, long term care facilities, schools, young children, and elders. The list is not inclusive, and we recognize that there are several communities within, adjacent, or sometimes downwind of the project that are likely to have some effects of smoke from Rim Country activities and are not listed.

Table 2. Smoke sensitive areas

Area	Proximity to Implementation Area
Apache County	Downwind east/northeast of the project area
Verde Valley	Less than 10 miles downslope south and southwest of project area
The Navajo Reservation	Northeast and east of the project area
Fort Apache Reservation	Adjacent to project area to the south and east
The Hopi Reservation	Northeast and east of the project area
Snowflake / Taylor	About 15 miles north of the project area
Tonto Basin /Roosevelt	About 10 miles south southwest of the project area
Show Low	Project area to the east and west of Show Low
Heber Overgaard	Project area is adjacent to town in multiple directions

Area	Proximity to Implementation Area
Strawberry / Pine	Project area is on all sides of both towns
Blue Ridge	Project area is on all sides of the developed areas
Pinetop/Lakeside	Project area is on all sides of the project area
Payson	Project area is on all sides of the project area

Meteorological and Topographical Effects on Air Quality

Topography and weather patterns determine the extent to which airborne particulate matter accumulates within local airsheds and the capacity of the atmosphere to disperse pollutants. Diurnal temperature changes affect how pollutants in the region are dispersed. Meteorological conditions limit how much smoke an airshed can absorb at any point in time without exceeding NAAQS. During the warmest days and seasons of the year, air is heated at the surface, and rises, lifting smoke up to heights where transport winds carry it away and disperse it during the daily burn periods. Winds in the project area are predominantly from the south and southwest (Figure 6) and, as such, during daytime hours, fire activities within the Rim Country treatment area are most likely to affect smoke sensitive receptors to the north and northeast of fire locations (DRI 2021).

The best windows for smoke dispersal are when the atmosphere is unstable, allowing smoke to rise up high and disperse. These conditions, when combined with low fuel moistures and high fuel loading, can also lead to undesirable fire behavior and effects. The best dispersal days are often too extreme for prescribed fire. Overnight, winds often become calm, allowing topographic effects to dominate smoke movement. As the temperature decreases, air flows downhill, carrying smoke from fires and which often pools in low lying areas until the air warms again the next day. Because most communities are located in valley or canyon bottoms nighttime settling of smoke from fires generally generates more concerns and complaints of nuisance smoke compared to daytime smoke (NWCG 2018).

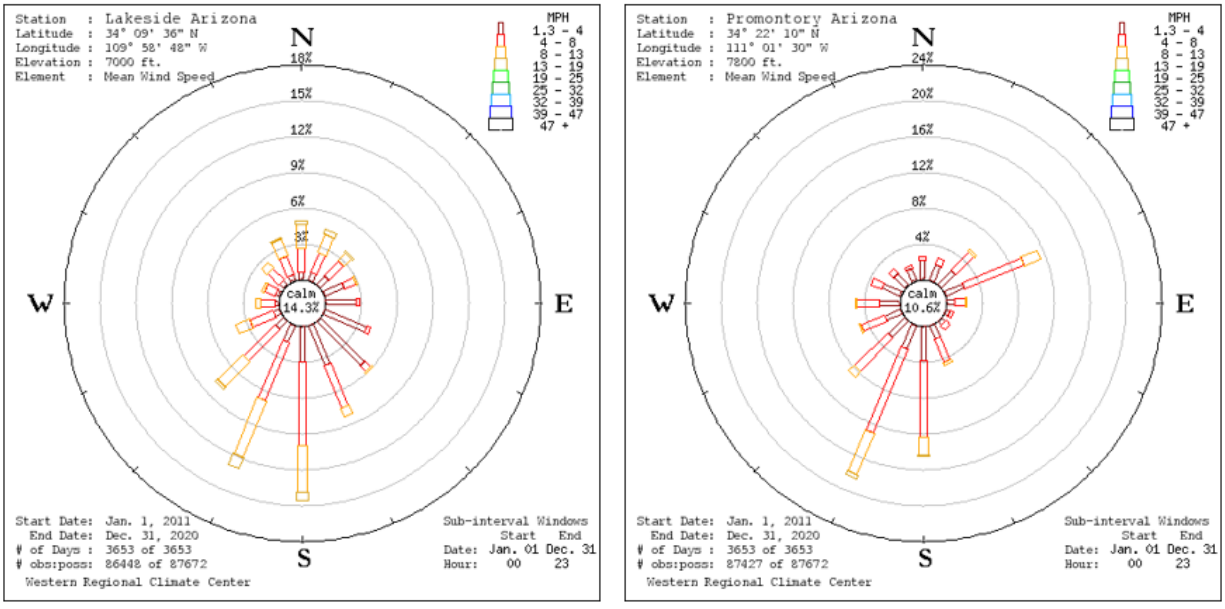


Figure 6. Lakeside and Promontory weather stations wind roses showing 24 hour or daily wind direction and speed over 10 years from 2011-2020. The bars show the direction the wind is blowing from.

During the winter, weather conditions can trap emissions in a layer of cold surface air or inversions. Under these conditions, particulates can be trapped close the surface in local airsheds, including the communities of Flagstaff, Young, Payson, Pumpkin Center, Roosevelt, St. John, and the Verde Valley.

Smoke Emissions – Criteria Air Pollutants

Sources of Air Pollution

Forest Service management activities with the largest direct effects on air quality are prescribed fires. From 1995-2018 the acreages of prescribed fire have increased across all three National Forests, though the actual amount fluctuates from year to year (Figure 7).

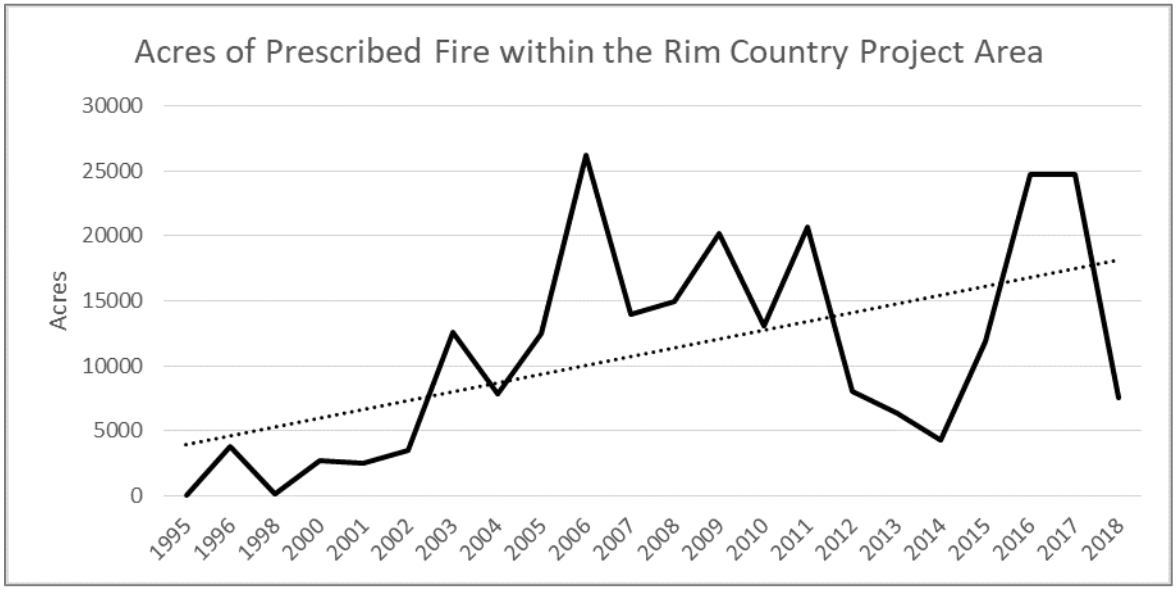


Figure 7. Acres of prescribed fire and trends for the Rim Country Project area from 1995-2018

Table 3 shows data from the 2017 National Emissions Inventory for annual criteria air pollutant emissions from various sources at the county, state and national levels for comparing to Rim Country annual emissions. The data includes emissions from wildfires, prescribed fires and agricultural field burning and total emissions from all polluting sources. The information is useful for comparing the potential project emissions with other sources in and around the Rim Country area (NEI 2017).

Table 3. Data from the 2017 National Emissions Inventory showing annual air pollutant emissions from various sources at the county, state and national levels for comparing to Rim Country annual emissions

Source - Geographic Area	Carbon Monoxide (tons per year)	PM2.5 (tons per year)	PM10 (tons per year)	Nitrogen Oxides (tons per year)	Sulfur Dioxide (tons per year)	Volatile Organic Compounds (tons per year)
Apache County	64,060.00	5,985	14,642.00	16,241.00	6,434.00	63,716.00
Coconino County – All Sources	217,728.5	16,310.2	27,990.8	16,352.1	1,193.4	135,338.3
Gila County – All Sources	51,468.8	4,450.6	10,961.9	3,428.6	24,736.8	53,066.8
Navajo County – All Sources	40,838.2	3,443.7	14,348.1	10,952.0	1,860.5	49,465.4
Yavapai County – All Sources	70,904.3	4,724.4	18,222.8	11,521.7	1,927.9	62,638.8

Source - Geographic Area	Carbon Monoxide (tons per year)	PM2.5 (tons per year)	PM10 (tons per year)	Nitrogen Oxides (tons per year)	Sulfur Dioxide (tons per year)	Volatile Organic Compounds (tons per year)
Arizona – All Sources	1,423,957.5	84,891.2	253,704.9	187,586.9	52,185.2	1,095,958.3
National – All Sources	70,995,207.7	5,708,145.2	17,064,238.9	11,855,303.5	2,725,449.4	43,105,760.8
Apache County – Prescribed Fires	37,870.19	3,144.05	3,709.98	357	235.80	8,890.19
Apache County – Wildfires	917.31	81.05	95.64	15.12	7.69	217.15
Apache County – Agricultural Field Burning	-	-	-	-	-	-
Coconino County – Prescribed Fires	87,038.6	7,261.7	8,568.8	867.9	556.3	20,445.8
Coconino County – Wildfires	84,468.2	7,182.6	8,475.4	1,021.1	594.6	19,891.9
Coconino County – Agricultural Field Burning	-	-	-	-	-	-
Gila County – Prescribed Fires	6,731.3	565.5	667.3	72.3	44.6	1,582.7
Gila County – Wildfires	26,798.1	2,449.5	2,890.4	549.6	257.6	6,373.9
Gila County - Agricultural Field Burning	11.8	1.5	2.0	0.3	0.1	1.2
Navajo County – Prescribed Fires	12,840.6	1,056.8	1,247.0	108.9	76.2	3,011.0
Navajo County – Wildfires	1,521.0	129.6	152.9	18.7	10.8	358.3
Navajo County - Agricultural Field Burning	-	-	-	-	-	-
Yavapai County – Prescribed Fires	2.164.8	189.5	223.6	33.3	17.4	511.8
Yavapai County – Wildfires	18,658.9	1,738.3	2,051.2	425.9	192.6	4,450.1
Yavapai County - Agricultural Field Burning	7.1	0.5	0.9	0.3	0.1	1.2
Arizona – Prescribed Fires	154,560.6	12,936.7	15,265.3	1,596.1	1,004.7	36,322.4
Arizona – Wildfires	369,187.8	32,221.9	38,021.8	5,557.9	2,933.6	87,248.1
Arizona - Agricultural Field Burning	1,772.1	201.2	282.7	57.1	18.4	214.6
National – Prescribed Fires	8,870,309.4	805,307.1	948,309.5	164,697.2	78,190.6	2,042,074.8
National – Wildfires	19,487,071.8	1,655,210.7	1952,987.6	230,541.0	135,352.6	4,577,921.8
National - Agricultural Field Burning	301,034.7	30,776.1	42,932.8	12,705.9	4,236.9	38,061.1

Comparing Wildfire to Prescribed Fire

Smoke is inevitable in the airsheds of fire-adapted ecosystems, such as those of northern Arizona. Federal land managers have the role of protecting and meeting air quality standards while simultaneously allowing fire, as nearly as possible, to function in its natural role in the ecosystem (USDA and USDOI 1995). Smoke and visibility impairment from wildland fire that closely mimics what would occur naturally is generally viewed as acceptable (Peterson 2001).

Currently, controlled prescribed burns are regulated and their emissions are monitored and regulated in the same manner as emissions sources that are more controllable (such fugitive dust, vehicle emissions, smoke from wood-burning stoves, and industrial emissions), and included in air quality assessments used to approve burn plans. Smoke impacts from wildfire can be more difficult or impossible to mitigate compared to prescribed fire. Among the many factors the federal land management agencies should weigh

when deciding whether to ignite a prescribed fire is whether the potential benefits of the fire outweigh the smoke affects or impacts. Prescribed fires and wildfires both produce smoke, but differ in the amount, timing, and predictability of these events (table 4). Most wildfires in the southwest occur between late April and mid-September. Currently, most prescribed fires are implemented in the early spring or late fall.

Fire managers can manage smoke impacts to some degree by implementing prescribed fire when metrological conditions are favorable. It may be possible to minimize burning and/or hold a fire in check on days when reduced emissions are needed. It can be advantageous to blackline a prescribed burn unit well in advance of burning the entire unit to take advantage of burn windows with good ventilation. Various Emissions Reductions Techniques and Smoke Management Techniques are utilized and documented as a standard part of implementing prescribed fires as required by ADEQ rules (ADEQ 2004).

Table 4. Generalized comparison of options for managing prescribed fire and wildfire

Emission Characteristics	Prescribed Fire	Wildfire
Predictability of when smoke events occur	Predictable	Somewhat predictable to unpredictable
Predictability of the **severity** (concentration) of smoke impacts	Predictable	Somewhat predictable to unpredictable
Predictability of **where** there will be smoke impacts	Mostly predictable	Somewhat predictable to unpredictable (knowing where a fire will start)
Controllability of smoke	Mostly controllable	Mostly controllable to uncontrollable
Duration of smoke events	Days or weeks	Days, weeks, or months
Frequency of smoke events	Intermittent to frequent and increasing	Intermittent to frequent during the fire season, likely to increase
Severity/desirability of the effects of the fire	Mostly desirable	Mostly desirable to mostly undesirable
Longevity of negative effects	Short to moderate	Short to permanent
Extent of negative effects	Small, unlikely to be more than a few contiguous acres if it occurs	Variable, ranging from less than an acre to hundreds of thousands of acres
Potential for significant negative effects (other than smoke), such as downstream flooding or damage to infrastructure outside the fire perimeter	Low, but present	Low to very high
Threat to human life and property	Low, but present	Low to very high

Activities on prescribed fires and wildfires in an airshed are coordinated between fire managers, working with the Arizona Department of Air Quality, to either spread high emission producing events from multiple wildland fires over several days to reduce the concentration of pollutants, or facilitate these events to occur simultaneously on days with favorable ventilation to move the pollutants up and out of the airshed all at once to reduce the concentration and duration of smoke impacts.

Actual smoke effects are dependent on numerous factors, some predictable, some less so. Air quality effects are more closely related to ventilation parameters, live and dead fuel moisture, wind direction and speed, fuel chemistry, firing techniques, timing and duration of ignition, fuel arrangements and loading, atmospheric stability, than the Rim Country alternatives.

Smoke can travel great distances and affect communities far away from the burn unit, often persisting for a time after the burn has been completed. Fires burning under historic conditions in the vegetation types

targeted for restoration treatments in this analysis produce behavior and effects that are mostly low to moderate. Large, uncharacteristically high-severity fires usually create more emissions over a longer time that prescribed fires, because of differences in the size and duration of the fires (Hardy et al. 2001) and the amount of fuel consumed.

Prescribed burning is implemented only with approved site-specific burn plans and with smoke management mitigation and approvals. All burning is conducted according to ADEQ rules, including the legal limits to smoke emissions from prescribed burns as imposed by Federal and State Law. The ADEQ enforces these rules by regulating acres that are treated based on expected air effects. These rules ensure that effects from all burning within the area are mitigated and that Clean Air Act requirements are met. Prescribed fires are initiated under conditions that allow managers to meet both control objectives (fire behavior), and resource objectives (fire effects, including air quality effects).

Smoke Emissions – Greenhouse Gas Emissions - Climate Change

Table 5 shows data from the 2017 National Emissions Inventory for annual greenhouse gas emissions from various sources at the county, state, and national levels for comparing to Rim Country annual emissions. The data includes emissions from wildfires and prescribed fires and total emissions from all polluting sources. The information is useful for comparing the potential project emissions with other sources in and around the Rim Country area (NEI 2017).

Table 5. Data from the 2017 National Emissions Inventory showing greenhouse gas emissions from various sources at the county, state and national levels for comparing to Rim Country annual emissions[3]

Source - Geographic Area	Carbon Dioxide (tons per year)	Methane (tons per year)	Nitrous Oxide (tons per year)	CO2e* (tons per year)
Apache County	15,150,672	3,547	251	15,353,162
Coconino County – All Sources	3,538,513	12,007	33	3,980,562
Gila County – All Sources	970,517	1,727	14	1,036,949
Navajo County – All Sources	6,121,739	5,881	115	6,367,851
Yavapai County – All Sources	4,414,659	4,253	63	4,586,517
Arizona – All Sources	85,815,904	81,357	2,381	89,454,179
National – All Sources	5,381,953,222	6,247,460	142,348	5,649,281,475
Apache County – Prescribed Fires	358,725	1,820	-	424,231
Apache County – Wildfires	12,287	45	-	13,907
Coconino County – Prescribed Fires	850,657	4,192	-	1,001,572
Coconino County – Wildfires	924,980	4,106	-	1,072,805
Gila County – Prescribed Fires	68,677	325	-	80,388
Gila County – Wildfires	418,981	1,351	-	467,604
Navajo County – Prescribed Fires	114,815	614	-	136,932
Navajo County – Wildfires	16,831	74	-	19,495
Yavapai County – Prescribed Fires	27,696	107	-	31,539
Yavapai County – Wildfires	315,809	950	-	349,996

[3] The 2017 NEI does not have data for Nitrous Oxide emissions available for prescribed and wildfire sources.

Source - Geographic Area	Carbon Dioxide (tons per year)	Methane (tons per year)	Nitrous Oxide (tons per year)	CO2e* (tons per year)
Arizona – Prescribed Fires	1,541,085	7,456	-	1,809,495
Arizona – Wildfires	4,652,066	18,180	-	5,306,541
National – Prescribed Fires	120,709,651	437,280	-	136,451,741
National – Wildfires	208,941,083	945,704	-	242,986,414

*CO2e or carbon dioxide equivalent is a term for describing different greenhouse gasses in a common unit.

Visibility or Regional Haze

Under the Clean Air Act the 1999 Regional Haze Rule (40 CFR Parts 51 and 52) mandates that states address control of man-made air pollution that impacts visibility in designated Class I areas. Class I areas include wilderness, national parks and monuments greater than 5,000 acres which existed as of August 7, 1977 (Figure 8).

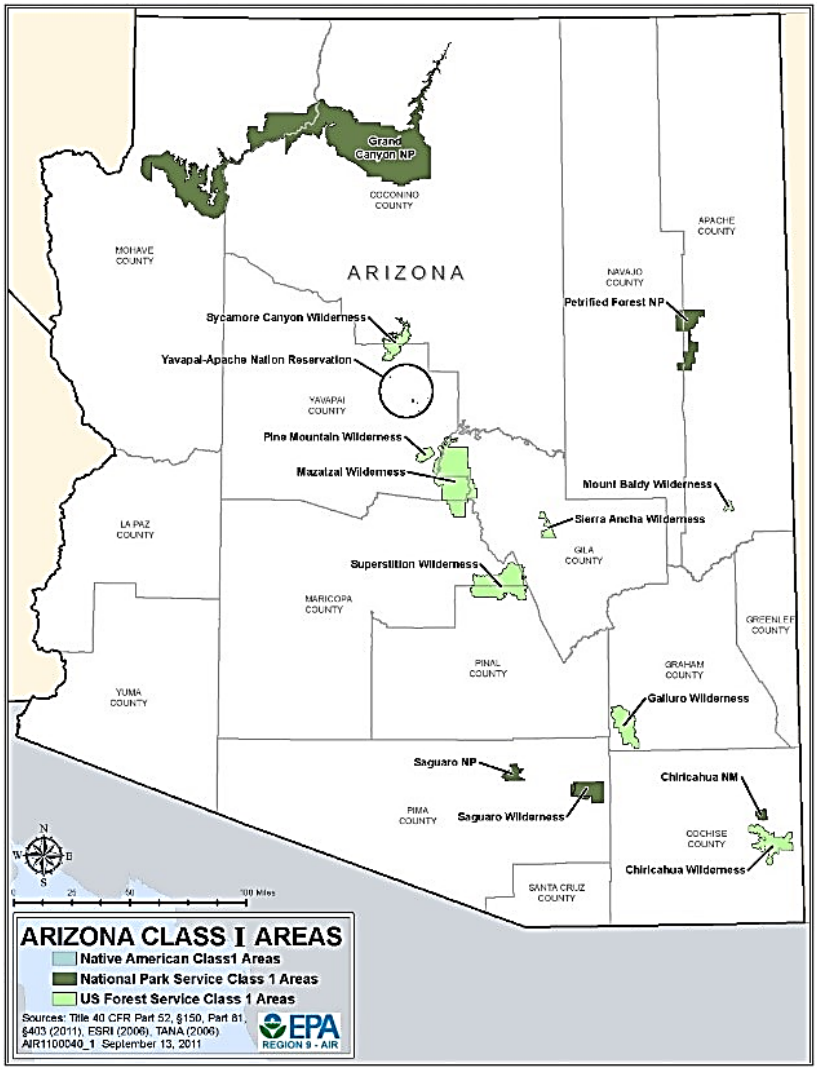


Figure 8. Arizona Class I Areas

The Class I areas most likely to be affected by smoke emissions from the Rim Country project area are Petrified Forest National Park, Mazatzal Wilderness, and Sierra Ancha Wilderness (Figure 9).

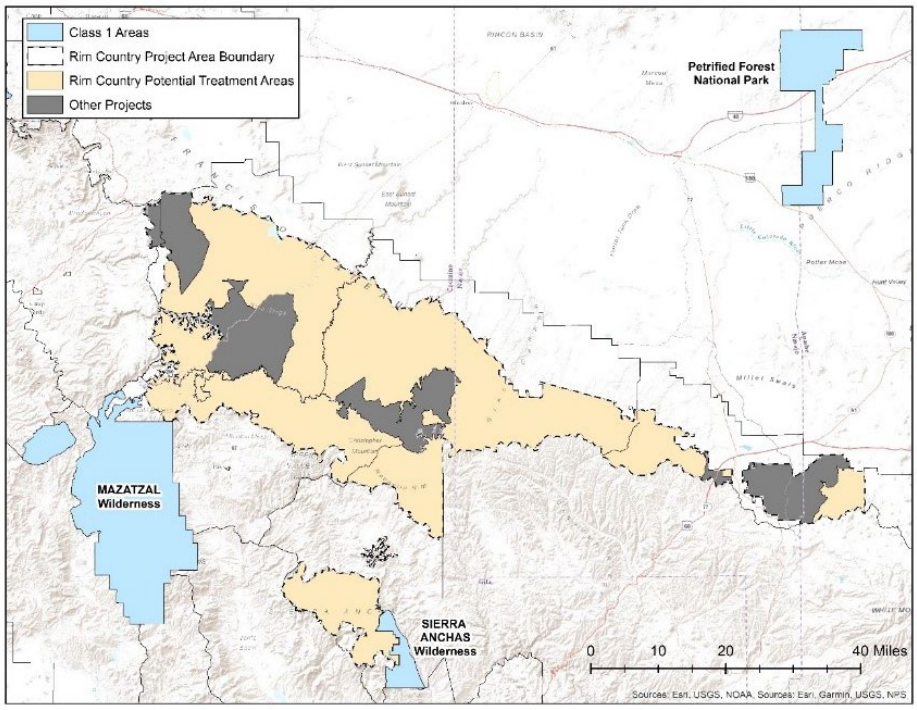


Figure 9. Class 1 areas with greatest potential to be affected by Rim Country smoke emissions

The goal of the Regional Haze Rule is to return visibility conditions in Class I areas to natural background conditions by the year 2064. EPA defines "regional haze" as visibility impairment produced by sources and activities that emit fine particles and their precursor emissions across a broad geographic area, which can interfere with the scenic vistas integral to our national parks, forests, and wilderness areas.

Under the Regional Haze Rule each area or state is given a reasonable progress goal for the 20 percent best and 20 percent most impaired days[4], which is reevaluated during each State Implementation Plan revision. The reasonable progress goalss incrementally reduce the amount of pollutants to ultimately reach a physical state termed "natural conditions" by 2064. Visibility values are expressed in deciviews, or a measurement based on perceptible change to the human eye. The Regional Haze Rule also includes requirements for periodic plan revisions and progress reports. Table 6 lists the Federal Class I areas in Arizona and their associated visibility values in deciviews (dv) (ADEQ 2015).

The Federal land management agencies responsibility with regard to visibility involves coordination with the EPA, and State, county, and tribal air regulatory agencies in managing and mitigating the emissions of air pollutants resulting from agency activities, such as the application of prescribed burning. If conditions

[4] Haziest, or worst visibility days include smoke from uncontrolled wildfires – something we cannot control. The new State Implementation Plan revisions are being based upon "most impaired days" and the new terminology replaces "worst visibility days".

prescribed by the Regional Haze Rule and the Arizona regional haze state implementation plan are met, visibility is expected to improve over time in and outside of the of the Rim Country area.

Table 6. List of the Federal Class I areas in Arizona and their associated visibility values in deciviews (dv)

Class I Area	20% Best Visibility Days - 2018 RPG (dv)	20% Best Visibility Days -2064 National Conditions (dv)	20% Worst Visibility Days- 2018 RPG (dv)	20% Worst Visibility Days- 2064 National Conditions (dv)
Chiricahua National Monument	4.77	1.83	13.19	7.20
Chiricahua Wilderness	4.77	1.83	13.19	7.20
Galiuro Wilderness	4.77	1.83	13.19	7.20
Grand Canyon National Park	2.02	0.31	11.02	7.04
Mazatzal Wilderness	5.07	1.91	12.63	6.68
Mount Baldy Wilderness	2.76	0.51	11.40	6.24
Petrified Forest National Park	4.62	1.07	12.64	6.49
Pine Mountain Wilderness	5.07	1.91	12.63	6.68
Saguaro National Park – East Unit	6.93	2.23	4.68	6.46
Saguaro National Park – West Unit	8.23	2.50	15.87	6.24
Sierra Ancha Wilderness	5.78	2.03	13.05	6.59
Superstition Wilderness	6.09	2.03	13.72	6.54
Sycamore Canyon Wilderness	5.39	0.98	14.92	6.65

According to the Interagency Monitoring of Protected Visual Environments (IMPROVE) data, the primary contributor to visibility impairment on the most impaired days for the Class I areas in and around the Rim County area is organic matter, which is often due to wildfire sources that are difficult to predict or control, but regulatory efforts can still have a positive impact on visibility by reducing other pollution sources.

Based on data from several years of data from the IMPROVE monitoring sites nearest to the Rim Country area the data is showing a gradual improvement in visibility (Figure 10, Figure 11, Figure 12, Figure 13, Figure 14, Figure 15, Figure 16, and Figure 17). Many emission reductions that are required as part of the Regional Haze State Implementation Plan process will occur over the next several years, so significant improvements in visibility should be seen in the next decade (IMPROVE 2021; ADEQ 2015).

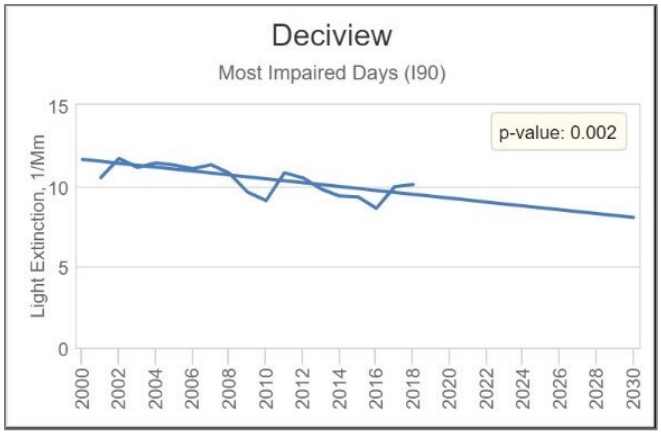


Figure 10. Ike's Backbone visibility on the most impaired days 2001-2018

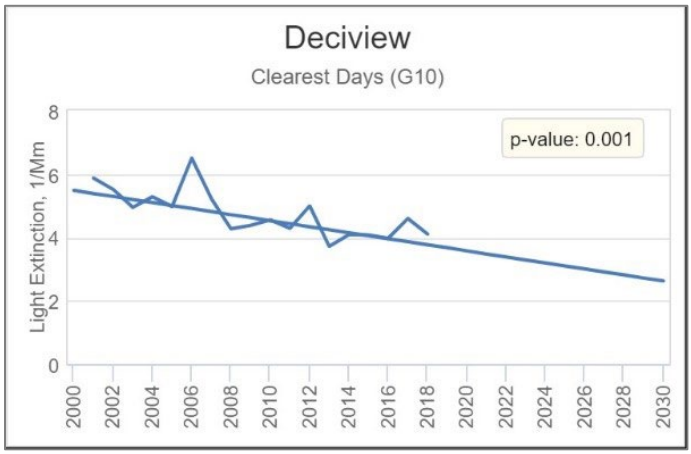


Figure 11. Ike's Backbone visibility on the clearest days 2001-2018

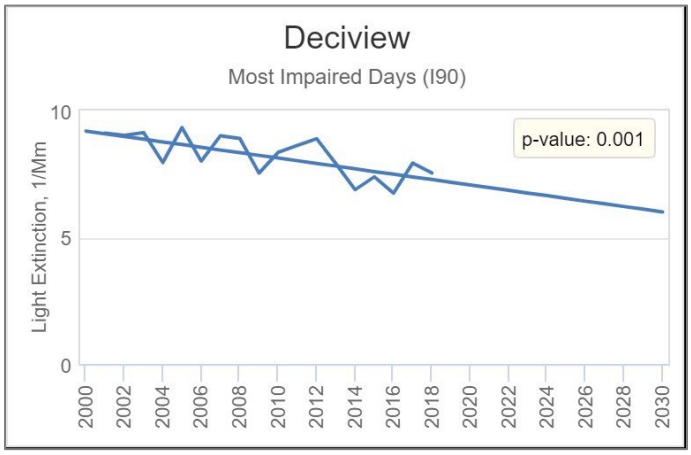


Figure 12. Mount Baldy visibility on the most impaired days 2001-2019

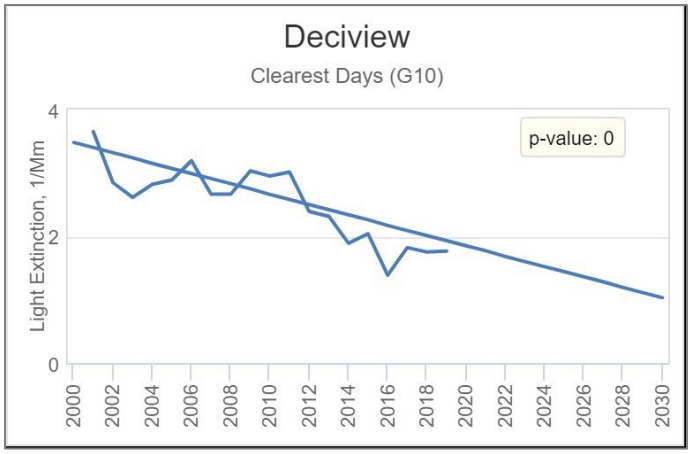


Figure 13. Mount Baldy visibility on the clearest days 2001-2019

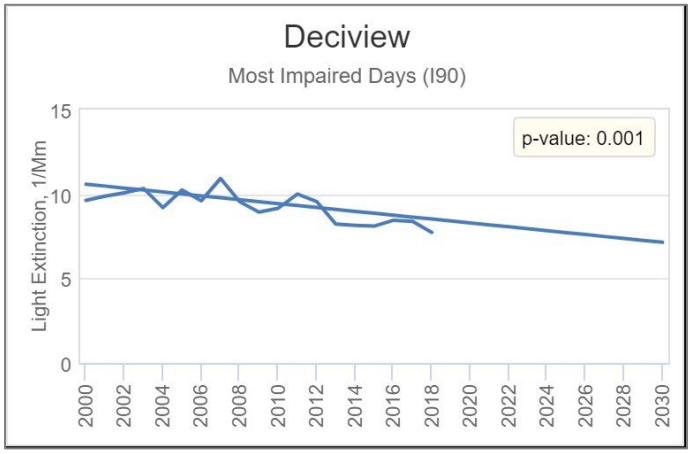


Figure 14. Petrified Forest National Park visibility on the most impaired days 1991-2019

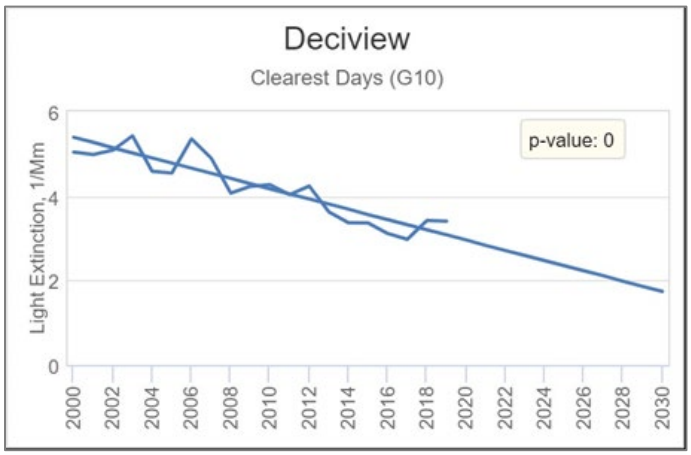


Figure 15. Petrified Forest National Park visibility on the clearest days 1991-2019

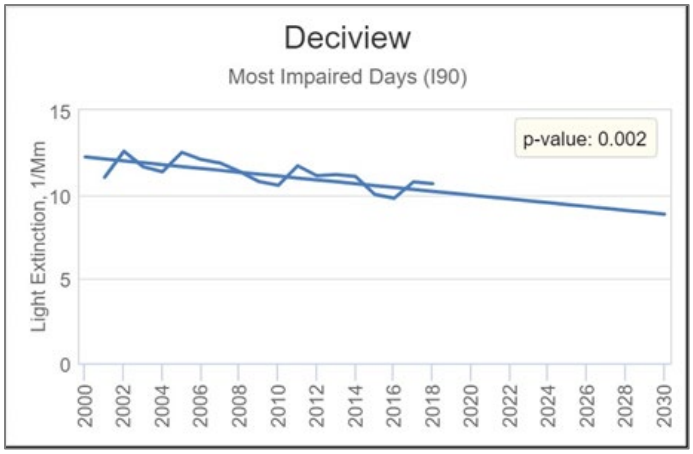


Figure 16. Tonto National Monument visibility on the most impaired days 1992-2019

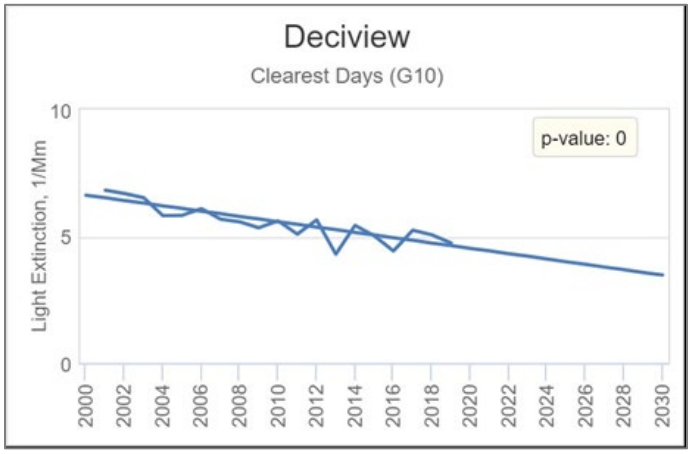


Figure 17. Tonto National Monument visibility on the clearest days 1992-2019

Wilderness Areas Air Quality Related Values

Air pollution affects the natural quality of Forest lands, particularly wilderness areas or Air Quality Related Values (AQRV). High ozone concentrations can injure sensitive vegetation. Fossil fuel burning emits sulfur dioxide (SO2) and nitrogen oxides (NOx) into the atmosphere. Certain types of agricultural activities, such as livestock grazing and dairy production, emit ammonia (NH3) to the atmosphere. Such emissions can lead to atmospheric deposition of sulfuric acids, nitric acids, and ammonium to national forest ecosystems above critical load thresholds. Atmospheric deposition can cause lake body acidification, eutrophication, and hypoxia, soil nutrient changes, and vegetation impacts. Deposition of toxic metals such as mercury and lead can be harmful to both aquatic and terrestrial ecosystems. Visibility in most national forests is obscured some portion of the year by anthropogenic haze of fine pollutant particles. In addition, the Clean Air Act requires Forest Service operations, visitor use, and permitted operations such as prescribed burning, fossil fuels development and production, and mining to comply with NAAQS and protection of AQRV (CASTNET 2021).

Ecological Effects of Smoke

Fire has historically played an important role in defining the character of ecosystems in northern Arizona. The cover types in the Rim Country analysis that are targeted for restoration treatments are adapted to frequent fire, often area-wide fires (Cooper 1960; Covington et al. 1997b; Kaib 2001; Fulé et al. 2003; Huffman 2017), indicating an even more frequent smoke regime. Research in northern Arizona has shown that the emergence of many species is enhanced by exposure to smoke from ponderosa pine needle litter (Abella 2006; Abella et al. 2007; Lata 2015).

From an ecological perspective, smoke effects are important to the germination of many native plants and, in some cases, appear to be more important than heat (Abella 2006; Abella et al. 2007; Schwilk and Zavala 2012; Lata 2015; Keeley and Pausas 2016). The composition of surface vegetative communities has shifted with fire suppression and changes to forest structure (Laughlin et al. 2011), and some of the changes may be attributable to the lack of smoke, or changes in the timing of smoke exposure (Abella 2006; Abella et al. 2007; Lata 2015). Many species with adaptations to smoke occur in the Rim Country project area, including, but not limited to, *Nama dichotomum*, *Heliomersis longifolia*, *Penstemon barbatus*, *Penstemon virgatum*, *Artemisia ludoviciana*, *Erigeron speciosus*, *Linum lewisii*, and *Symphyotrichum falcatum*. Pine needle smoke may also be a natural control for mistletoe and other tree infections (Parmeter and Uhrenholdt 1974; Alexander and Hawksworth 1976; Zimmerman and Laven 1987).

Issues, Indicators, and Analysis Topics

Issue 6 – Smoke/Air Quality

The proposed prescribed burning may have negative effects on air quality and human health. Some commenters are concerned that the smoke from prescribed burns would degrade air quality and the health of northern Arizona residents.

How Issue 6 is addressed

Alternative 3 was partially developed to respond to this issue. It includes fewer acres of prescribed burning than the other action alternatives. This issue was also addressed in a considered and eliminated from detailed study alternative that proposed even less prescribed fire (see FEIS chapter 2). This issue will be addressed in the effect's analysis for all alternatives. Design features or mitigation measures would be included as needed where current law, rules, rules and policy would not adequately minimize the effects on air quality from the proposed project prescribed burning.

Indicators/Measures

The potential for smoke emissions from proposed prescribed fire to affected communities will be evaluated qualitatively and quantitatively. Four main smoke effects will be evaluated: (1) nuisance smoke; (2) unhealthy smoke effects that would result from exceedances of the National Ambient Air Quality Standards (NAAQS) caused by project implementation burning. (It should be noted that uncontrolled smoke emissions from the project could cause NAAQS exceedances on clean air days or add to background air pollutant levels and increase air pollution to unhealthy amounts. Project smoke emissions from prescribed burning would be regulated by the Arizona Department of Environmental Quality in order to prevent exceedances of NAAQS); (3) effects to visibility or regional haze; and (4) greenhouse gas emissions.

A quantitative analysis of criteria air pollutant emissions to be modeled include the following: carbon monoxide (CO), nitrogen dioxide (NO2), particulate matter less than 10 microns in size (PM10), particulate matter less than 2.5 microns in size (PM2.5), and sulfur dioxide (SO2). The project's potential annual smoke emissions will be compared to annual emissions shown in the EPA's National Emissions Inventory in order to provide readers with comparisons of the amounts of smoke the project could produce compared to county, statewide and national prescribed fire and wildfire smoke emissions.

Greenhouse gas (CO2 equivalent) emissions estimates will also be completed for comparison purposes to the National Emissions Inventory.

Methodology

Nuisance smoke is analyzed qualitatively and discussed in terms of the regulatory framework used by the State of Arizona for dealing with smoke complaints.

National Ambient Air Quality Standards are analyzed qualitatively and discussed in terms of the regulatory framework used by the State of Arizona for preventing exceedances of the health standards.[5]

Project smoke emissions are analyzed quantitatively to show comparisons of potential prescribed fire smoke emissions to county, statewide, and national level prescribed fire and wildfire emissions (NEI, 2017). The DEIS First Order Fire Effects Model data (FOFEM) were expanded on for the FEIS (Air Quality report Appendices B, C, D). The DEIS Table 44, Comparison of Percent Changes in Total Surface Fuel Loadings from existing conditions (DEIS p 258) was removed because the table showed a set of values that are not used to estimate emissions in the FEIS air quality section.

Visibility or regional haze is analyzed qualitatively and discussed in terms of the regional haze planning framework used by the State of Arizona for moving current visibility conditions toward meeting visibility goals

Prescribed fire greenhouse gas emissions are analyzed quantitatively in order to show comparisons of potential CO2 equivalent (CO2e) emissions to county, statewide and national level prescribed fire and wildfire emissions (NEI 2017).

For detailed information about methodology see Appendix B of the Air Quality Specialist Report (USDA FS 2021e).

[5] Compared to the other current and planned prescribed burning projects in Arizona the Rim Country project would produce large amounts of smoke emissions over 20 years. This analysis shows the approximate amounts of emissions using several burning scenarios. While this information can be useful for comparing the project's emissions to other emissions sources the amounts of emissions does not easily equate into knowing what the smoke concentrations would be in populated or smoke sensitive areas. Estimating smoke concentrations would require smoke dispersion modeling that generally is available for up to a 72-hour forecast period based on weather forecast models. The ADEQ uses such modeling for forecasting the capacity of the atmosphere to disperse smoke emissions. The department bases burn day authorizations on the amounts of burning the land management agencies have requested to complete, weather forecasts and smoke dispersion modeling.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects of Alternative 1

Under this alternative, smoke emissions from the proposed treatment area and effects would come from wildfires. The impacts would be infrequent perhaps a few times a year, and with unpredictable temporal and spatial scale and health effects.

Nuisance Smoke

Under alternative 1, nuisance smoke from wildfires would continue to occur at current levels and would probably increase over time as increases to forest fuels accumulations and stand densities causes potentially greater fire behavior intensity and fire size, or extent. Climate change is forecast to also cause an increase in the occurrence and severity of droughts and drier and warmer fire seasons resulting in increasing wildfire intensity and extent. Nuisance smoke complaints from prescribed burning and wildfires would be managed under the State's smoke management program described under Consistency with Relevant Laws, Rules, and Policy below (Personal communication with Ronald Sherman, Arizona State Smoke Management Program, December 9, 2020).

Exceedances of NAAQS

Under alternative 1, exceedances of air quality human health standards would follow the same path as nuisance smoke.

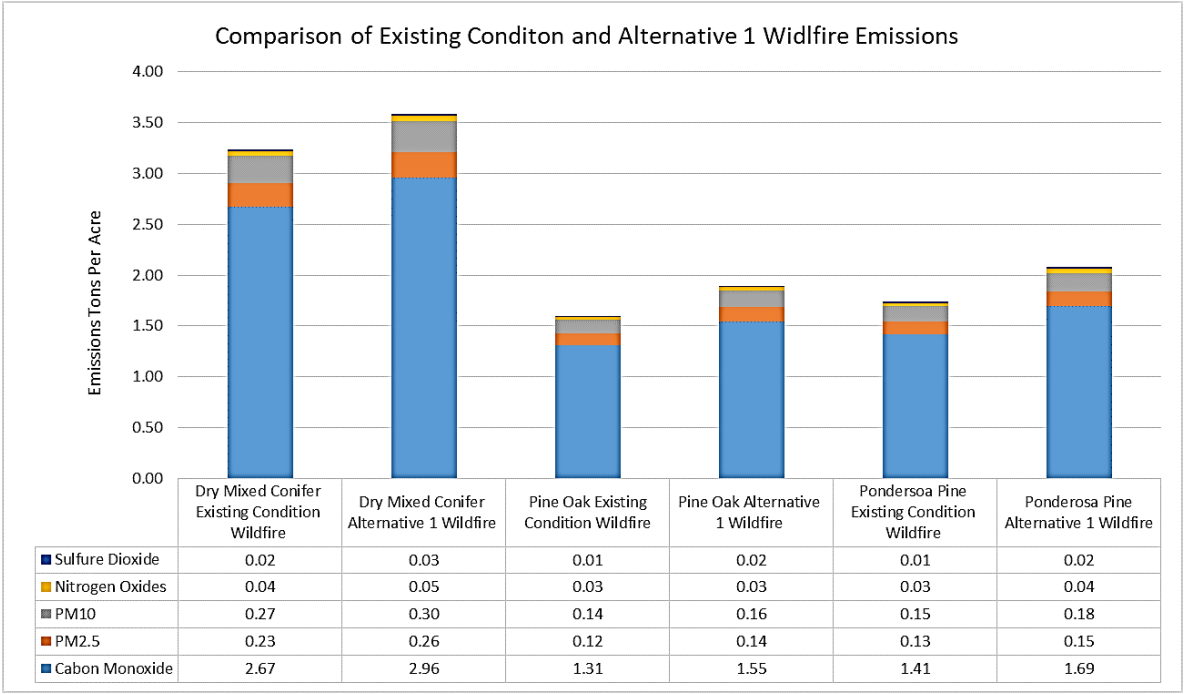
Smoke Emissions – Criteria Air Pollutants

If the current average annual acres burned by wildfire remained the same, about 27,426 acres, it is likely that the entire proposed treatment area would burn by 2057, along with the associated air quality effects (Rim Country FEIS Fire Ecology Report). Due to increasing surface fuel loadings, and forests moving toward denser stands, the potential for increasing high fire intensity fire behavior and crown fire from wildfires burning under alternative 1, conditions in 2029 would produce more emissions than one burning under current existing conditions. Wildfires would produce the most emissions from the treatment area under this alternative. On a per acre basis, potential emissions increase by 10 to 20 percent, due to the increase in surface fuel loadings and lingering smoke, stand densities, fire behavior intensity. Much of the lingering smoke comes from high amounts of duff, litter, coarse woody debris, stumps, and other fuels that can smolder more than fuels burned in a fire's flaming front or flaming zone. This in combination with the expected increase in annual acres burned would lead to an increase in overall emissions from wildfires. The timing and type of smoke effects would change little initially, but as the likelihood of large fires increase so does the potential for air pollution levels that exceed the NAAQS and causes nuisance smoke.

Alternative 1 would not increase potential smoke impacts during the times of the year when smoke impacts are largely from prescribed fire and wood heating burning (wood stoves), generally, mid to late fall, winter, and early spring.

Figure 18 shows a comparison of current condition potential wildfire emissions and potential alternative 1 wildfire emissions in 2029. The graph and table show the average per acre emissions for dry mixed conifer, pine oak and ponderosa pine ecological response units. Dry mixed conifer has the highest fuel

loading and consequently produces the greatest amounts of smoke on a per acre basis followed by pine oak and ponderosa pine that show similar, lesser amounts.



	Dry Mixed Conifer Existing Condition Wildfire	Dry Mixed Conifer Alternative 1 Wildfire	Pine Oak Existing Condition Wildfire	Pine Oak Alternative 1 Wildfire	Pondersoa Pine Existing Condition Wildfire	Ponderosa Pine Alternative 1 Wildfire
Sulfure Dioxide	0.02	0.03	0.01	0.02	0.01	0.02
Nitrogen Oxides	0.04	0.05	0.03	0.03	0.03	0.04
PM10	0.27	0.30	0.14	0.16	0.15	0.18
PM2.5	0.23	0.26	0.12	0.14	0.13	0.15
Cabon Monoxide	2.67	2.96	1.31	1.55	1.41	1.69

Figure 18. Existing condition (2018) wildfire smoke criteria air pollutant emissions and alternative 1 (2029) wildfire emissions for dry mixed conifer, pine oak and ponderosa pine ecological response units (tons per acre)

Table 7 shows the amount of smoke emissions that would be produced if an alternative 1 wildfire scenario were to burn the three major project area ecological response units that are proposed for restoration treatments under the action alternatives. A comparison of the emissions to Arizona's annual total wildfire emissions is shown. If a wildfire were to burn the entire 974,440-acre area the criteria air pollutant emissions would range approximately from 461-684 percent greater than the total Arizona annual wildfire emissions.

Table 7. Comparison of alternative 1 wildfire scenario smoke emissions to the action alternatives major project area ecological response units that are proposed for restoration treatments and Arizona annual emissions[6]

Rim Country FEIS Alternative 1 Ecological Response Units	Burned Acres	Carbon Monoxide (tons)	PM2.5 (tons)	PM10 (tons)	Nitrogen Oxides (tons)	Sulfur Dioxide (tons)
Dry Mixed Conifer	59,858	177,180	15,563	17,957	2,993	1,796
Pine Oak	149,440	231,632	20,922	23,910	4,483	2,989
Ponderosa Pine	765,142	1,293,090	114,771	137,726	30,605	15,303

[6] The project smoke emissions modeling does not include volatile organic compounds (VOC) outputs.

Rim Country FEIS Alternative 1 Ecological Response Units	Burned Acres	Carbon Monoxide (tons)	PM2.5 (tons)	PM10 (tons)	Nitrogen Oxides (tons)	Sulfur Dioxide (tons)
Total	**974,440**	**1,701,902**	**151,256**	**179,593**	**38,081**	**20,088**
Arizona Annual Wildfire Emissions	-	369,188	32,222	38,022	5,558	2,934
Percent Increase of Alternative 1 Wildfire Emission Compared to Arizona Annual Wildfire Emissions	-	461%	469%	472%	685%	684%

Smoke Emissions – Greenhouse Gas Emissions

Under alternative 1, in about year 2029 potential emissions would increase to above current condition emissions due to increasing accumulations of fuels over time. Figure 19 shows the burned acre CO2e [7] emissions based on the amount of CO2 and CH4 that would be produced. (For this analysis, the conservative CH4 Global Warming Potential value of 36 is used.)

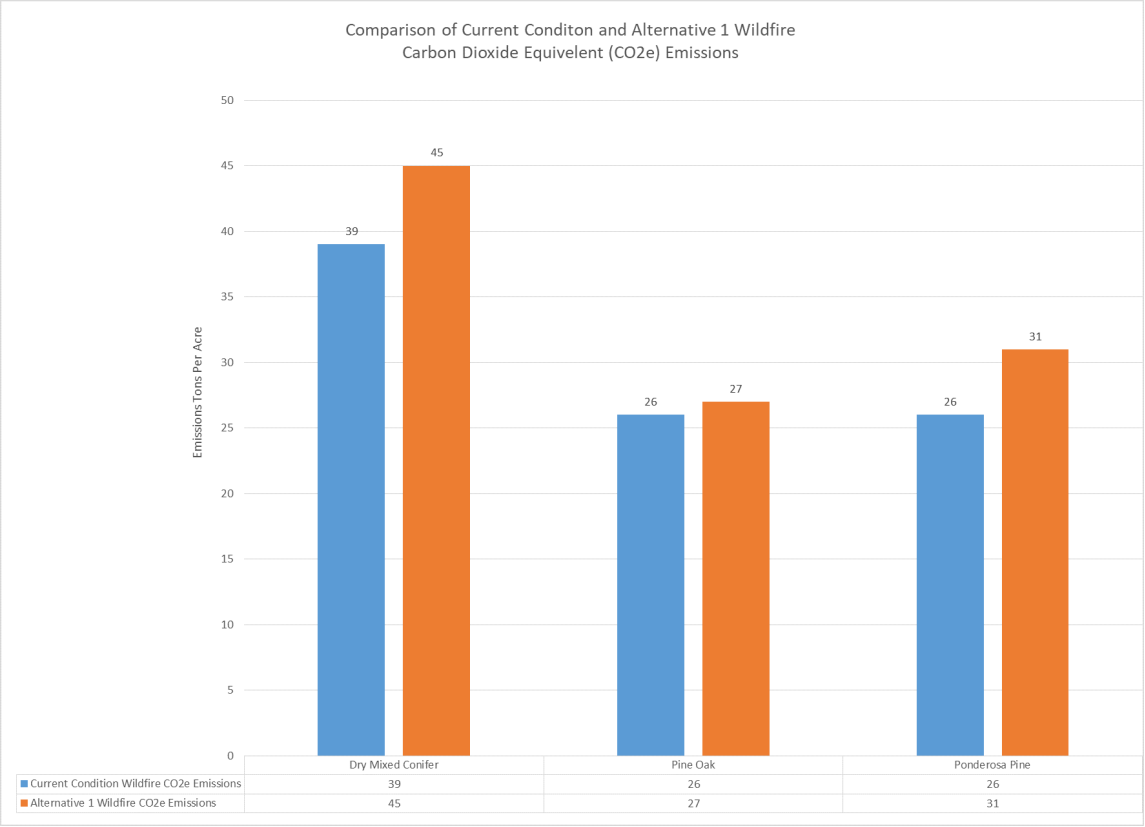


Figure 19. Comparison of current condition and alternative 1 carbon dioxide equivalent (CO2e) emissions for dry mixed conifer, pine oak, and ponderosa pine ecological response units (tons per acre)

[7] Carbon Dioxide equivalent emission or CO2e are based on the amount of CO2 and CH4 that would be produced. For this analysis the conservative CH4 Global Warming Potential value of 36 is used.

Table 8 shows data from the 2017 National Emissions Inventory for annual greenhouse gas emissions from various sources at the county, state, and national levels for comparing to Rim Country annual emissions.

Table 8. Data from the 2017 National Emissions Inventory showing greenhouse gas emissions from various sources at the county, state and national levels for comparing to Rim Country annual emissions

Source - Geographic Area	Carbon Dioxide (tons per year)	Methane (tons per year)	Nitrous Oxide (tons per year)	CO2e (tons per year)
Apache County – All Sources	15,150,672	3,547	251	15,353,162
Coconino County – All Sources	3,538,513	12,007	33	3,980,562
Gila County – All Sources	970,517	1,727	14	1,036,949
Navajo County – All Sources	6,121,739	5,881	115	6,367,851
Yavapai County – All Sources	4,414,659	4,253	63	4,586,517
Arizona – All Sources	85,815,904	81,357	2,381	89,454,179
National – All Sources	5,381,953,222	6,247,460	142,348	5,649,281,475
Apache County – Prescribed Fires	358,725	1,820	-	424,231
Apache County – Wildfires	12,287	45	-	13,907
Coconino County – Prescribed Fires	850,657	4,192	-	1,001,572
Coconino County – Wildfires	924,980	4,106	-	1,072,805
Gila County – Prescribed Fires	68,677	325	-	80,388
Gila County – Wildfires	418,981	1,351	-	467,604
Navajo County – Prescribed Fires	114,815	614	-	136,932
Navajo County – Wildfires	16,831	74	-	19,495
Yavapai County – Prescribed Fires	27,696	107	-	31,539
Yavapai County – Wildfires	315,809	950	-	349,996
Arizona – Prescribed Fires	1,541,085	7,456	-	1,809,495
Arizona – Wildfires	4,652,066	18,180	-	5,306,541
National – Prescribed Fires	120,709,651	437,280	-	136,451,741
National – Wildfires	208,941,083	945,704	-	242,986,414

Table 9 shows the amount of smoke greenhouse gas emissions emission that would be produced if an alternative 1 wildfire scenario were to burn the three major project area ecological response units that are proposed for restoration treatments under the action alternatives. If a wildfire were to burn the entire 974,440-acre area the greenhouse gas emissions would be approximately 566 percent greater than the total Arizona annual wildfire emissions.

Visibility or Regional Haze

Technically under alternative 1, the potential for increasing wildfire smoke emissions over time could adversely affect visibility; however, wildfires are not regulated under the Regional Haze Rule like other human-caused emissions including smoke from prescribed fires.

Table 9. Comparison of alternative 1 wildfire scenario smoke greenhouse gas emissions to the action alternatives major project area ecological response units that are proposed for restoration treatments and Arizona annual emissions

Alternative 1 Ecological Response Units	Burned Acres	CO2e Carbon Dioxide Plus Methane (tons)
Dry Mixed Conifer	59,858	2,662,484
Pine Oak	149,440	4,006,486
Ponderosa Pine	765,142	23,398,042
Total	**974,440**	**30,067,012**
Arizona Annual Wildfire Emissions	-	5,306,541
Percent Increase of Alternative 1 Wildfire Emission Compared to Arizona Annual Wildfire Emissions	-	566%

Air Quality and Smoke Effects Common to the Action Alternatives

Direct and Indirect Effects Common to the Action Alternatives

Nuisance Smoke

Nuisance smoke would generally be the same under all alternatives. As the project is implemented over 20 years the potential for wildfire emissions would be reduced and replaced by controlled prescribed fire emissions and, overtime, may reduce the reports of nuisance smoke connected to the project.

Exceedances of NAAQS

Implementation of the project would comply with the Federal Clean Air Act and the Act is implemented at the state level under the ADEQ rules that require the project to not cause exceedances of the National and State Ambient Air Quality Standards in populated areas. The ADEQ is the agency having jurisdiction over determining permissive burn days and authorizing implementation of prescribed burning. The ADEQ requires the Federal land management agencies to follow and use the emissions reduction and smoke management techniques stipulated in burning authorizations. A detailed description of the ADEQ's smoke management regulation, Article 15, and the state's smoke management program is described under Other Relevant Law, Regulation, or Policy below. The text of Article 15 is available under the reference section (ADEQ 2004).

Equipment use over the approximately 20-year implementation timeframe of the project would include only tens of gasoline or diesel fuel powered vehicles and specialized tree harvesting equipment on any given day, spread out over a large area. Therefore, the amount of emissions the equipment would produce would be insignificantly small and generally unknowable because it is not known at this time exactly where, when and how many acres would be treated on any given day, and the number of and types of vehicles or equipment that would be used, and their hours of operation. In most circumstances vehicle and equipment emissions disperse rapidly and in the potential concentrations caused by only tens of vehicles or equipment would not cause NAAQS exceedances.

Smoke Emissions – Criteria Air Pollutants

The amounts of criteria air pollutants and greenhouse gas emissions from burning live vegetation and dead fuels varies widely depending on many variables including vegetation types and their condition, fuel loadings, fuel moistures and weather parameters. Open stands support surface fire over crown fire under most conditions, and surface fire produces fewer particulates than crown fire. Stands that have burned more recently and more frequently also produce lower emissions. Figure 20 shows differences in

emissions from wildfire and prescribed fires that would be burned at different stages in burn only and mechanical plus burn treatment cycles.

A comparison between alternatives can be made by looking at the effects of treatments that reduce the likelihood of active crown fire and heavy surface fuel loading. Active crown fire and heavy surface fuel loading produce large quantities of emissions. The action alternatives that alter stand structure to promote surface fire over active crown fire and decrease surface fuel loading would have the least negative environmental consequences to air quality.

Up to two prescribed burns would be implemented, which may include activity fuels pile burning in advance of broadcast burns or underburning. To maintain Land Management Plan desired conditions for the three major project ecological response unit's, prescribed fires should occur on an average of every 10 years, depending on yearly fluctuations in climate and weather at different locations within the treatment area. Some areas would have had prescribed fire or wildfire within the last 10 to 15 years, so prescribed fires that are implemented would be maintenance burns. Limitations such as wildlife concerns, cumulative smoke effects and ADEQ burn day authorizations, funding, and resource availability may make it difficult to attain an average of a 10-year fire return interval across the proposed treatment area. Burning some areas on a slightly longer return interval may be warranted to reduce smoke effects to smoke sensitive areas although delays in re-burning would cause fuels to re-accumulate and subsequent prescribed burning would produce more smoke emissions.

First Entry Burns

First entry burns are those burns in which a first-time fire occurs in an area that has missed several fire cycles or after mechanical treatments are completed. In mechanical treatment units, activity-generated fuels may increase fuel loadings and first entry burns may produce more smoke compared to burn units that are not mechanically treated. First entry burns can cause mortality to shrubs, branch wood and small trees, and these woody fuels can accumulate on forest floors over several years and increase overall surface fuel loadings to above pre first entry burn fuel loading.

Second Entry Burns

Second entry burns are those burns that occur within about 10 years of a first entry burn in forest stands. For second entry burns, fuel loads would generally be lower than in first entry burns, producing less smoke and with lower potential for high-severity fire. However, after first entry burns fire caused mortality to shrubs, branch wood and small trees can increase woody fuels accumulations on forest floors over several years and increase overall surface fuel loadings to above pre first entry burn fuel loading. A second entry burn should occur after surface fuels have recovered sufficiently to produce fire behavior sufficient to meet burn objectives.

Maintenance Burns

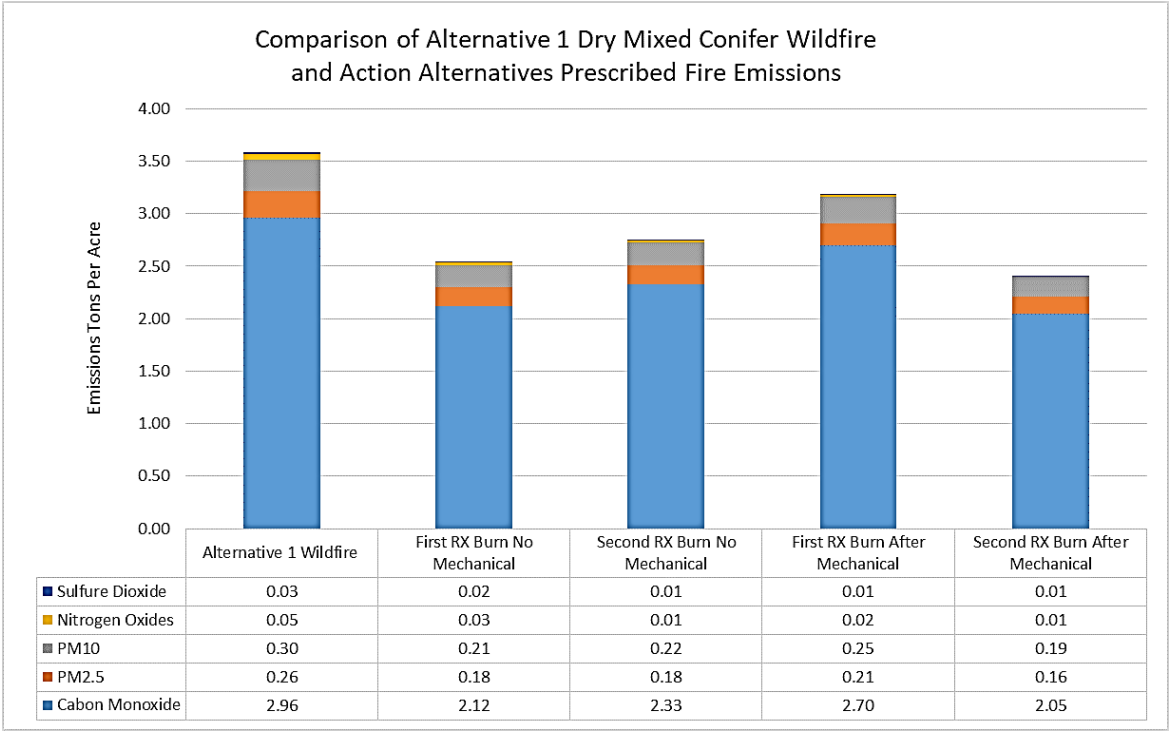
Maintenance burns generally begin with the second or third burn in an area that is being restored. This could apply in areas within the treatment area that have burned from wildfire or prescribed fire within the last 10 to 15 years. Maintenance burns occur when ecosystem conditions are such that fire can play its historic role on the ecosystem, as a disturbance that establishes site-specific and landscape-scale patterns, regulates flora and fauna, and other ecosystem functions. In ponderosa pine, these burns produce low-severity effects, fewer emissions, and can be conducted with fewer resources. The timing of maintenance burns should mimic the natural seasonality of fire as closely as possible. For those areas which have had

two or more fires (wildfire or prescribed fire) in the last 20 years, prescribed fires would be true maintenance burns, with minimal emissions (Robinson 2004), and only maintenance needed from the fire.

For many acres of the treatment area, prescribed fires would be maintenance burning and, from an ecological perspective, should occur in the summer months if possible (Fulé et al. 2007).

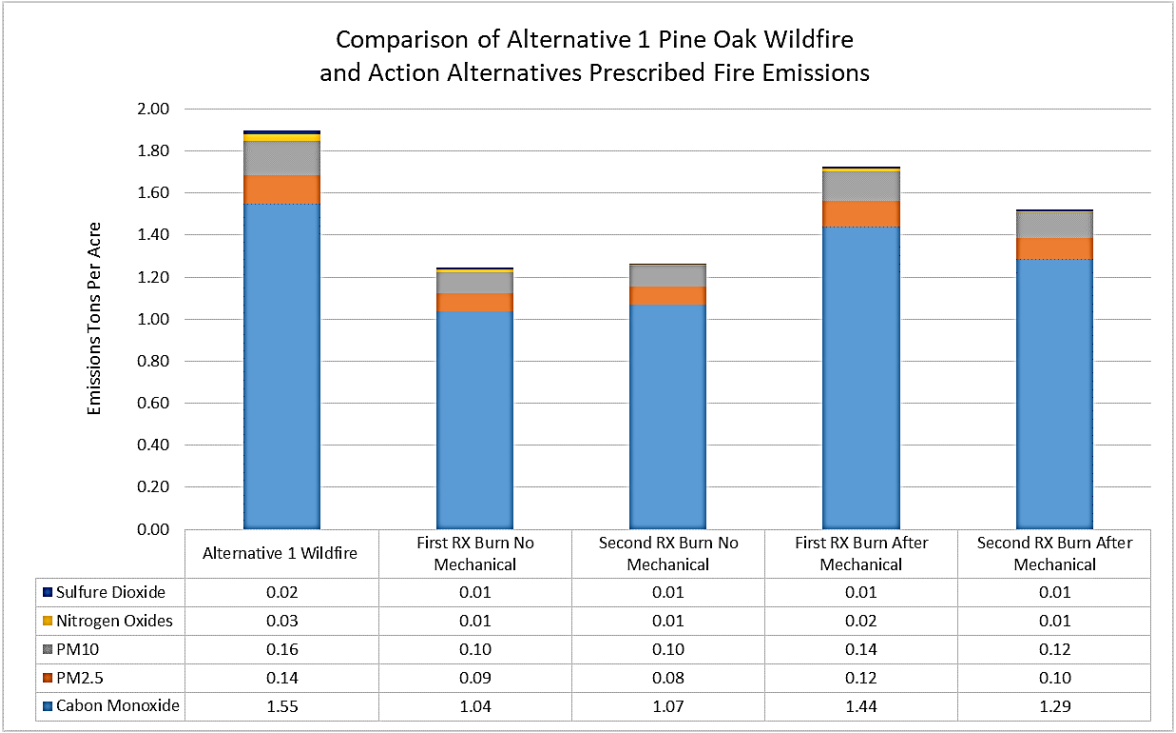
Figure 20, Figure 21, and Figure 22 show the estimated criteria air pollutant emissions for alternative 1 and compares the emissions to the estimated action alternatives emissions for dry mixed conifer, pine oak and ponderosa pine ecological response units. For the action alternatives, four prescribed burning emissions scenarios are shown:

1. First entry prescribed burn without mechanical treatments.
2. Second entry prescribed burn without mechanical treatments.
3. First entry prescribed burn after mechanical treatments are completed.
4. Second entry prescribed burn after mechanical treatments are completed.



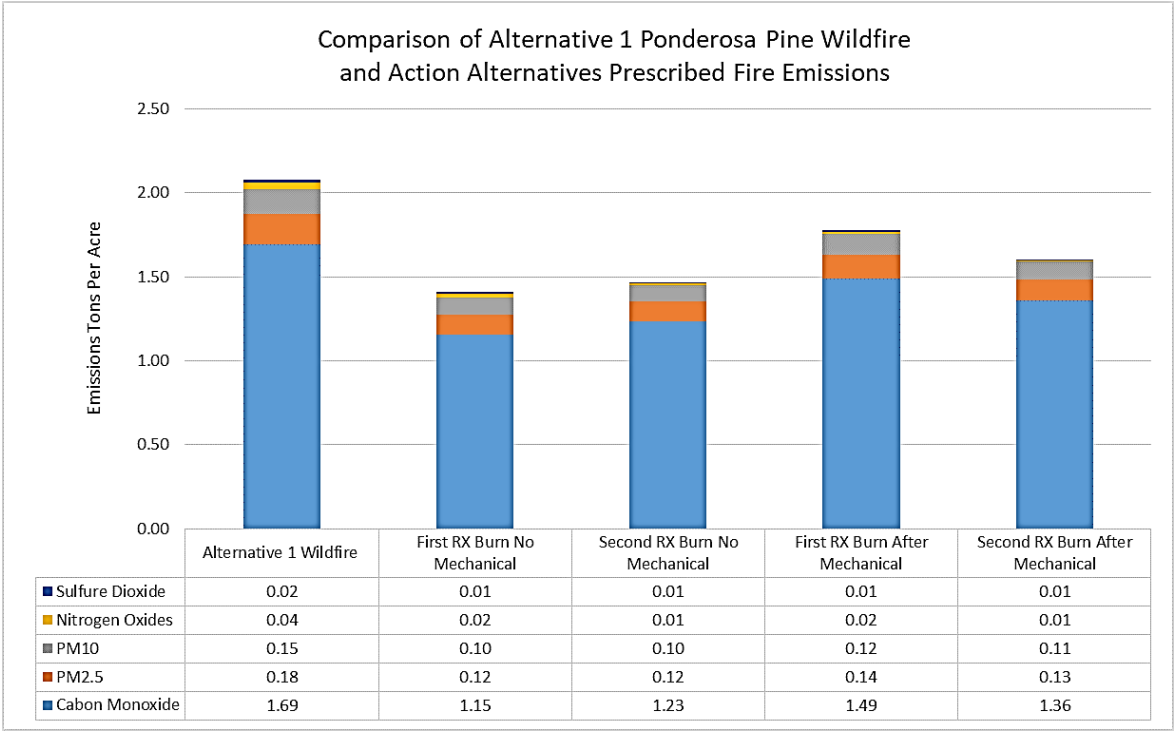
	Alternative 1 Wildfire	First RX Burn No Mechanical	Second RX Burn No Mechanical	First RX Burn After Mechanical	Second RX Burn After Mechanical
Sulfure Dioxide	0.03	0.02	0.01	0.01	0.01
Nitrogen Oxides	0.05	0.03	0.01	0.02	0.01
PM10	0.30	0.21	0.22	0.25	0.19
PM2.5	0.26	0.18	0.18	0.21	0.16
Cabon Monoxide	2.96	2.12	2.33	2.70	2.05

Figure 20. Comparison of alternative 1 estimated criteria air pollutant emissions to the action alternatives estimated emissions for dry mixed conifer (tons per acre)



	Alternative 1 Wildfire	First RX Burn No Mechanical	Second RX Burn No Mechanical	First RX Burn After Mechanical	Second RX Burn After Mechanical
Sulfure Dioxide	0.02	0.01	0.01	0.01	0.01
Nitrogen Oxides	0.03	0.01	0.01	0.02	0.01
PM10	0.16	0.10	0.10	0.14	0.12
PM2.5	0.14	0.09	0.08	0.12	0.10
Cabon Monoxide	1.55	1.04	1.07	1.44	1.29

Figure 21. Comparison of alternative 1 estimated criteria air pollutant emissions to the action alternatives estimated emissions for pine oak (tons per acre)



	Alternative 1 Wildfire	First RX Burn No Mechanical	Second RX Burn No Mechanical	First RX Burn After Mechanical	Second RX Burn After Mechanical
Sulfure Dioxide	0.02	0.01	0.01	0.01	0.01
Nitrogen Oxides	0.04	0.02	0.01	0.02	0.01
PM10	0.15	0.10	0.10	0.12	0.11
PM2.5	0.18	0.12	0.12	0.14	0.13
Cabon Monoxide	1.69	1.15	1.23	1.49	1.36

Figure 22. Comparison of alternative 1 estimated criteria air pollutant emissions to the action alternatives estimated emissions for ponderosa pine (tons per acre)

Smoke Emissions – Greenhouse Gas Emissions

Figure 23, Figure 24, and Figure 25 show the estimated greenhouse gas emissions for alternative 1 and compares the emissions to the estimated action alternatives emissions for dry mixed conifer, pine oak and ponderosa pine ecological response units. For the action alternatives, four prescribed burning emissions scenarios are shown:

1. First entry prescribed burn without mechanical treatments.
2. Second entry prescribed burn without mechanical treatments.
3. First entry prescribed burn after mechanical treatments are completed.
4. Second entry prescribed burn after mechanical treatments are completed.

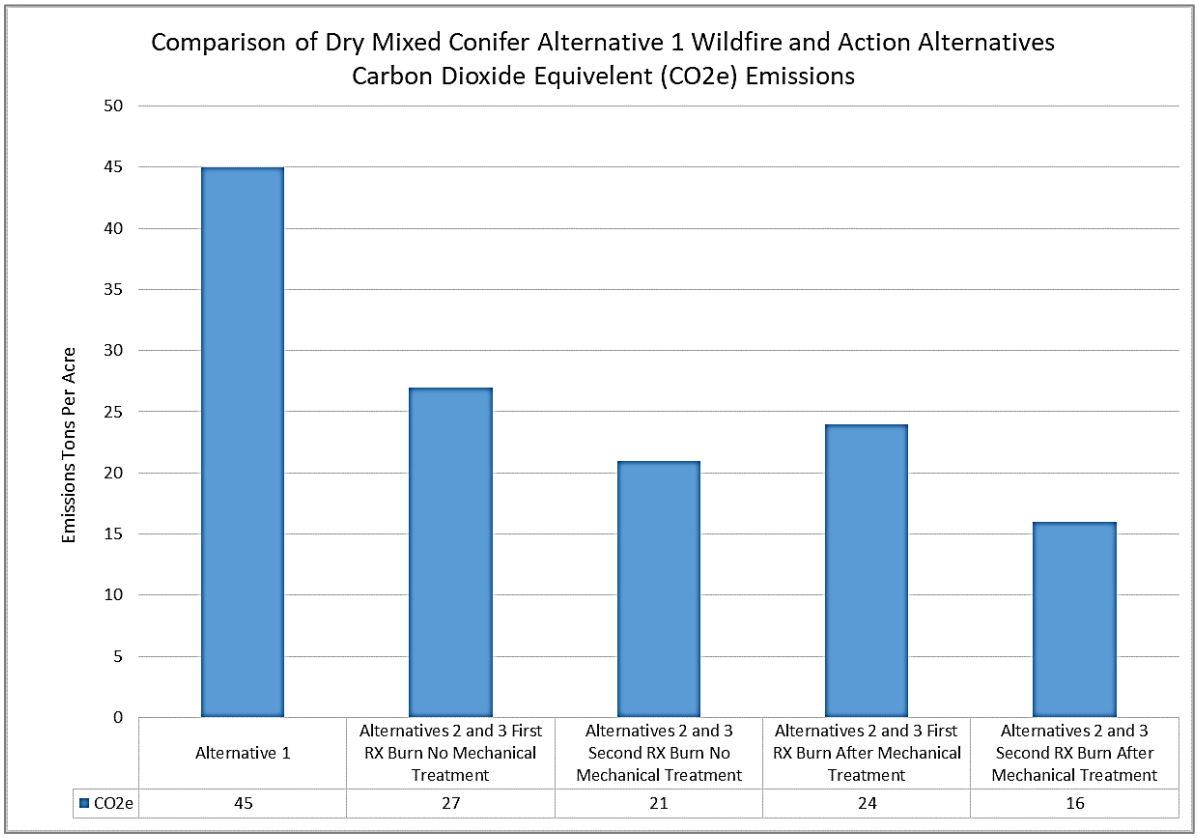


Figure 23. Comparison of alternative 1 dry mixed conifer estimated greenhouse gas emissions to the action alternatives estimated emissions for mixed conifer (tons per acre)

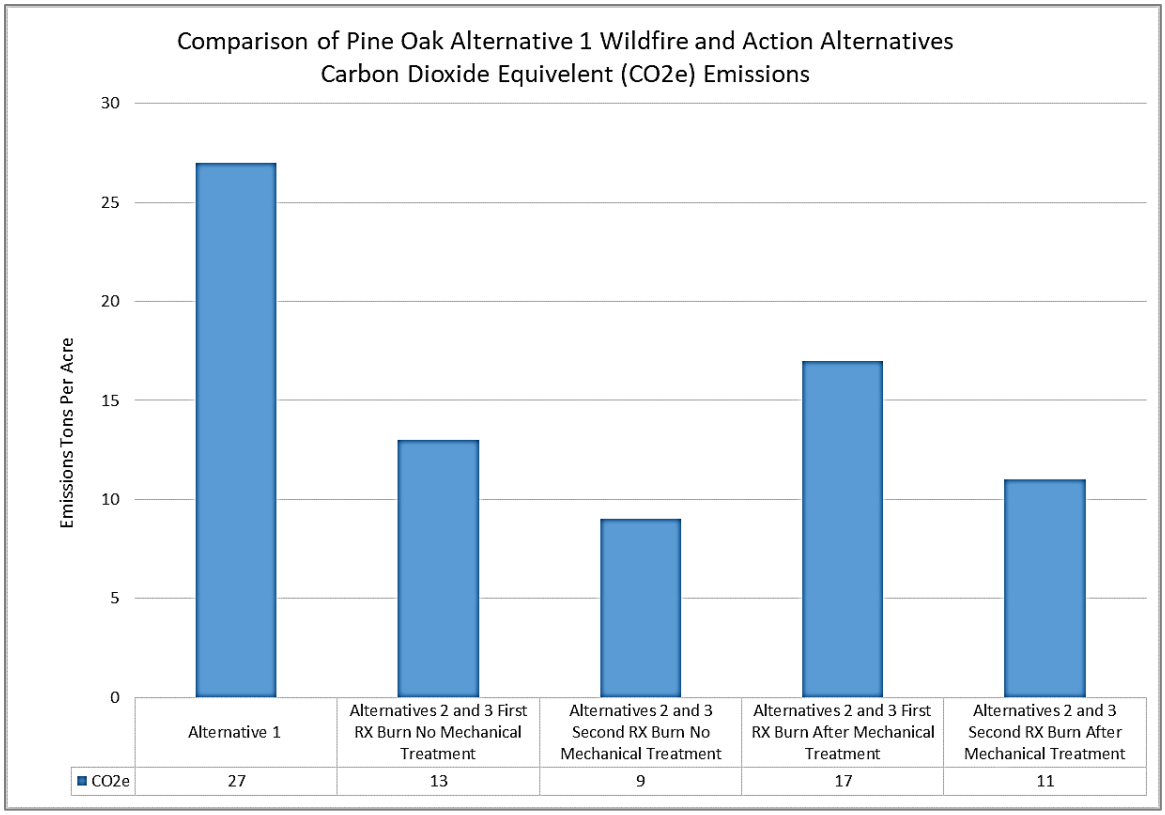


Figure 24. Comparison of alternative 1 pine oak estimated greenhouse gas emissions to the action alternatives estimated emissions for pine oak (tons per acre)

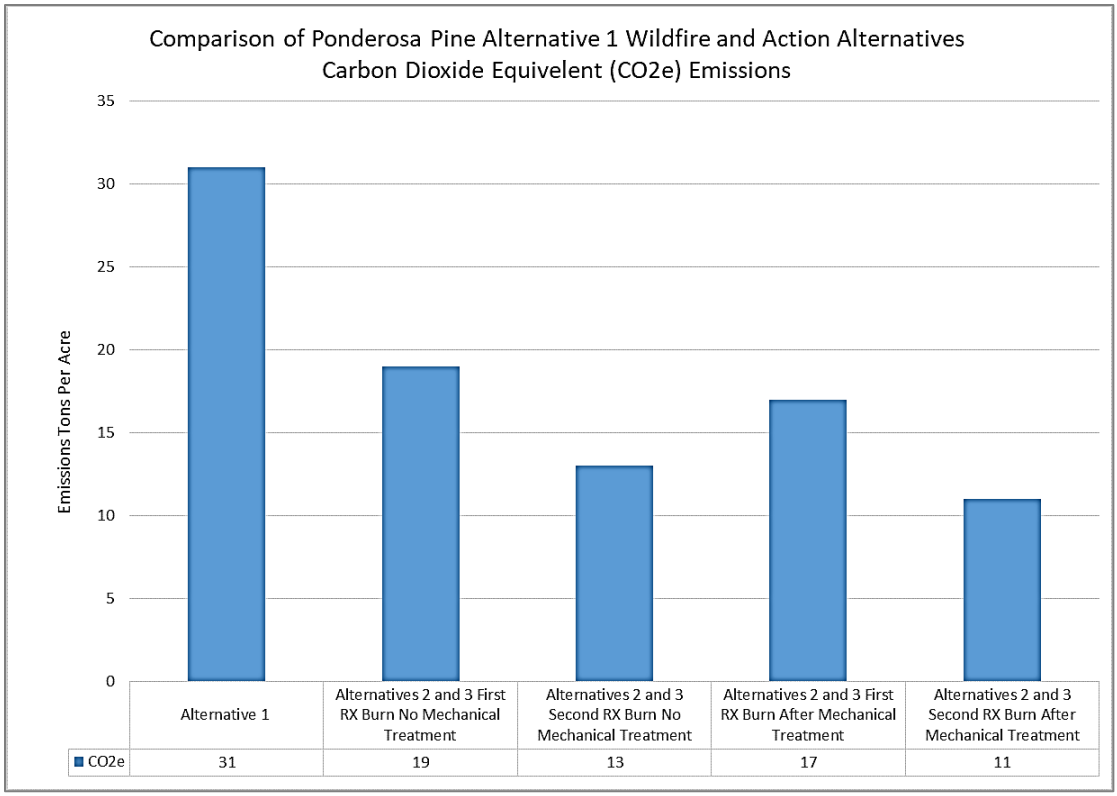


Figure 25. Comparison of alternative 1 ponderosa pine estimated greenhouse gas emissions to the action alternatives estimated emissions for ponderosa pine (tons per acre)

Visibility or Regional Haze

Under the action alternatives prescribed fire smoke emissions would be controlled by the ADEQ and over time prescribed fire smoke does have at least some potential to impact the Statement Implementation Plan.

Alternative 2 – Modified Proposed Action

Direct and Indirect Effects

Smoke Emissions – Criteria Air Pollutants and Greenhouse Gas Emissions

Alternative 2 would meet the project's purpose and need and Land Management Plan desired conditions for air quality. The number of days or duration of smoke exposure, as well as the intensity or concentration of the exposure are of concern to the public. While there could be the variability from year to year, under this alternative, prescribed fire would need to be implemented on up to 99,106 acres annually to produce an average fire return interval of 10 years across 991,060 acres proposed for prescribed fire treatment. Potential air quality effects during implementation of alternative 2, and the necessary maintenance burning after the initial implementation has been completed would be noticeable, although National Ambient Air Quality Standards would not be exceeded.

Table 10 shows the approximate amounts of criteria air pollutants and greenhouse gas emissions that would occur annually over the 20 spans of the project for four scenarios. The actual amounts of acreages that would be burned each year is currently unknown and the purpose of the information is for the

comparison between the alternatives showing several scenarios. Table 10 and table 11 show the approximate amounts of criteria air pollutants and greenhouse gas emissions the project would produce if only first entry burns were completed without mechanical treatment and with mechanical treatments over 20 years.

If first entry without mechanical treatments prescribed burning burns the acreages shown in Table 10 the criteria air pollutant emissions would range from approximately 37 to 58 percent and greenhouse emissions would be approximately 49 percent of the total Arizona annual prescribed fire emissions.

If first entry with mechanical treatments prescribed burning burns the acreages shown in table 11, 47 to 58 percent of criteria pollutants and 46 percent of greenhouse gases would be produced, compared to the Arizona annual prescribed fire emissions.

Table 10. Alternative 2 annual prescribed burning smoke emissions, first entry no mechanical treatment scenario over 20 years, compared to Arizona annual emissions

RIM Country FEIS Alternative 2 Ecological Response Units	Annual Burned Acres / Percent Project Area	Carbon Monoxide (tons)	PM2.5 (tons)	PM10 (tons)	Nitrogen Oxides (tons)	Sulfur Dioxide (tons)	CO2e Carbon Dioxide Plus Methane (tons)
First Entry Dry Mixed Conifer	2,973 / 6%	6,303	535	624	89	59	80,093
First Entry Pine Oak	7,433 / 15%	7,730	669	743	74	74	94,696
First Entry Ponderosa Pine	38,156 / 77%	43,879	3,816	4,579	763	382	715,807
Total	**48,562**	**57,912**	**5,020**	**5,946**	**926**	**515**	**890,596**
Arizona Annual Prescribed Fire Emissions	-	154,561	12,937	15,265	1,596	1,005	1,809,495
Percent of Alternative 2 Prescribed Burning Emissions Compared to Arizona Annual Prescribed Fire Emissions	-	37%	39%	39%	58%	51%	49%

Table 11. Alternative 2 annual prescribed burning smoke emissions, first entry after mechanical treatment scenario over 20 years, compared to Arizona annual emissions

RIM Country FEIS Alternative 2 Ecological Response Units	Annual Burned Acres / Percent Project Area	Carbon Monoxide (tons)	PM2.5 (tons)	PM10 (tons)	Nitrogen Oxides (tons)	Sulfur Dioxide (tons)	CO2e Carbon Dioxide Plus Methane (tons)
First Entry Dry Mixed Conifer	2,973 / 6%	8,027	624	743	30	30	70,936
First Entry Pine Oak	7,433 / 15%	10,704	892	1,041	149	149	128,888
First Entry Ponderosa Pine	38,156 / 77%	56,852	4,579	5,342	763	382	639,495
Total	**48,562**	**75,583**	**6,095**	**7,126**	**942**	**561**	**839,319**
Arizona Annual Prescribed Fire Emissions	-	154,561	12,937	15,265	1,596	1,005	1,809,495

RIM Country FEIS Alternative 2 Ecological Response Units	Annual Burned Acres / Percent Project Area	Carbon Monoxide (tons)	PM2.5 (tons)	PM10 (tons)	Nitrogen Oxides (tons)	Sulfur Dioxide (tons)	CO2e Carbon Dioxide Plus Methane (tons)
Percent of Alternative 2 Prescribed Burning Emissions Compared to Arizona Annual Prescribed Fire Emissions	-	49%	47%	47%	58%	56%	46%

Table 12, table 13, table 14, and table 15 show the amounts of criteria air pollutants and greenhouse gas emissions that would be produced annually over the 20-year span of the project. The scenarios assume that the first entry burns would occur during the first decade and second entry burns would occur during the second decade and completed without mechanical treatment and with mechanical treatments over 20 years.

If first entry prescribed burning burns the acreages shown in table 12, the criteria air pollutant emissions would range from approximately 75 to 116 percent and greenhouse gas emissions would be approximately 98 percent of the total Arizona annual prescribed fire emissions.

If second entry prescribed burning burns the averages shown in table 13, the criteria pollutants emissions would range from 61 to 97 percent and greenhouse gases emissions would be about 68 percent of the total Arizona annual prescribed fire emissions.

Table 12. Alternative 2 first decade, first entry, no mechanical treatment scenario annual prescribed burning smoke emissions, completed within 10 years, compared to Arizona annual emissions

Alternative 2 Ecological Response Units	Annual Burned Acres / Percent Project Area	Carbon Monoxide (tons)	PM2.5 (tons)	PM10 (tons)	Nitrogen Oxides (tons)	Sulfur Dioxide (tons)	CO2e Carbon Dioxide Plus Methane (tons)
First Entry Dry Mixed Conifer	5,946 / 6%	12,606	1,070	1,249	178	119	160,185
First Entry Pine Oak	14,866 / 15%	15,461	1,338	1,487	149	149	189,393
First Entry Ponderosa Pine	76,311 / 77%	87,758	7,631	9,157	1,526	763	1,431,594
Total	**97,123**	**115,825**	**10,039**	**11,893**	**1,853**	**1031**	**1,781,172**
Arizona Annual Prescribed Fire Emissions	-	154,561	12,937	15,265	1,596	1,005	1,809,495
Percent of Alternative 2 Prescribed Burning Emissions Compared to Arizona Annual Prescribed Fire Emissions	-	75%	78%	78%	116%	103%	98%

Table 13. Alternative 2 second decade, second entry, no mechanical treatment scenario annual prescribed burning smoke emissions, completed within 10 years, compared to Arizona annual emissions

Alternative 2 Ecological Response Units	Annual Burned Acres / Percent Project Area	Carbon Monoxide (tons)	PM2.5 (tons)	PM10 (tons)	Nitrogen Oxides (tons)	Sulfur Dioxide (tons)	CO2e Carbon Dioxide Plus Methane (tons)
Second Entry Dry Mixed Conifer	5,946 / 6%	13,854	1,070	1,308	59	59	126,471
Second Entry Pine Oak	14,866 / 15%	15,906	1,189	1,487	149	149	139,294
Second Entry Ponderosa Pine	76,311 / 77%	93,863	7,631	9,157	763	763	956,940
Total	**97,123**	**123,623**	**9,890**	**11,952**	**971**	**971**	**1,222,705**
Arizona Annual Prescribed Fire Emissions	-	154,561	12,937	15,265	1,596	1,005	1,809,495
Percent of Alternative 2 Prescribed Burning Emissions Compared to Arizona Annual Prescribed Fire Emissions	-	80%	765%	78%	61%	97%	68%

If first entry prescribed burning burns (the acreages shown in table 14), the criteria air pollutant emissions would range from approximately 93 to 118 percent and greenhouse gas emissions would be approximately 94 percent of the total Arizona annual prescribed fire emissions.

If second entry prescribed burning burns (the acreages shown in table 15), the criteria pollutant emissions would range from approximately 61 to 97 percent and greenhouse gas emissions would be approximately 61 percent of the total Arizona annual prescribed fire emissions.

Table 14. Alternative 2 first decade, first entry, after mechanical treatment scenario annual prescribed burning smoke emissions, completed within 10 years, compared to Arizona annual emissions

Alternative 2 Ecological Response Units	Annual Burned Acres / Percent Project Area	Carbon Monoxide (tons)	PM2.5 (tons)	PM10 (tons)	Nitrogen Oxides (tons)	Sulfur Dioxide (tons)	CO2e Carbon Dioxide Plus Methane (tons)
First Entry Dry Mixed Conifer	5,946 / 6%	16,054	1,249	1,487	59	59	141,872
First Entry Pine Oak	14,866 / 15%	21,407	1,784	2,081	297	297	275,776
First Entry Ponderosa Pine	76,311 / 77%	113,703	9,157	10,684	1,526	763	1,278,972
Total	**97,123**	**151,164**	**12,190**	**14,252**	**1,882**	**1119**	**1,696,620**
Arizona Annual Prescribed Fire Emissions	-	154,561	12,937	15,265	1,596	1,005	1,809,495
Percent of Alternative 2 Prescribed Burning Emissions Compared to Arizona Annual Prescribed Fire Emissions	-	98%	94%	93%	118%	111%	94%

Table 15. Alternative 2 second decade, second entry, after mechanical treatment scenario annual prescribed burning smoke emissions, completed within 10 year, compared to Arizona annual emissions

Alternative 2 Ecological Response Units	Annual Burned Acres / Percent Project Area	Carbon Monoxide (tons)	PM2.5 (tons)	PM10 (tons)	Nitrogen Oxides (tons)	Sulfur Dioxide (tons)	CO2e Carbon Dioxide Plus Methane (tons)
Second Entry Dry Mixed Conifer	5,946 / 6%	12,189	951	1,130	59	59	94,363
Second Entry Pine Oak	14,866 / 15%	19,177	1,487	1,784	149	149	169,770
Second Entry Ponderosa Pine	76,311 / 77%	103,783	8,394	9,920	763	763	836,369
Total	**97,123**	**135,149**	**10,832**	**12,834**	**971**	**971**	**1,100,502**
Arizona Annual Prescribed Fire Emissions	-	154,561	12,937	15,265	1,596	1,005	1,809,495
Percent of Alternative 2 Prescribed Burning Emissions Compared to Arizona Annual Prescribed Fire Emissions	-	87%	84%	84%	61%	97%	61%

Cumulative Effects

Smoke Emissions – Criteria Air Pollutants and Greenhouse Gases

The cumulative effects under alternative 2 include the greatest number of acres being treated with prescribed fire across the project area. This alternative combined with current and reasonably foreseeable activities in and around the project area would result in an annual average of more than 140,000 acres of prescribed fire though annual amounts may vary considerably. The overall effects from this amount of prescribed fire is expected to be more than those associated with alternatives 1 and 3. All prescribed fires would be implemented in compliance with ADEQ rules that regulate criteria air pollutants as well as Land Management Plan direction to meet legal standards and provide for public safety.

Areas with potential for air pollution and visual effects include the Colorado River Airshed, the Little Colorado River Watershed, and the Verde River Watershed. Class 1 airsheds that could be affected include Petrified Forest National Park, Sierra Ancha Wilderness Area and Mazatzal Wilderness Area. As more acres are treated, there would be broader burn windows, potentially resulting in more days of prescribed fire and days of air pollution and visual quality effects when added to prescribed burning occurring in the cumulative effects boundary.

Alternative 3 – Focused Restoration

Direct and Indirect Effects

Smoke Emissions – Criteria Air Pollutants and Greenhouse Gases

This alternative would meet the purpose and need, and desired conditions for air quality. Effects to air quality from smoke emissions would be a mix of alternative 1 and alternative 2, and 528,850 acres would be treated over 20 years, resulting in lower emissions from a post-treatment wildfire. The remaining untreated project area acres would increase in potential wildfire emissions due to increases in surface fuel loadings, drought mortality and crown fire potential.

The number of days and duration of smoke effects, as well as the intensity and concentration of the effects are of concern to the public. While there would be variability from year to year, under alternative 3, prescribed fire would need to be implemented on up to 52,885 acres annually to produce an average fire return interval of 10 years across 528,850 acres proposed for prescribed fire. Implementing prescribed fire as proposed in alternative 3 would result in lower emissions than if the area burned in a wildfire because there would be less biomass to burn.

Table 16, table 17, table 18 show the amounts of criteria air pollutants and greenhouse gas emissions that would be produced annually over the 20 spans of the project.

If first entry without mechanical treatments prescribed burning burns (the acreages are shown in Table 16, the criteria air pollutant emissions would range approximately from 20 to 31 percent and greenhouse emissions would be approximately 26 percent of the total Arizona annual prescribed fire emissions.

If first entry with mechanical treatments prescribed burning burns (the acreages are shown in Table 17), the criteria air pollutant emissions would range approximately from 25 to 31 percent and greenhouse gases would be approximately would be approximately 25 percent of the Arizona annual prescribed fire emissions.

Table 16. Alternative 3 first entry no mechanical treatment scenario annual prescribed burning smoke emissions over 20 years, compared to Arizona annual emissions

Alternative 3 Ecological Response Units	Annual Burned Acres / Percent Project Area	Carbon Monoxide (tons)	PM2.5 (tons)	PM10 (tons)	Nitrogen Oxides (tons)	Sulfur Dioxide (tons)	CO2e Carbon Dioxide Plus Methane (tons)
First Entry Dry Mixed Conifer	1,587 / 6%	3,364	286	333	48	32	42,754
First Entry Pine Oak	3,967 / 15%	4,126	397	397	40	40	50,540
First Entry Ponderosa Pine	20,361 / 77%	23,415	2,443	2,508	407	204	381,972
Total	**25,915**	**30,905**	**3,126**	**3,238**	**495**	**276**	**475,266**
Arizona Annual Prescribed Fire Emissions	-	154,561	12,937	15,265	1,596	1,005	1,809,495
Percent of Alternative 3 Prescribed Burning Emissions Compared to Arizona Annual Prescribed Fire Emissions	-	20%	24%	21%	31%	27%	26%

Table 17. Alternative 3 first entry after mechanical treatment completed scenario annual prescribed burning smoke emissions over 20 years, compared to Arizona annual emissions

Alternative 3 Ecological Response Units	Annual Burned Acres / Percent Project Area	Carbon Monoxide (tons)	PM2.5 (tons)	PM10 (tons)	Nitrogen Oxides (tons)	Sulfur Dioxide (tons)	CO2e Carbon Dioxide Plus Methane (tons)
First Entry Dry Mixed Conifer	1,587 / 6%	4,285	333	397	16	16	37,866
First Entry Pine Oak	3,967 / 15%	5,712	476	555	79	79	68,788
First Entry Ponderosa Pine	20,361 / 77%	30,338	2,443	2,851	407	204	341,250

Alternative 3 Ecological Response Units	Annual Burned Acres / Percent Project Area	Carbon Monoxide (tons)	PM2.5 (tons)	PM10 (tons)	Nitrogen Oxides (tons)	Sulfur Dioxide (tons)	CO2e Carbon Dioxide Plus Methane (tons)
Total	**25,915**	**40,335**	**3,252**	**3,803**	**502**	**299**	**447,904**
Arizona Annual Prescribed Fire Emissions	-	154,561	12,937	15,265	1,596	1,005	1,809,495
Percent of Alternative 3 Prescribed Burning Emissions Compared to Arizona Annual Prescribed Fire Emissions	-	26%	25%	25%	31%	30%	25%

The ecological response unit acreages reflect the percentages that the three ecological response unit's occur in the entire project area (528,885 acres) divided by 10 years. A comparison of the emissions to Arizona's annual total prescribed fire emissions is shown.

If first entry prescribed burning burns (the acreages shown in table 18), the criteria air pollutant emissions would range approximately from 41 to 62 percent and greenhouse gas emissions would be approximately 53 percent of the total Arizona annual prescribed fire emissions.

If second entry prescribed burning burns (the acreages shown in table 19), the criteria air pollutant emissions would range approximately from shows 32 to 52 percent and greenhouse gases emissions would be approximately 36 percent of the Arizona annual prescribed fire emissions.

Table 18. Alternative 3 first decade, first entry, no mechanical treatment scenario annual prescribed burning smoke emissions, completed within 10 years, compared to Arizona annual emissions

RIM Country FEIS Alternative 3 Ecological Response Units	Annual Burned Acres / Percent Project Area	Carbon Monoxide (tons)	PM2.5 (tons)	PM10 (tons)	Nitrogen Oxides (tons)	Sulfur Dioxide (tons)	CO2e Carbon Dioxide Plus Methane (tons)
First Entry Dry Mixed Conifer	3,173 / 6%	6,727	571	666	95	63	85,481
First Entry Pine Oak	7,933 / 15%	8,250	714	793	79	79	101,066
First Entry Ponderosa Pine	40,721 / 77%	48,829	4,072	4,887	814	407	763,926
Total	**51,827**	**63,806**	**5,357**	**6,346**	**988**	**549**	**950,473**
Arizona Annual Prescribed Fire Emissions	-	154,561	12,937	15,265	1,596	1,005	1,809,495
Percent of Alternative 3 Prescribed Burning Emissions Compared to Arizona Annual Prescribed Fire Emissions	-	41%	41%	42%	62%	55%	53%

Table 19. Alternative 3 second decade, second entry, no mechanical treatments scenario annual prescribed burning smoke emissions, completed within 10 years, compared to Arizona annual emissions

RIM Country FEIS Alternative 3 Ecological Response Units	Annual Burned Acres / Percent Project Area	Carbon Monoxide (tons)	PM2.5 (tons)	PM10 (tons)	Nitrogen Oxides (tons)	Sulfur Dioxide (tons)	CO2e Carbon Dioxide Plus Methane (tons)
Second Entry Dry Mixed Conifer	3,173 / 6%	7,393	571	698	32	32	67,490
Second Entry Pine Oak	7,933 / 15%	8,488	635	794	79	79	74,332
Second Entry Ponderosa Pine	40,721 / 77%	50,087	4,072	4,887	407	407	510,641
Total	**51,827**	**65,968**	**5,278**	**6,379**	**518**	**518**	**652,463**
Arizona Annual Prescribed Fire Emissions	-	154,561	12,937	15,265	1,596	1,005	1,809,495
Percent of Alternative 3 Prescribed Burning Emissions Compared to Arizona Annual Prescribed Fire Emissions	-	43%	41%	42%	32%	52%	36%

If first entry prescribed burning burns (the acreages shown in table 20), the criteria air pollutant emissions would range from approximately 50 to 64 percent and greenhouse gas emissions would be approximately 50 percent of the total Arizona annual prescribed fire emissions.

If second entry prescribed burning burns (the acreages shown in table 21), the criteria air pollutant emissions would range from approximately 32 to 52 percent and greenhouse gas emissions would be approximately 33 percent of the Arizona annual prescribed fire emissions.

Table 20. Alternative 3 first decade, first entry, after mechanical treatment scenario annual prescribed burning smoke emissions, completed within 10 year, compared to Arizona annual emissions

RIM Country FEIS Alternative 3 Ecological Response Units	Annual Burned Acres / Percent Project Area	Carbon Monoxide (tons)	PM2.5 (tons)	PM10 (tons)	Nitrogen Oxides (tons)	Sulfur Dioxide (tons)	CO2e Carbon Dioxide Plus Methane (tons)
First Entry Dry Mixed Conifer	3,173 / 6%	8,567	666	793	32	32	75,708
First Entry Pine Oak	7,933 / 15%	11,424	952	1,111	159	159	137,558
First Entry Ponderosa Pine	40,721 / 77%	62,274	4,887	5,701	814	407	682,484
Total	**51,827**	**82,265**	**6,505**	**7,605**	**1005**	**598**	**895,750**
Arizona Annual Prescribed Fire Emissions	-	154,561	12,937	15,265	1,596	1,005	1,809,495
Percent of Alternative 3 Prescribed Burning Emissions Compared to Arizona Annual Prescribed Fire Emissions	-	53%	50%	50%	63%	60%	50%

Table 21. Alternative 3 second decade, after mechanical treatment scenario annual prescribed burning smoke emissions completed within 10 years, compared to Arizona annual emissions

RIM Country FEIS Alternative 3 Ecological Response Units	Annual Burned Acres / Percent Project Area	Carbon Monoxide (tons)	PM2.5 (tons)	PM10 (tons)	Nitrogen Oxides (tons)	Sulfur Dioxide (tons)	CO2e Carbon Dioxide Plus Methane (tons)
Second Entry Dry Mixed Conifer	3,173 / 6%	6,505	508	603	32	32	50,356
Second Entry Pine Oak	7,933 / 15%	10,234	794	952	79	79	90,595
Second Entry Ponderosa Pine	40,721 / 77%	55,381	4,479	5,294	407	407	446,302
Total	**51,827**	**72,120**	**5,781**	**6,849**	**518**	**518**	**587,253**
Arizona Annual Prescribed Fire Emissions	-	154,561	12,937	15,265	1,596	1,005	1,809,495
Percent of Alternative 3 Prescribed Burning Emissions Compared to Arizona Annual Prescribed Fire Emissions	-	47%	45%	45%	32%	52%	33%

Cumulative Effects

Smoke Emissions – Criteria Air Pollutants and Greenhouse Gas Emissions

Cumulatively, alternative 3 combined with current and reasonably foreseeable activities would result in an annual average of more than 97,000 acres of prescribed fire though annual amounts may vary considerably. The overall effects from this amount of prescribed fire is expected to be nearly a third less than those associated with alternative 2, but more than alternative 1. The potential for higher overall emissions associated with wildfires burning in areas not identified for treatment under alternative 3 would result in more emissions in these areas than alternative 2. All prescribed fires would be implemented in compliance with ADEQ rules that regulate criteria air pollutants as well as Land Management Plan direction to meet legal standards and provide for public safety.

Areas with potential for air pollution and visual effects include the Colorado River Airshed, the Little Colorado River Watershed, and the Verde River Watershed. Class 1 airsheds that could be affected include Petrified Forest National Park, Sierra Ancha Wilderness Area, and Mazatzal Wilderness Area. As more acres are treated, there would be broader burn windows, potentially resulting in more days of prescribed fire and days of air pollution and visual quality effects when added to prescribed burning occurring in the cumulative effects boundary.

Climate Change - Carbon Storage

Climate change impacts are analyzed by resource throughout chapter 3 and greenhouse gas emissions are analyzed in the Air Quality section. This section focuses on Carbon Storage.[8]

[8] Carbon sequestration refers to the process of removing Carbon from the atmosphere and depositing it in a reservoir, while Carbon storage refers to the quantity of Carbon stored in a reservoir.

Affected Environment

Carbon sequestration is an important dynamic of climate change that has been and continues to be affected by current and past forest management. Fire suppression practices have changed the dynamics of fire in ponderosa pine forests across the southwest, resulting in greater fuel-loads and increased risk of uncharacteristic fire. Under current conditions, dense forest stands can store more carbon than open forests, shrublands, or grasslands, although it is not a stable state. These forests are prone to increasingly large, high-severity wildfires, which release a pulse of carbon emissions, shifting carbon storage from live trees to standing dead trees and woody debris (North et al. 2009, Kolb et al. 2007) have shown that biomass and carbon may fail to recover; the Horseshoe Fire was still a net carbon source 15 years after the fire (Figure 26). Savage and Mast (2005) showed that these conditions can persist for decades.

High-severity fire in ponderosa pine forests releases large quantities of CO2 to the atmosphere (Air Quality – Smoke Emissions Greenhouse Gas Emissions section). The emissions below are associated with ponderosa pine within an existing, healthy fire regime. Far more carbon is stored in the healthy ponderosa pine forest than the area recovering from a high-severity fire (Figure 27).



Figure 26. The Horseshoe Fire was still a net carbon source 15 years after the fire (photo from November 2011)



Figure 27. A healthy ponderosa pine forest

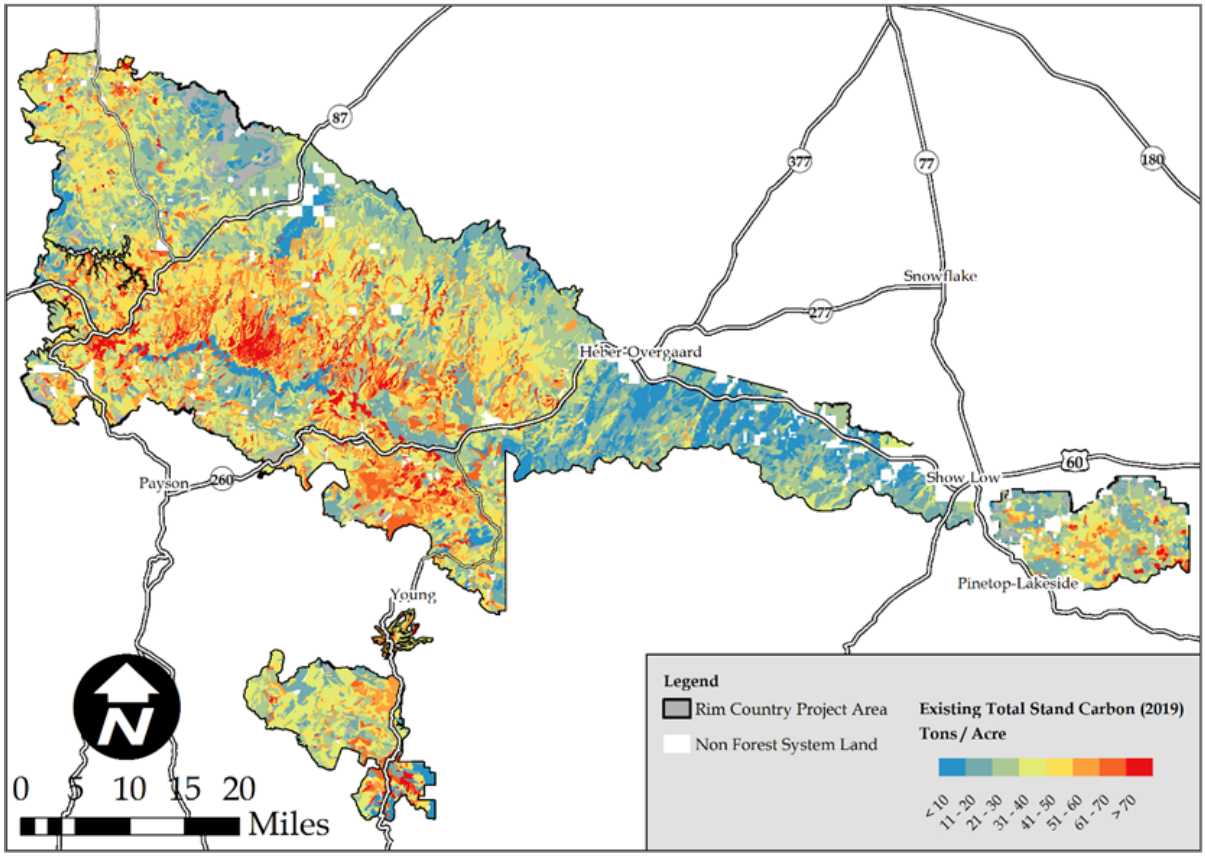


Figure 28. Total estimated above and below ground sequestered carbon in 2019 for the Rim Country project area

Environmental Consequences

Effects Common to All Alternatives

Climate scientists agree that the earth is undergoing a warming trend, and that human-caused elevations in atmospheric concentrations of carbon dioxide and other greenhouse gases are among the causes of global temperature increases. Forests serve as carbon reservoirs; however, large-scale fire events can counter this benefit by releasing significant amounts of carbon into the atmosphere. Restoration treatments including thinning and prescribed fire as identified in the proposed action, promote low-density stand structures, characterized by larger, fire-resistant trees. This strategy should afford for greater carbon storage in southwestern fire-adapted ecosystems over time (Hurteau and North 2009). Although fire-excluded forests contain higher carbon stocks, this benefit is outweighed in the long term by the loss that would be likely from uncharacteristic stand-replacing fires if left untreated (Hurteau et al. 2011). Research has also shown that the long-term gains acquired through prescribed fire and mechanical thinning outweighs short-term losses in sequestered carbon. In the long term (100 years) thinning and burning would create more resilient forests, less prone to stand-replacing fire.

Finkral and Evans (2008) examined the full effects on carbon of an actual restoration thinning treatment in a ponderosa pine forest. They found that while the treatment initially produced a 30 percent reduction in the carbon held in live trees, it significantly reduced the threat of an active crown fire, which they predicted would kill all the trees and release 3.7 tons of carbon per acre in any untreated areas. Such findings are especially important when one considers that climate change is expected to make the conditions for damaging wildfire and insect outbreaks even more prevalent in the western United States.

Both thinning and prescribed burning would help to mitigate the negative impacts of stand-replacing fire in dry, dense forests, by consuming less biomass and releasing less carbon into the atmosphere (Finkral and Evans 2008, Wiedinmyer and Hurteau 2010). Thinning, prescribed burning, or allowing wildfires that produce only low to moderate-severity effects reduces on-site carbon stocks and releases carbon into the atmosphere at a lower rate than high-severity fire. Woods et al. (2012) found that, although burn frequency affected the rate and total amount of carbon storage in a ponderosa pine forest, both 20 year and 10 year fire return intervals produced forests that were net carbon sinks, while the no action alternative forest became a net carbon source.

In the long term, approximately 100 years, the action alternatives would create more resilient forests, less prone to stand-replacing wildfires and mortality caused by severe drought, and subsequently able to store more carbon by an increased availability of live, healthy trees, harvested wood products, and energy products created from resulting slash which are used in place of fossil fuels (North and Hurteau 2011, Sorenson et al. 2011, Woods et al. 2012). Not all forest products store carbon equally. For example, products with longer average lifespans such as buildings made of wood components, have a greater potential to store carbon than short lived products such as fence posts and unmaintained gazebos. In addition, biomass products created from slash can be used in place of fossil fuels greatly reducing carbon emissions into the atmosphere (Ryan et al. 2010). Wood products, which substitute standard building materials such as steel and concrete, produce far less greenhouse gas emissions during their production while simultaneously storing carbon (Ryan et al. 2010). Thoughtful incorporation of carbon effects in landscape-scale planning should help implementation of Rim Country actions improve the ability of the project area to store carbon in a stable condition.

In a recent study McCauley (2019) found:

> Despite initial decreases in carbon in the first two decades due to accelerated harvest and prescribed fire, the moderate[1] and fast[2]-4FRI scenarios resulted in greater carbon storage by the end of the century than the status quo and no-harvest scenarios and that pattern remained consistent among the climate models. Depending on the climate model, the overall increases in Total Environmental Carbon (TEC) for the fast-4FRI scenario were 9–18% higher than the no-harvest scenario, equating to an increase of 6.3 million–12.7 million metric tons of carbon across the 4FRI project area. Climate models that predicted the largest temperature increases by late (21st) century showed greater decreases in TEC in all restoration scenarios by the end of the century (McCauley et al. 2019).

Thinning and burning, as proposed at various levels in all action alternatives would:

- temporarily lower the amount of biomass in the forest and, thus, the amount of carbon the forest stores over the short term
- reduce the amount of competition for water and nutrients, allowing the remaining trees to grow larger and, subsequently, sequester more carbon over the long term
- works with the ecology of the ponderosa pine system to restore a condition in which carbon is stored in its most stable form within the vegetation and soil
- softens the effects of uncharacteristic disturbances (such as wildfires, insects, disease), allowing natural disturbances (such as low-severity surface fires) to play their essential roles

Figure 29 shows a comparison between the alternatives of total above and below ground project carbon storage n in 2019, 2029, 2039, and 2049[9]. For comparison purposes, the total estimated amounts of forest ecosystem sequestered carbon in all U.S. forested areas declined from 740,753,201 tons in 1990, to 684,535,324 tons in 2017[10] (Domke et al. 2019). For alternative 1, this assumes that above and below ground carbon storage would increase primarily due to vegetation growth accumulation that is not reduced by drought stress or insect infestations and wildfires.

[9] The use of the term above and below ground here includes aboveground biomass; belowground biomass; dead wood; and litter.

[10] Forest ecosystem includes aboveground biomass; belowground biomass; dead wood; litter, soil (mineral); soil (organic); drained organic soil; harvested wood; products in use; and solid waste disposal sites.

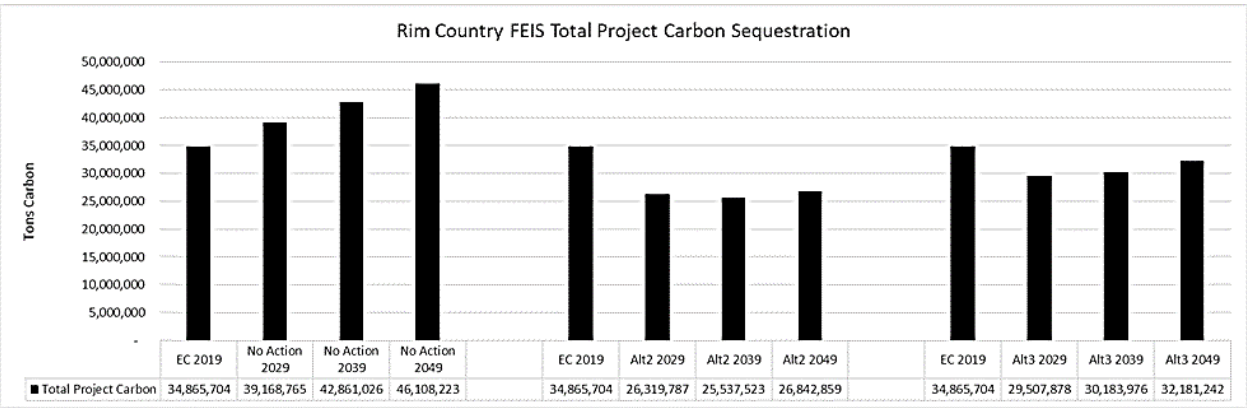


Figure 29. Comparison between the alternatives of total above and below ground carbon stores in 2019, 2029, 2039 and 2049 (tons)

Alternative 1 – No Action

Under alternative 1, Figure 30 shows an increase in total above and below ground carbon over time (2019-2049) depending upon no disturbances occurring such as from wildfires or mortality caused by severe droughts.

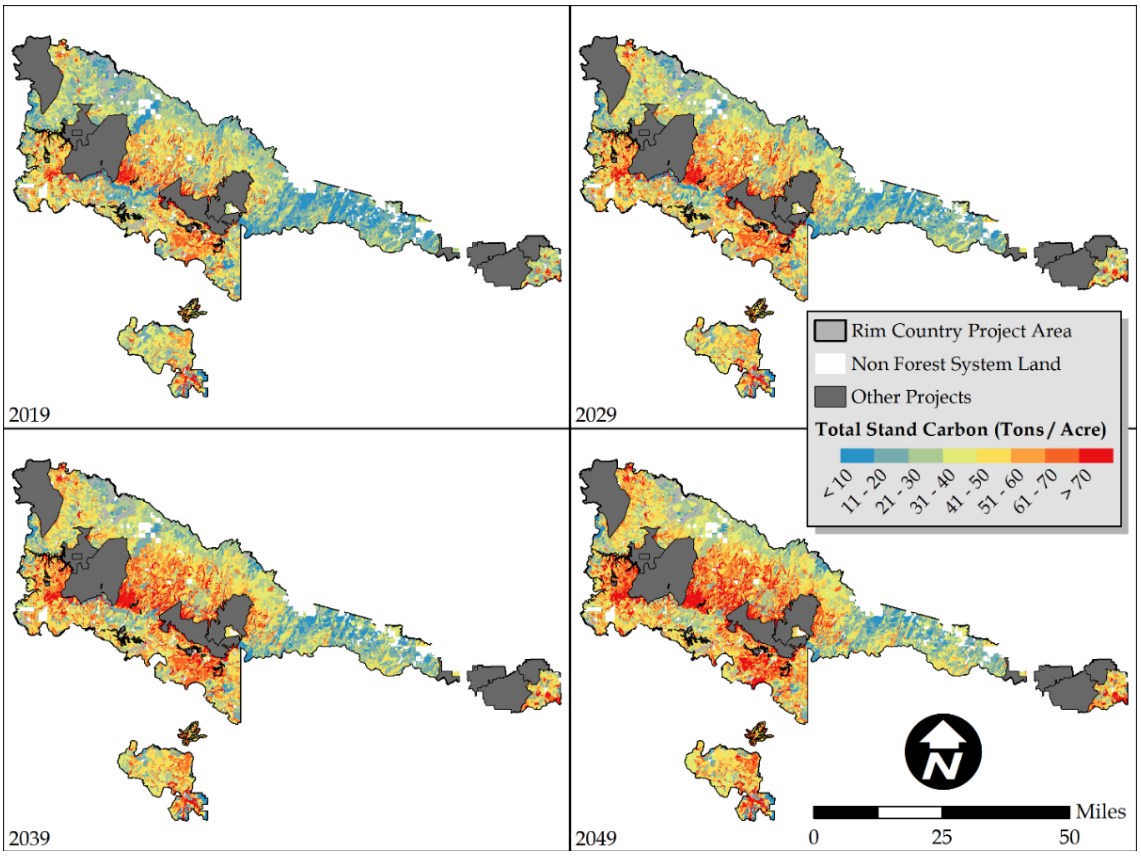


Figure 30. Alternative 1 increases in total above and below ground carbon over time - 2019-2049 (tons per acre)

Alternative 2 – Modified Proposed Action

Under alternative 2, Figure 31 shows the greatest short-term decrease in total above and below ground carbon from 2029-2049 compared to all other alternatives. The reduction in carbon would be due to forest thinning and prescribed burning. The maps do not include the potential for other disturbances that could occur such as from wildfires or mortality caused by severe droughts.

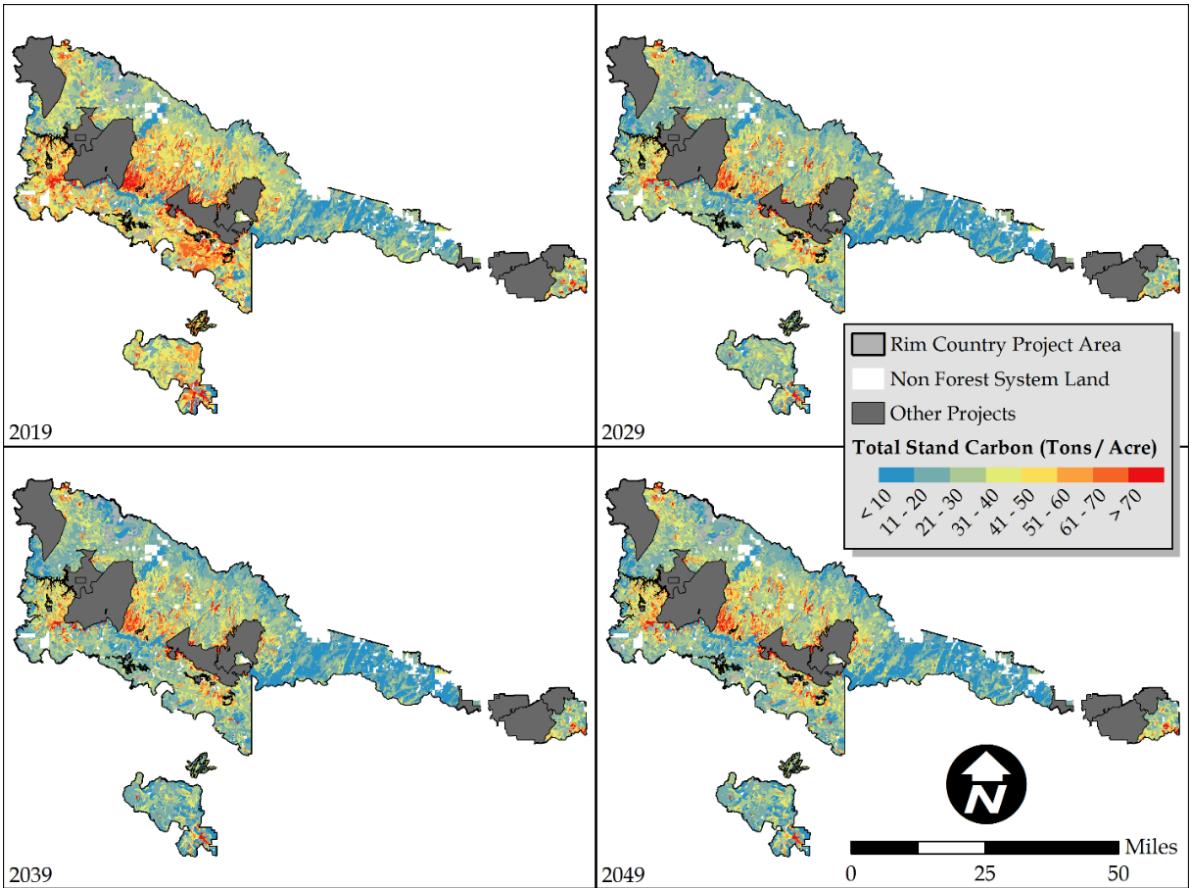


Figure 31. Alternative 2 changes in total above and below ground carbon over time 2019-2049 (tons per acre)

Alternative 3 – Focused Restoration

Under alternative 3, Figure 32 shows the short-term decrease in total above and below ground carbon from 2029-2049 more than alternative 1 and less than alternative 2. The reduction in carbon would be due to forest thinning and prescribed burning. The maps do not include the potential for other disturbances that could occur such as from wildfires or mortality caused by severe droughts.

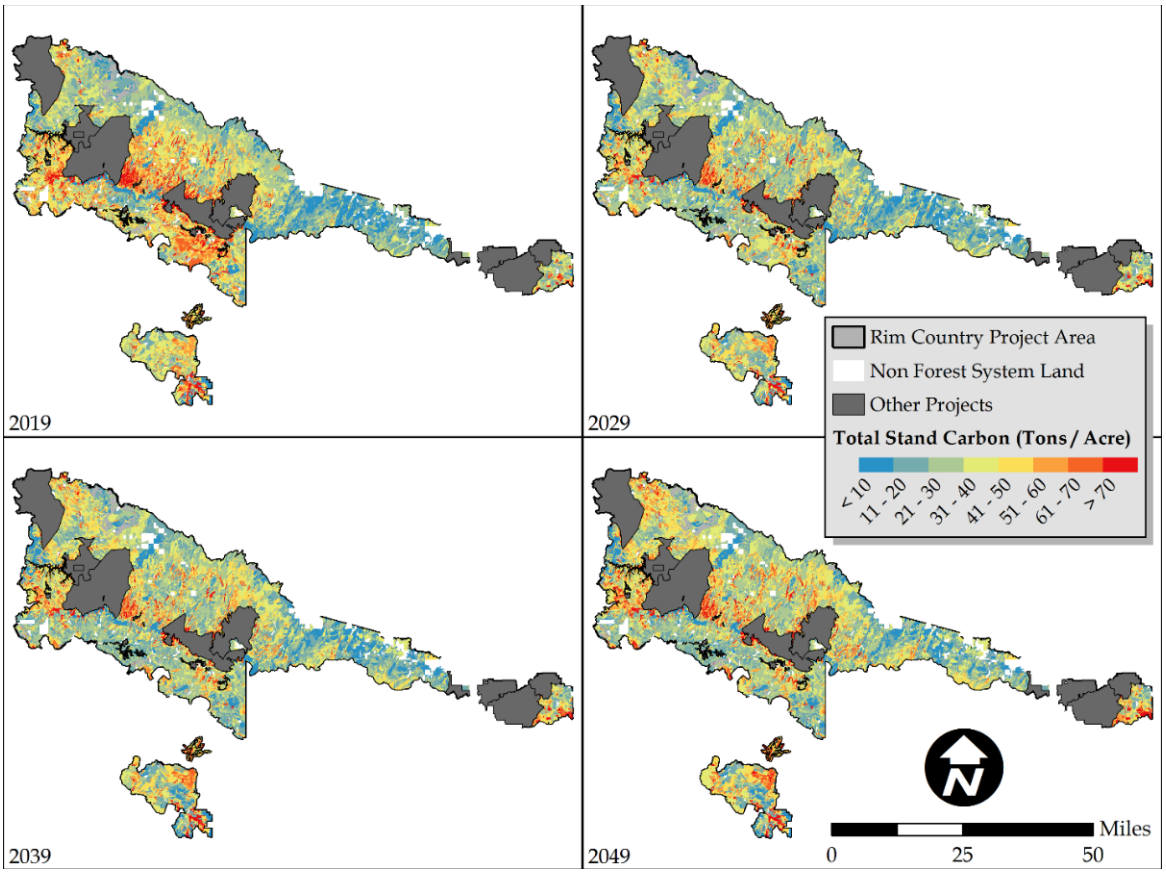


Figure 32. Alternative 3 changes in total above and below ground carbon over time - 2019-2049 (tons per acre)

Cultural Resources

A summary of the cultural resource analysis is presented here and the complete cultural resources specialist report (USDA FS 2021e) is incorporated by reference.

Affected Environment

Within the Rim Country project area, cultural resources range temporally from prehistoric times through the historic period and into modern times. Prehistoric sites can include rock art, cliff dwellings, pithouses, multiple room pueblos and artifact scatters. Historic resources may consist of logging railroad grades, trails and historic roads, cabins and homesteads, Forest Service administrative sites, Basque sheep camps, mining camps, Civilian Conservation Corps sites, and Native American shelters such as sweat lodges and brush shelters. Cultural resources also include Native American traditional use areas and places known as Traditional Cultural Properties. These hold a central and important place in Native American culture.

The existing condition for cultural resources is determined by the number of existing cultural inventories within the analysis area, in addition to the amount and/or types of resources, and cultural periods represented by those resources, that have been identified within the boundaries of the FEIS. Table 22 was generated by the Apache-Sitgreaves and Coconino National Forests using their cultural GIS databases, while the Tonto used their hard copy cultural atlases.

Table 22. Cultural resource sites and surveys (2017)

Forest Name	Acres Previously Surveyed	Cultural Resources Recorded	National Register Listed Sites	NR eligible Sites	Unevaluated Sites	Site Previously Evaluated Ineligible
Apache-Sitgreaves	104,474	3,012	6	795	2,026	57
Coconino	97,900	946	2	148	774	22
Tonto	29,226	1,100	2	388	621	91

Apache-Sitgreaves National Forests

The Rim Country EIS Area of Potential Effect includes 539,942 acres of the Apache-Sitgreaves National Forests, 401,911 acres on the Black Mesa Ranger District (65 percent of the district), and 138,031 acres on the Lakeside Ranger District (51 percent of the district). According to current geographic information systems (GIS) data, forest archaeologists have surveyed 90,929 acres, approximately 17 percent of the 539,942 acres in the Rim Country project area.

Three thousand and twelve (3,012) cultural resources have been recorded, 1,694 on the Black Mesa Ranger District and 1,318 on the Lakeside Ranger District, of which six are listed on the National Register of Historic Places, 795 were determined eligible for inclusion on the National Register, 2,026 are unevaluated for eligibility, and 27 have been determined not eligible for inclusion on the National Register. Most of the sites recorded are prehistoric or protohistoric in nature (84 percent), followed by historic sites (12 percent), 74 sites of unknown affiliation (2.5 percent), and multi-component sites with historic and prehistoric artifacts/features (1.5 percent). Site types represent a full range of human occupation, from Paleoindian sites of the Pleistocene to a wide variety of historic period sites dating to 50 or more years ago.

Coconino National Forest

The Rim Country EIS Area of Potential Effect includes 398,860 acres of the Coconino National Forest, 389,482 acres on the Mogollon Rim Ranger District and 9,378 acres on the Red Rock Ranger District. Within this area, forest archaeologists have surveyed 97,900 acres, approximately 25 percent of the 398,860 acres in the Rim Country project area. Archaeologists have identified 946 cultural resources, of which two are listed on the National Register of Historic Places, 148 were determined eligible for inclusion on the National Register, 774 are unevaluated for eligibility, and 22 have been determined not eligible for inclusion on the National Register.

Most of the sites recorded on the Coconino are prehistoric in nature (78 percent), followed by historic sites (20 percent), multi-component sites with historic and prehistoric artifacts/features (16 percent), and four sites of unknown affiliation. The majority of the prehistoric sites are lithic scatters (47 percent) and scatters with lithic artifacts and ceramics (21 percent). Other prehistoric sites include sites with house features: field houses, pueblos, pithouses, cliff dwellings, or other house features (20 percent), caves/rockshelters/cavates (3 percent), agricultural fields (3 percent), and rock art sites (4 percent). The 189 historic sites include those associated with national forest management (21 percent), logging or sawmills (7 percent), ranching (47 percent), historic trails or wagon roads (6 percent), mining (3 percent), military (3 percent), historic burials (3 percent), and trash dumps that may be related to one or several of these historic activities (10 percent).

Tonto National Forest

The Rim Country EIS Area of Potential Effect includes 290,090 acres on the Payson and Pleasant Valley Ranger Districts of the Tonto National Forest. Within this area, forest archaeologists have surveyed

29,226 acres, approximately 10 percent of the 290,090 acres in the Rim Country project area. Archaeologists have identified 1,100 cultural resources, of which two are listed on the National Register of Historic Places, 388 were determined eligible for inclusion on the National Register, 621 are unevaluated for eligibility, and 91 have been determined not eligible for inclusion on the National Register.

Assumptions and Methodology

The primary assumption for this effects analysis is that the removal of fuel from archaeological sites and improving or decommissioning roads is a benefit to cultural resources. These activities could protect cultural resources from the effects of extremely hot, highly destructive wildfires by removing fuel from around and off of archaeological sites. Improving or decommissioning roads could protect archaeological sites by removing roads that go through sensitive sites. Improving rough, impassible roads could reduce the threats to archaeological sites from off-road driving. This would also encourage drivers to remain on roads rather than drive cross-country to avoid bad spots in roads. However, the methods for accomplishing these tasks, such as mechanical thinning or ripping of roads, also has the potential to adversely affect cultural resources.

The secondary assumption is that cultural resources would be present at the proposed spring, riparian, or stream restoration locations. Cultural resources are frequently found in association with water sources such as springs, streams, and riparian areas. Water sources would have been exploited prehistorically and during historic periods. A reliable spring, for example, would likely have been developed to supply stock grazing, logging operations, or farming.

The final assumption is that all activities proposed with the Rim Country EIS would meet the criteria of a No Adverse Effect determination as defined in the Programmatic Agreement (USDA Forest Service 2003) and/or 36 CFR 800.6 where appropriate.

In consultation with the Arizona State Historic Preservation Office (SHPO), the forests are going to rely on multiple guidance documents and strategies to assist in reaching a No Adverse Effect determination. The primary guidance would be Appendix J of the Programmatic Agreement. Appendix J of that agreement outlines the consultation protocols and strategies for implementing large-scale fuels reduction, vegetation treatment, and habitat improvement projects.

To supplement Appendix J, in consultation with the Arizona SHPO and tribes, the Rim Country Project forests' created a sample survey strategy specifically for vegetation projects that would involve mechanical treatments (Morgan et al. 2017). Appendix J of the Programmatic Agreement provides guidance for mechanical treatment. However, it does not distinguish between the various types of mechanical treatment options, for example, feller-buncher versus agra-ax, nor does it take into account existing site inventory data or identified high and low site densities areas. A model was created using terrestrial ecological unit strata and known site densities within the project area. The model, amount of existing inventory within a task area and the type of proposed mechanical treatment would all be taken into account when determining the amount of inventory necessary and any standard mitigation measures that need to be implemented to meet the criteria of No Adverse Effect.

The Programmatic Agreement would guide the analysis for the remaining activities proposed in the Rim Country EIS. The one exception would be road improvement and decommissioning. Some Forest roads are known to cross archaeological sites and they often have exposed artifacts and cultural features in the roadbeds. Improving or decommissioning roads could involve some level of mechanical work such as

grading or ripping roadbeds. The forests, in consultation with the Arizona SHPO and tribes, developed a road plating protocol. This protocol outlines procedures for "plating" or covering the portions of sites within roadbeds that have remaining features or intact cultural deposits. This would help to protect intact cultural remains in the roads from blading or other types of maintenance or decommissioning activities.

Phased Section 106 Compliance

Because of the size of the undertaking, implementation would be phased over several years. Appendix J, reviewed by the Arizona, New Mexico, Texas, and Oklahoma SHPOs, the ACHP, and tribes, allows for the phasing of compliance with Section 106 of the National Historic Preservation Act of 1966. Appendix J of the Programmatic Agreement and the Rim Country Sampling Strategy (Hangan 2021), developed in consultation with tribes and the Arizona SHPO, describes the methods to be used to achieve a no adverse effect determination for the Rim Country analysis as a whole, while providing a strategy for a phased Section 106 evaluation for individual task orders.

Individual task orders, or undertakings, would be inventoried when each specific project area is identified. A Section 106 report would be produced for each proposed individual undertaking, and all consultation with the Arizona SHPO and appropriate tribes would be completed prior to implementing the task order.

Environmental Consequences

Alternative 1 – No Action

Under alternative 1, existing fuels in and around archaeological sites would continue to increase. This could result in more frequent and intense wildfires which could result in site and artifact damage such as spalling of rock art and cracking of artifacts. Fire suppression actions, particularly bulldozer operations, could damage or completely destroy surface and subsurface (pit houses/kivas) archaeological sites, resulting in the loss of those resources and their research potential.

Soil erosion due to uncharacteristic wildfires could have both direct and indirect effects on cultural resources. Rain and snow melt could cause channels to form within denuded sites, or mud slides from nearby slopes could deposit soil and debris within site boundaries, leading to the loss of data potential and the characteristics that would make a cultural property eligible for the National Register of Historic Places.

Archaeological sites located within open grass lands would be affected by an increased number of trees growing inside the site boundaries. The trees and their root systems might displace surface and subsurface artifacts and features. Also, the trees would increase the amount of fuel on the sites. This might result in effects from intense wildfires.

Forest system roads that cross archaeological sites would continue to affect the sites by degrading cultural deposits and features within roadbeds located inside site boundaries. Also, when roads are not well maintained, users may drive off existing roads to avoid "bad spots" and could affect cultural sites adjacent to the roads.

No action might also result in the reduction over time of pre-European settlement-adapted native plants, some of which have been collected since historic times by Native Americans for food and medicine. Additionally, springs, seeps, and riparian areas are important locations to Native Americans and other members of the public, and increasingly overstocked forests might have some effects on those historic water sources.

Effects Common to Both Action Alternatives

Each of the alternatives recommends a substantial amount of ground disturbance, particularly mechanical treatments as part of thinning trees, grassland restoration, blading in new temporary roads, maintaining existing roads, or decommissioning roads. Other activities such as stream and riparian restoration, and the installation of barriers around springs, aspen, and other native trees may also include-ground disturbing activities. Riparian areas and water sources like streams and springs tend to be locations where the presence of cultural resources can be reliably predicted. All of these activities have the potential to adversely affect cultural resources. Effects could include rutting, erosion, dislocation, or breakage of artifacts and features, and destruction of sites and site stratigraphy.

Prescribed burning also has the potential to affect sites. If the burning is low to moderate in heat intensity, and there is little fuel on the sites, most sites located inside the project area would be minimally affected, if at all, with the exception of sites that include wood elements or rock art. Sites within the project area with a significant amount of fuel in a prescribed burn area could be affected by heat damage in the same manner as a wildfire if the fuel is not removed prior to burning. Effects from heat damage would include breaking, pocking, and spalling of ground stone tools and architectural features. Excessive heat could alter obsidian hydration rinds, destroying their dating potential and the associated loss of scientific information. Effects on structural components such as rock walls or rock faces include discoloration, cracking, and spalling, making the rocks susceptible to accelerated deterioration. There is also the potential for effects from soil erosion due to the removal of vegetation. Rain and snow melt, for example, could cause channels to form within denuded sites. Mud slides from nearby slopes could deposit soil and debris inside site boundaries, leading to the loss of data potential and the characteristics that would make a cultural property eligible for the National Register of Historic Places. The majority of the effects listed above can be mitigated through project design, avoidance, removing fuel from sites prior to project implementation, and implementing site protection measures (see Appendix C).

Thinning and prescribed burning should reduce unnatural fuel loading around and inside the boundary of National Register listed or eligible cultural resources. Uncharacteristic fire behavior should also be reduced by these treatments, which would help to prevent extensive heat damage from future wildfires. There would be less need for fire suppression activities during a wildfire, and consequently less of a threat from ground-disturbing activities, such as bulldozer fire-line construction.

Initial reduction of heavy fuels may lead to an increase in site visibility, public visitation, and possible vandalism. Those issues are mitigated through management actions that include project-specific as well as long-term monitoring. Initial entry prescribed burns should be periodically revisited and burned to reduce natural fuel accumulations, and archaeological site monitoring is part of that process. Road decommissioning can also assist in limiting access to some archaeological sites, thus minimizing post-burn visibility and visitation issues at those sites.

The proposed temporary road construction, road maintenance, and road decommissioning do have the potential to affect cultural resources. The Programmatic Agreement includes mitigation measures that would help protect cultural resources affected by system roads identified for maintenance or decommission. The locations of temporary roads would be inventoried prior to implementation and any potential effects to sites would be mitigated through avoidance or project redesign. Decommissioning activities, if contained within the roadbeds and not inside site boundaries, should have no effects on cultural resources. In those cases where road maintenance or decommissioning might occur within National Register listed or eligible cultural resources, a site plating strategy should be used that has been

developed in consultation with the Arizona SHPO and tribes[11]. The protocol includes mitigation measures to protect any existing cultural deposits or features present within the roadbeds or along road cuts.

Restoration activities for grasslands, riparian areas, and streams do have the potential to affect cultural resources. Grasslands tend to contain low densities of archaeological sites. Some restoration activities, such as the use of an agra-ax to remove encroaching trees, though a mechanical treatment, are known to disturb little of the ground surface. Therefore, grassland restoration activities are less likely to adversely affect cultural resources. Where sites are present, mitigation measures listed in the Programmatic Agreement and design features in Appendix C would be implemented.

Springs, streams, and riparian areas are known to be very sensitive for the presence of cultural sites and culturally important plants. Restoration activities that are highly ground-disturbing would affect cultural resources. The Programmatic Agreement lists mitigation measures that should be implemented to minimize effects on cultural sites.

There is the possibility that cultural resources would be discovered during project implementation. These inadvertent discoveries would be handled, in consultation with Arizona SHPO and tribes, following the guidance in Appendix J of the Programmatic Agreement and 36 C.F.R 800.13., if appropriate.

Effects Unique to Each Action Alternative

The action alternatives propose essentially the same activities, ranging from various mechanical treatments, comprehensive restoration, and various types of road work. The major differences involve the amount of each activity being proposed. From a cultural resource standpoint, there are no effects that are unique or different between the alternatives. Effects on cultural resources are highly dependent upon the proposed activity, its location, and the likelihood of the presence or absence of cultural resources in the proposed treatment area. Therefore, mechanically thinning less acres under alternative 3 only matters in that fewer acres proposed for mechanical treatment means less of a threat of effects on cultural resources from this activity. However, it also means less fuel removed, thus less protection to cultural resources from the effects of high-severity wildfires.

Effects from Rock Pit Use and Expansion

Approximately 10 existing rock pits on the Coconino National Forest are being proposed for use within the Rim Country P roject area. On the Apache-Sitgreaves National Forests, 11 sites are proposed for expansion and use.

The rock pits would be used as a source of gravel for various road maintenance activities. Their access roads might undergo some level of maintenance and the pits might be expanded in various directions to a maximum of 500 feet, where needed to increase their capacity to yield material. The rock pit locations on the Coconino National Forest were evaluated for Section 106 compliance as part of the Rock Pits Environmental Assessment (USDA Forest Service 2016). Unlike the pits on the Coconino National Forest, the rock pits on the Apache-Sitgreaves National Forests have not been evaluated for Section 106 compliance beyond their current operations. According to the forest's cultural resource database, Carr

11 The region is in the process of working on adding this strategy as a protocol to the Region 3 Programmatic Agreement. Until that time, Arizona SHPO agreed that this plating strategy can be used within the 4FRI Rim Country area.

Lake, Brookbank, Borrow, and Cottonwoods Wash pits all have cultural resources that would need to be mitigated before any expansion of the pits.

Rock pit operations and expansions have the potential to affect cultural resource sites adjacent to the rock pits and their access road locations. Erosion by mass wastage, slope wash, and wind over many years can strip cultural deposits from archaeological sites, remove or displace artifacts, and undermine historical structures. Ground disturbances adjacent to cultural resource sites may accelerate erosion by damaging vegetation, loosening stable soil surfaces, or compacting soils, and thereby promote surface runoff. Vehicle tracks tend to channel surface runoff, causing down-cutting and increased soil erosion. These effects are expected to be avoided at cultural sites near rock pits through pit expansion design and avoidance measures such as erecting temporary fences around sites during periods of operation.

It is possible that increased truck traffic to and from proposed rock pits could result in indirect erosion effects on a small number of sites that occur adjacent to access roads. Keeping these roads well maintained would be expected to limit these effects.

The risk of unauthorized collection of artifacts would increase due to the presence of project personnel in areas where the locations of cultural resource sites are clearly marked. Unauthorized removal of materials from cultural resource sites could result in the loss of objects with cultural importance to Native American groups, or of artifacts needed to determine the age and nature of the occupation at prehistoric sites. This would be mitigated by requiring that sites identified near the pit operation areas are recorded in detail, then monitored after the operations have been completed.

Effects from Use of In-woods Processing and Storage Sites

Twelve locations have been identified as potential processing and storage areas within the Rim Country project area on the Coconino and Tonto National Forests.

The storage and processing areas located on the Coconino National Forest are within the Cragin Watershed Protection Project area. These areas were assessed for Section 106 compliance as part of the Cragin Watershed Protection Project Environmental Assessment heritage evaluation (Swift 2018). Mitigation measures and design features for the Cragin Environmental Assessment (USDA Forest Service 2018b) parallel those listed in the Programmatic Agreement and Appendix C of this Rim Country EIS and would be implemented prior to project implementation. If the proposed processing and storage areas are selected for use, the Mogollon Rim Ranger District archaeologist would review the existing inventory for that location and would ensure that mitigation measures as described in the Cragin Project Environmental Assessment are implemented, if needed.

The potential locations on the Tonto National Forest would likely be utilized for task orders or contracts in those areas. The evaluation for all of the processing and storage locations would follow the processes outlined in the design features in appendix C. Otherwise the guidance within the Programmatic Agreement would be used. Proposed mitigation measures would be implemented prior to the areas being used. With the implementation of standard mitigation measures and design features, there should be no adverse effects on cultural resources due to the use of these locations as storage and processing areas.

Effects from Land Management Plan Amendment

Three plan amendment exceptions are proposed to the Tonto National Land Management Plan. The exceptions would remove language restricting mechanical equipment on slopes of over 40 percent, amend Plan language and components to align with the 2012 Mexican Spotted Owl Recovery Plan (USDI Fish

and Wildlife Service 2012), and would redefine the treatment for ponderosa pine vegetation types. Of these three amendment exceptions, removing restrictions for mechanical equipment on slopes of less than 40 percent has the most potential to affect cultural resources and the methods for conducting Section 106 analysis.

Sensitive cultural resources such as rock art and rock shelters tend to be located on 40 percent or greater slopes of small hills, rock outcroppings and mountain slopes. However, because steeps slopes are typically not treated mechanically, Appendix J of the Programmatic Agreement includes provisions that would allow for exempting slopes 40 percent or greater from intensive archaeological inventory. The Rim Country Project alternatives would include treatment of slopes up to 40 percent. This increases the likelihood of impacts to the types of cultural resources found in those locations. It also means that the archaeological analysis would need to include an intensive inventory of the steep slope treatment locations.

Cumulative Effects

The cumulative effects analysis area is the Area of Potential Effect for the Rim Country EIS.

Alternative 1 – No Action

If this proposed large-scale, landscape-level forest health project is not implemented, there would still be some serious cumulative effects on cultural resources. High-severity wildfires and the construction of fire breaks using bulldozers during a wildfire could severely damage sites. Wildfires could also sterilize the soil or completely remove ground fuels, making the sites vulnerable to soil erosion. Also, because sites are more visible after a fire, they are much more susceptible to vandalism. Soil erosion from dry channels that are within or adjacent to sites could continue to affect a site's cultural stratigraphy and displace much cultural material. Roads through sites would continue to degrade cultural deposits and features. Trees would continue to encroach into grasslands and displace artifacts and cultural deposits within sites.

Cumulative Effects Common to Both Action Alternatives

Cumulative effects from mechanical treatments, temporary road construction, and other ground-disturbing activities, as well as effects caused by prescribed burning, would be mitigated using site protection measures identified in Appendix C of the Rim Country FEIS, Appendix J of the Programmatic Agreement, the Rim Country Sample Survey Strategy, and the Site Plating Strategy (Hangan 2021). These include archaeological monitors during mechanical activities, keeping ground-disturbing activities out of sites by flagging and avoiding the sites, and post prescribed burn site monitoring to assess the effects of the low-severity burns. Covering cultural deposits and features in roadbeds within cultural sites prior to maintenance activities or during decommissioning would protect buried cultural deposits and features. Also, well-maintained roads would encourage the public to remain on roads and deter cross-country travel which could damage sites located near roads. Because all ground-disturbing and prescribed fire undertakings go through the Section 106 review process, and identified potential effects would be mitigated, the overall cumulative effects from these undertakings should be minimal. Therefore, there should be few cumulative effects on cultural resources as a result of the activities proposed for the Rim Country Project.

There is the possibility of cumulative effects from archaeological site vandalism that results from increased visibility once the project is implemented. However, the management practice of implementing low to moderate-severity prescribed fire typically does not sterilize soil or completely remove ground fuels, as does a high-severity wildfire. Low-severity fires also tend to leave some trees in place that would eventually cover the surface with a recurring needle cast. Sites are also periodically monitored both

during project implementation, as well as for NHPA Section 110 purposes, by agency and volunteer personnel. Proposed road closures would also reduce public access to some of these areas.

The likelihood of erosion on cultural resources is also minimal. Reducing fuel loads and implementing low to moderate-severity prescribed fires does not cause soil sterilization or hydrophobic soils like high-severity wildfires. As noted previously, low-severity prescribed fires leave some vegetation in place and re-vegetation occurs soon afterwards if soils are not sterilized. However, as implementation occurs, archaeologists would monitor for erosion concerns, examining sites in the project areas, especially focused on slopes, drainages, and other high probability areas where cultural resources maybe present.

The proposed restoration activities in grasslands, riparian, streams, and seeps would also have a very limited ability to cause cumulative effects. All of these activities can easily be modified to minimize effects on cultural resources through avoidance or prescription modification. In the case of grasslands, the physical removal of encroaching trees and other fuels would have the added benefit of protecting sites from the effects of wildfire.

Tribal Relations

Affected Environment

Ancestorial Use

All of the lands in the Rim Country Project area are ancestral homelands to American Indian tribes. The archaeological resources within the project area demonstrate a high level of traditional use which continue today (see cultural resources section for more details concerning archaeological resources). The archaeological records demonstrate that the American Indian ancestral sites within the project area range in age from very early prehistory to historic times and can include rock art, cliff dwellings, pit houses, multiple room pueblos and artifact scatters. Additionally, places retain sacred values that are still relevant to contemporary tribes. Some of the more prominent sacred sites are evaluated as historic properties, pursuant the National Historic Preservation Act 1992 amendment. Under that act, certain qualifying sites can be determined eligible, and listed on the National Register as Traditional Cultural Places. Generally, Traditional Cultural Places consist of specific locations, or can be landscape in scale such as an individual mountain or a viewshed.

Contemporary Uses

The entire Rim Country Project area is managed by the Forest Service and is aboriginal land to the consulting tribes. However, with aboriginal ties to the land many tribal members also use the forest for traditional resources and ceremonies and to gather medicinal plants for other traditional and cultural purposes. Traditional gatherings and ceremonies are conducted throughout the forest and may or may not occur at the knowledge of the land manager. Additionally, these activities may occur over the span of an hour, to several hours or several days. The Forests recognize the importance of maintaining these traditions to area tribes and would accommodate traditional use of Forest Service lands by American Indians provided it complies with existing laws and regulations. However, in an attempt to reduce the likelihood of conflicts between traditional tribal activities and operations related to 4FRI, consultation and coordination is a critical component between the tribes and the forests regarding the timing and locations of specific planned activities and operations.

Years of government-to-government consultation with federally recognized tribes have identified numerous traditional uses in or near the Rim Country Project area. Examples of these uses include collection of forest products such as medicinal plants, tree boughs, ceremonial fuelwood, and piñon nuts, and ongoing use of ceremonial sites, shrines, and traditional gathering areas. Plant collecting is almost always conducted in more than one area in order to not deplete any particular plant species.

In some cases, specific traditional use areas have been identified on the Forest through project-level consultation. However, it is assumed most traditional use areas have not yet been identified. While some traditional uses consistently occur in one location, others may occur in a variety of locations based on the availability of resources. Therefore, prior to initiating project-specific Task Orders, the Forests would consult with federally recognized tribes to identify traditional use areas and, if necessary, develop project-specific mitigation measures to accommodate traditional use of the Forest by tribal members.

When areas of the Rim Country Project are selected for treatment, detailed maps of the area would be presented to tribes through on-going tribal consultation. This would be used to learn of any other sensitive areas of tribal importance that could be potentially impacted by 4FRI. Additionally, adjusting timing of treatment would coincide with seasonal plant gathering and ceremonial use.

Tribal Consultation

The Rim Country Project is situated across a landscape that is ancestral to at least 17 American Indian tribes. Federal law, regulation, and policy require consultation between the Forest Service and federally recognized American Indian tribes. For this project in particular it is relevant to acknowledge the Forests and Tribes share a common interest in maintaining the health of the forests, which can be explored through consultation and partnership development. Because all of the lands in the Rim Country project area are ancestral to American Indian tribes, it is in the best interest of the Forest Service to utilize tribal knowledge and resources in order to restore and maintain a healthy forest ecosystem. From April 2016 to May 2021, Forest Service Supervisors attended over 20 consultation meetings with tribes to discuss the Rim Country Initiative.

During consultation the tribes expressed concerns regarding: springs, medicinal and culturally utilized plants (Emory oak, sumac berry, tobacco), mechanical equipment, archaeological sites, traditional cultural properties, shared borders, access to forest products, fire sensitive archaeological sites (hogans, cradleboards, scarred trees, etc.), smoke impacts (smoke is not good for the elderly and fire from lightning struck trees is harmful to Navajo people), and herbicide usage (signs should be used so tribal members don’t collect plants in these areas). Comments were consolidated in the Tribal Relations Specialist Report within the DEIS and throughout the DEIS where relevant.

Table 23. Tribal consultation conducted for the Rim Country EIS

Date of Meeting	Tribes Attending	Meeting Location	Comments/Concerns
4/20/2016	Hopi Tribe	Flagstaff, Arizona	Known golden eagle nesting sites should be monitored
08/16/2016	Pueblo of Zuni, Yavapai-Apache Nation, San Carlos Apache Tribe, Tonto Apache Tribe, White Mountain Apache Tribe	Payson, Arizona	Tribes desire "pre-reservation conditions" for the forests. Tribes are concerned with long term access to forest resources particularly forest products which are traditionally utilized. Mechanical treatment should be culturally/tribally monitored to prevent destruction of traditional cultural properties and archaeological sites. Tribes (WMAT and SCAT) should be notified prior to prescribed burns. Smoke effects the elderly in tribal communities. San Carlos would like logging materials for their mills. There should be a TCP inventory conducted. There should be a harvesting/subsistence site inventory. Hot fires destroy the sumac berry, which is important to the Apaches. Mechanical thinning can destroy tobacco, which is important to the Apaches
8/18/2016	Salt River Pima-Maricopa Indian Community and Gila River Indian Community	Sacaton, Arizona	Concerned about wooden and other fire sensitive archaeological sites. For example, hogans with wood implements, cradle board scarred trees
11/21/16	Navajo Nation	Window Rock	There have been smoke impacts to Bitter Springs and Cedar Point. Smoke is not good for the elderly. Fire from lightning-struck trees is harmful to Navajo people. There may be a need for medicine men to be involved with these fires that are encouraged and maintained by Forest Service.
11/22/16	Pueblo of Zuni	Zuni, New Mexico	Zuni YCC crews are looking for work and work like to be involved. Springs are Zuni TCPs. Zuni would like to participate in cultural plant inventory and spring inventories (specific to Kaibab).
11/29/16	Fort McDowell Yavapai Nation & Yavapai-Prescott Indian Tribe	TNF Headquarters	Request for continued information sharing.
12/9/16	Mescalero Apache Tribe San Carlos Apache Tribe Tonto Apache Tribe	Payson, Arizona	Herbicide usage should be signed so tribal members don't collect plants in these areas. Agave parryi, acorn oaks, piñon, and cattails are important.
12/13/16	Pueblo of Zuni	Zuni, New Mexico	Zuni has crews that could assist in implementation. They also have cultural resources survey crews.
12/30/16	Salt River Pima Maricopa Indian Community Gila River Indian Community	TNF Headquarters	Gila River has thinning crews that could potentially assist in implementation. Salt River could provide cultural sensitivity training for contractors.
2/21/ 17	Hopi Tribe	Kykotsmovi, Arizona	Discussed gathering/harvesting of forest products, including forest access
3/14/17	White Mountain Apache	Email	Archeological firms conducting surveys should be familiar with the identification of Apache sites, as they do not always consist of physical objects, remains, and/or features
4/4/17	Navajo Nation	Email	Shared updates on the Rim Country project
4/5/17	White Mountain Apache	Email	Gathering and harvesting of forest products should not be impeded, especially acorn. Emory Oaks should not be destroyed

Date of Meeting	Tribes Attending	Meeting Location	Comments/Concerns
5/12/17	Yavapai-Apache Nation	Phone call and Email	The Western Apache Tribes are very concerned about the regeneration of Emory Oak stands on Forest Service managed lands. Saplings are trampled on, eaten and affected by fire, to the point where they are not reaching maturity. They would like us to identify stands of immature saplings and protect them with exclosures.
01/17/18	Hopi Tribes	Flagstaff, Arizona	Hopi would like the EIS to identify areas where springs, rock cairns, and plants such as wild tobacco, cattails, and osha are found in the areas stated for treatment. They want to be updated on the sampling strategies being developed.
01/11/18	Kaibab Band of Paiute Indians	Pipe Springs, Arizona	Tribe is interested in developing a SPA to provide thinning crews.
03/08/18	Pueblo of Zuni	Zuni, New Mexico	Pueblo of Zuni President signed the Tribal Crews Master Participating Agreement (MPA).
04/03/18	Havasupai Tribe, Hualapai Tribe, Hopi Tribe, Pueblo of Zuni	Kaibab NF Field Visit	Discussed project development under the MPA. Tribes need timbers and other forest products for traditional uses.
04/27/18	Gila River & Salt River Pima-Maricopa Indian Communities	TNF Headquarters	Gila River would like to participate in forest restoration activities. Salt River would be interested in providing input to the Citizen-Science Naturalist Program.
05/01/18	Tonto Apache Tribe, San Carlos Apache Tribe, Yavapai Apache Nation, White Mountain Apache Tribe	Twin Arrows, Flagstaff	Apache Tribes are very interested in the restoration, protection, and sustainability of Emory oak trees. They are willing to assist in designed management actions. Discussed Citizen Science project implementation. Discussed SPA development under the Tribal Crews Master Participating Agreement.
05/03/18	Hopi and Zuni	Twin Arrows, Flagstaff	Tribes are interested in assisting in forest restoration activities. Tribes use the forest to access timber and forest products not available on their reservations. Discussed Citizen Science Naturalist project implementation. Discussed SPA development under the MPA.
05/07/18	Havasupai Tribe	Supai, Arizona	Discussed MPA and possibility of Havasupai Water Resources assisting with water restoration projects
05/14/18	San Carlos Apache Tribe & White Mountain Apache Tribe	Payson Ranger District	Strategy meeting to discuss how to move forward to partner in Forest Restoration Activities
11/19/18	Hopi Tribe	Flagstaff and Mogollon Rim	Consultation is on-going. The Forest sends copies of reports to Hopi for the first EIS. Second EIS includes Apache-Sitgreaves, Coconino, and Tonto National Forests
5/23/19	Navajo Heritage and Historic Preservation Division	Flagstaff and Mogollon Rim	Consultation is on-going. Second EIS includes Coconino. Apache-Sitgreaves and Tonto National Forests. Discussed sites sensitive to fire and concerns with thinning levels.
5/29/19	Hopi Tribe	Flagstaff and Mogollon Rim	Rim Country was the first item on the SOPA that was to be discussed, the Tribe indicated they preferred to focus on other projects, not Rim Country
6/4/19	All Consulting Tribes	Email	In addition to the meetings listed above the all the associated Tribes were provided an opportunity to review the “Drafty DEIS” that was shared with the Stakeholders and the wider public on our website. This was in June of 2019. The outreach to them was through email by the tribal liaison(s) for the project. We did not receive any input.

Date of Meeting	Tribes Attending	Meeting Location	Comments/Concerns
8/14/19	Salt River Pima Maricopa Indian Community, Gila River Indian Community, San Carlos Apache Tribe, Tohono O'odham, Hualapai Tribe, Navajo Nation,	Meeting in Phoenix	Cultural resource surveys should be done. Plating archaeological sites is an adverse effect to ancestral sites
10/18/19	All Consulting Tribes	Letter	Provided letter with Rim Country DEIS availability information and electronic links to the documents
11/20/20	Havasupai Tribe	Meeting -Virtual	An update on the 4FRI project was provided by Robbin Bundrock. The tribal council requested project information. 11/30/2020: The forest sent the 4FRI website and story map links to the Tribal Council.
4/6/21	San Carlos Apache Tribe	Provided electronic information on the Rim Country Project	The San Carlos Apache Tribe requested a project update for 4FRI after the forest sent its second quarter SOPA list. Robbin Bundrock provided a project to the tribe on 04/21/2021, see below. We also sent the 4FRI Master Agreement with tribes for restoration activities as the tribe has an active forestry program.
5/13/21	Navajo Nation	Meeting-Virtual	A brief update on the Rim Country Project was provided by forest staff. No requests for information or follow up requests were made.

Assumptions and Methodology

Assumptions made are as follows: no activities would adversely affect archaeological sites or traditional cultural properties; the removal of excess fuels is a benefit to cultural resources, traditional cultural properties, traditional use forest products, and adjacent tribal lands; low heat prescription wildfires can result in the regeneration of medicinal plants; mechanical thinning of specific species can protect other plant species of cultural importance (such as Emory oak groves); restoration activities would benefit natural springs which are of universal importance to Indian tribes; Indian tribes would be consulted at critical points before project activities.

Issues, Indicators, and Analysis Topics

During consultation the tribes have expressed concerns about the following:

- Springs that are important to tribal communities are drying up.
- A lack of low-severity fire is reducing regeneration of medicinal plants.
- Active forest restoration is desirable so long as mechanical equipment is monitored to ensure for the protection of archaeological sites and traditional cultural properties.
- Tribes would like to assist in forest restoration activities, especially along shared borders.
- Tribes are concerned about long-term access to forest products for traditional use.
- Traditional cultural properties, harvest sites, springs, and cultural plants should be inventoried to ensure they are taken into consideration when planning project activities.
- Hot fires destroy the sumac berry which is important to the Apaches.
- Mechanical thinning can destroy tobacco which is important to the Apaches.
- Fire can destroy fire sensitive archaeological sites (hogans, cradleboards, scarred trees, etc.)

- There have been smoke impacts to Bitter Springs and Cedar Point.
- Fire from lightning struck trees is harmful to Navajo people. There may be a need for medicine men to be involved with these fires that are encouraged and maintained by the Forest Service.
- Wildland fire smoke negatively impacts tribal communities, especially the health of the elderly.
- Herbicide usage should be signed so tribal members don't collect plants in these areas.

Environmental Consequences

Alternative 1 – No Action

Tradition cultural use areas are at risk to catastrophic fire because it can destroy the setting of the Traditional cultural use areas. Springs and plant collection areas are at risk to catastrophic fire because of excessive runoff from monsoon rain washing in ash and debris in a fire devastated landscape. Overstocked stands are reducing the sunlight available for cultural and medicinal plants and catastrophic fire can destroy seed and habitat for native plants. A lack of low-severity fire is reducing regeneration of plants collected by native people.

Soil erosion due to uncharacteristic wildfires could have both a direct and indirect effect on traditional collecting areas. Rain and snow melt could cause channels to form, or mud slides from nearby slopes could deposit soil and debris over traditional areas leading to the loss of biological communities for both plant and animal species used by the tribes.

A "No Action" may result in the possible reduction over time of pre-settlement adapted native plants, some of which have been collected since historical times by American Indians for food and medicine. Additionally, springs and seeps are important locations to American Indians and other members of the public and increasingly overstocked forests may have some effect on those historic water sources.

Lastly, with continued drying trends across the southwest the Forest may need to issue forest closures and fire restrictions more frequently, thus, affecting access to traditional collecting and ceremonial use area.

Effects Common to All Action Alternatives

Mechanical thinning treatments, temporary road construction and closures, and other ground disturbing activities associated with Rim Country have the potential to affect traditional collecting and gathering, and ceremonial areas and Traditional Cultural Places. Prescribed burning also has the potential to affect fire sensitive areas.

However, restoration activities in general could positively impact the sustainability and availability of traditionally important plant species and natural springs. Initial reduction of heavy fuels may lead to an increase in understory plant growth and which could benefit to the habitat supporting culturally important plants. Low heat fires can also enhance certain plant species such as wild tobacco. The reduction in tree density would allow more water to flow through seeps and springs. Reducing unnatural fuel loads around National Register listed or eligible cultural resources which are known to be of interest to the local tribes representing the "footprints of their ancestors," would help to protect the sites from damage caused by high heat intensity wildfires.

Project implementation schedules may impact some American Indian uses as tribal members commonly access forest lands for ceremonial activities and to gather forest products and, in some cases, the timing of

these activities are related to ceremonies or the seasonality of some plant species. Access concerns can be addressed through on-going consultations between the forests and American Indian groups.

Increases in prescribed fire in all action alternatives, except no action, create the potential for increased smoke impacts. Most of the smoke from prescribed fire from within the Rim Country EIS area would carry from the southwest to the northeast, potentially affecting reservation communities located north and east of burn areas such as the Navajo Nations and White Mountain Apache Reservation.

Many people living in these areas are senior with health conditions and are sensitive to smoke. The effects of limited communications (they cannot access a website to learn about burning locations and other information), language barriers, or cultural differences make it difficult to get information to them and receive information in return about smoke impacts; and there is a general lack of smoke monitoring data on the reservations. Therefore, those living on these reservations may be disproportionately impacted by smoke from the various agencies (especially from multiple fires on multiple jurisdictions).

Possible road decommissioning can assist in limiting access to some sensitive tribal areas such as shrines and traditional gathering areas thus minimizing post burn visibility and visitation issues at those sites (for further discussion, refer to the cultural resources section). However, this may have the unintended consequence of impending tribal elders from accessing these areas as well because they are not physically able to walk long distances.

Effects Unique to Each Action Alternative and Differences among Them

The alternatives propose essentially the same activities ranging from various mechanical treatments, restoration, and various types of road work. The major differences involve the proposed quantity of each activity being performed, with the exception of alternative 1. From a tribal relation standpoint, there are no effects that are unique or different between the alternatives. Effects to resources and places that are important to tribal communities are highly dependent on the proposed activity, its location, and the likelihood of the presence or absence of a culturally important places or resources within the proposed treatment area and the effects to them. Therefore, mechanically thinning 873,420 acres versus 466,290 acres only matters in that less acres proposed for mechanical treatment means less threat to culturally important places from being impacted by this activity. However, it also means less fuel removed, thus less protection to the culturally important places and resources from the effects of high-severity wildfires. Also, an increase or a decrease in the amount of impacts from smoke on tribal communities.

Effects from Rock Pit Use and Expansion

Approximately 10 existing rock pits (see chapter 2 of the FEIS, volume 1) on the Coconino National Forest are being proposed for use within the Rim Country project area.

The pits are proposed to be used as a source of surfacing material (gravel/pit run), rock armoring (riprap), and borrow material for various road maintenance activities. Their access roads would undergo some level of maintenance and the pits may be expanded in various directions to a maximum of 500 feet to increase their capacity to yield material. The rock pit locations on the Coconino were evaluated for Section 106 as part of the Rock Pits Environmental Assessment (USDA 2016). Unlike the pits on the Coconino, pits on the Apache-Sitgreaves have not been evaluated for Section 106 compliance beyond their current operations. According to the Forest's cultural resource database, Carr Lake, Brookbank, Borrow and Cottonwoods Wash pits all have cultural resources that would need to be mitigated before expanding the pits.

Proposed rock pit operations and expansions have the potential to affect cultural resource sites adjacent to proposed rock pit and access road locations. Erosion by mass wastage, slope wash, and wind over many years, can strip cultural deposits from archaeological sites, remove or displace artifacts, and undermine historical structures. Ground disturbances adjacent to cultural resource sites may accelerate erosion by damaging vegetation, loosening stable soil surfaces, and/or compacting soils and thereby promote surface runoff. Vehicle tracks tend to channel surface runoff causing down-cutting and increased soil erosion. These effects are expected to be avoided at cultural sites near rock pits through pit expansion design and avoidance measures such as erecting temporary fences around sites during operation periods.

It is possible that increased truck traffic to and from proposed rock pits could result in indirect erosion effects on a small number of sites that occur adjacent to access roads. Keeping these roads well maintained would be expected to limit these effects.

The risk of unauthorized collection of artifacts would increase due to the presence of project personnel in areas where the locations of cultural resource sites are clearly marked. Unauthorized removal of materials from cultural resource sites could result in the loss of objects with cultural importance to Native American groups, or of artifacts needed to determine the age and nature of the occupation at prehistoric sites. This would be mitigated by requiring that sites identified near the pit operation areas are recorded in detail, then monitored after the operations are completed.

Effects from Use of In-woods Processing and Storage Sites

Twelve locations have been identified as potential processing and storage areas within the Rim Country project area on the Coconino and Tonto National Forests. Table 24 shows the proposed locations and current cultural information.

Table 24. Known cultural inventory and proposed storage sites

Name	Acres	Forest	Current Status of Inventory
137 / 96	141.8	Coconino	Minor previous survey, low probability, Historic Trail present
139 / 9729D	15.1	Coconino	Some survey, site located in or near proposed area
145A / 9615X	14.3	Coconino	Mostly surveyed, no sites, low probability
294 / 294D	81.1	Coconino	Half surveyed, no sites, low probability
81 / 81E	9.1	Coconino	Partially surveyed, sites located nearby, high probability
9364L / FH3	40.5	Coconino	No survey, several sites nearby, moderate probability
9731G / Hwy87	6.0	Coconino	No survey, very high probability
Snafu	10.7	Coconino	100% surveyed, one site near but not in. Has sinkhole
117 / 1321	3.8	Tonto	Not surveyed
582 / Hwy87	4.6	Tonto	Mostly surveyed
74 / 64	5.9	Tonto	Not surveyed, multicomponent site 04-1533 located in area. Unevaluated
288/2781	unknown	Tonto	Unknown
3238 / 512	23.5	Tonto	100% surveyed
609 / 1938	5.3	Tonto	Not surveyed, prehistoric multi-room compound site 05-188 located in area. Unevaluated.

The potential storage and processing areas located on the Coconino National Forest are within the project area for the Cragin Watershed Protection Project Environmental Assessment. The areas where they are

located were assessed as part of the Cragin heritage resources evaluation. Mitigation measures listed in the Environmental Assessment parallel those listed in the Programmatic Agreement and Appendix J and would be implemented prior to project implementation. If the proposed processing and storage areas are selected for use, the Mogollon Rim Ranger District archaeologist would review the existing inventory for that location and would ensure that mitigation measures listed in the Cragin Environmental Assessment (USDA FS 2018b) are implemented, if needed.

The potential locations on the Tonto National Forest would likely be utilized for task orders or contracts in these areas. The evaluation for all of the processing and storage locations, if evaluated as a part of a task order, would follow the processes outlined in Appendix J. Otherwise the guidance within the Programmatic Agreement would be used. Proposed mitigation measures would be implemented prior to the areas being used. With the implementation of standard mitigation measures, there should be no adverse effects to cultural resources due to the use of these locations as storage and processing areas.

Effects from Land Management Plan Amendment

One project-specific plan amendment, with three exceptions, is proposed to the Tonto National Forest Land Management Plan. The amendment would except the project from restricting mechanical equipment on slopes of over 40 percent, align with the Mexican Spotted Owl Recovery Plan, and redefine the treatment for ponderosa pine vegetation types. Of these three exceptions, removing restrictions for mechanical equipment on slopes of less than 40 percent has the most potential to affect cultural resources and the methods for conducting Section 106 analysis.

Sensitive cultural resources such as rock art and rock shelters tend to be located on 40 percent or greater slopes of small hills, rock outcroppings and mountain slopes. However, because steeps slopes are typically not treated mechanically, Appendix J includes provisions that would allow for exempting slopes 40 percent or greater from intensive archaeological inventory. The Rim Country alternatives would include treatment of slopes up to 40 percent. This increases the likelihood of impacts to the types of cultural resources found in those locations. It also means that the archaeological analysis would need to include an intensive inventory of the steep slope treatment locations. Moreover, plants culturally significant to tribes may occur on slopes that would be open to mechanical treatment. As areas for treatment are delineated, consultation is expected to occur with tribes to determine impacts to cultural resources. Consultation should include discussion of potential vegetation impacts to determine effects on tribally significant plant resources.

Cumulative Effects

Alternative 1 – No Action

If the proposed large-scale, landscape-level forest health project does not occur, there would still be some serious cumulative effects to cultural resources. High-severity wildfires and the construction of fire breaks using bulldozers during a wildfire could severely damage sites. Wildfires could also sterilize the soil or completely remove ground fuels making the sites vulnerable to soil erosion. Also, because sites are more visible after a fire, they are much more susceptible to vandalism. Soil erosion from dry channels that are within or adjacent to sites could continue to affect a site's cultural stratigraphy and displace much cultural material. Roads through sites would continue to degrade cultural deposits and features. Trees would continue to encroach into grass lands and displace artifacts and cultural deposits within sites.

Effects Common to All Action Alternatives

Cumulative effects from mechanical treatments, temporary road construction, and other ground disturbing activities, as well as effects caused by prescribed burning, would be mitigated using site protection measures identified in the Programmatic Agreement, Appendix J, the Rim Country Sample Survey Strategy and the Site Plating Strategy. These include archaeological monitors during mechanical activities, keeping ground disturbing activities out of site boundaries by flagging and avoiding the sites, and post-prescribed burn site monitoring to assess the effects of the low-severity burns. Covering cultural deposits and features in roadbeds within cultural sites prior to maintenance activities or during decommissioning would protect buried cultural deposits and features. Also, well maintained roads would encourage the public to remain on roads and deter cross country travel which can damage sites located near roads. Because all ground disturbing and prescribed fire undertakings go through the Section 106 review process, and identified potential effects would be mitigated, the overall cumulative effects from these undertakings should be minimal. Therefore, there should be little cumulative effects to cultural resources as a result of the activities proposed in this EIS.

Mechanical treatments are not likely to cause cumulative effects if the measures discussed above are taken to protect cultural resources, culturally important place like springs and culturally important plants. The potential cumulative effects on Traditional Cultural Places, traditional gathering and ceremonial use areas and springs resulting from any potential increase in erosion are minimal. Reducing fuel loads and implementing low to moderate-severity prescribed fires does not cause soil sterilization or hydrophobic soils as high-severity wildfires do. Low-severity prescribed fires leave some vegetation in place and re-vegetation occurs soon afterwards if soils are not sterilized. However, as implementation occurs, monitors would check for erosion concerns by examining culturally sensitive locations like Traditional Cultural Places and ceremonial sites in the project areas, including focusing on slopes, drainages, and other high probability areas with cultural resources present. The cumulative effects to cultural resources caused by an increase in erosion can be considered to be adverse if not addressed. Finally, smoke impacts on tribal communities is temporary and with the implementation of the restoration projects, effects from smoke should decrease over time due to a decrease in prescribes and wildfires.

There is a possibility of cumulative effects with regards to archaeological site vandalism resulting from increased visibility once the project is implemented. However, the management practice of implementing low to moderate-severity prescribed fire typically does not sterilize soil or completely remove ground fuels as does a high-severity wildfire. Low-severity fires also tend to leave some trees in place that would eventually cover the surface with a recurring needle cast. Sites are also periodically monitored both during project implementation as well as for NHPA Section 110 purposes by agency and volunteer personnel. Proposed road closures and decommissioning would also reduce public access to some of these areas.

The likelihood of erosion on cultural resources is also minimal. Reducing fuel loads and implementing low to moderate-severity prescribed fires does not cause soil sterilization or hydrophobic soils like high-severity wildfires. As noted previously, low-severity prescribed fires leave some vegetation in place and re-vegetation occurs soon afterwards if soils are not sterilized. However, as implementation occurs, archaeologists would monitor for erosion concerns, examining sites in the project areas, especially focused on slopes, drainages, and other high probability areas where cultural resources maybe present.

The proposed restoration activities in grasslands, riparian, streams and seeps would also have a very limited ability to cause cumulative effects. All of these activities can easily be modified to minimize effects to cultural resources through avoidance or prescription modification. In the case of grasslands, the

physical removal of encroaching trees and other fuels would have the added benefit of protecting sites from the effects of wildfire.

Socio-Economics

A summary of the Socioeconomic Report is presented here. The complete specialist report (USDA FS 2021e) is incorporated by reference. The analysis describes the current conditions and trends related to the social and economic environment of the planning area, including population and demographic changes, potential environmental justice populations, and employment and income conditions.

Affected Environment

Population Growth

The planning area counties are home to approximately 615,000 people, which is approximately 9 percent of Arizona's population (U.S. Census Bureau 2020b). Table 25 displays population estimates for the planning area counties and the state.

Table 25. Population estimates 2010 to 2019

Location	2010	2019	Percent Change 2010-2019
Apache County	71,829	71,887	0.1%
Coconino County	134,612	143,476	6.6%
Gila County	53,561	54,018	0.9%
Navajo County	107,697	110,924	3.0%
Yavapai County	210,983	235,099	11.4%
Arizona	6,407,172	7,278,717	13.6%

Source: U.S. Census Bureau, 2020

Arizona was among the fastest growing states between 2010 and 2019, over which period Arizona grew 13.6 percent (U.S. Census Bureau 2020b). The counties in the planning area grew more slowly over this period, ranging from 11.4 percent population growth in Yavapai County to no growth in Apache County (U.S. Census Bureau 2020a).

Population growth in the planning area may interact with forest management activities. For example, population growth may increase the size of the wildland-urban interface. Wildland-urban interface growth can affect ecological integrity, wildfire suppression costs, and the number of people exposed to smoke emissions.

Wildland-Urban Interface

(The Wildland-Urban Interface section has been added for consistency from the specialist report that was published with the DEIS, gray highlights in this section indicates updated text in the specialist report from DEIS to FEIS.)

The wildland-urban interface is the area where urban development contacts natural or undeveloped land. This wildland-urban interface is especially vulnerable to wildland fire. Figure 33 displays the share of homes in the wildland-urban interface in the planning area. Approximately one-fifth of homes in Coconino, Gila, and Navajo Counties are in the wildland-urban interface. Only 6.4 percent of homes in

Yavapai County are in the wildland-urban interface. These data reveal that a sizeable share of residents in the planning area have homes in the wildland-urban interface. Homes in the wildland-urban interface are about far more common in the planning area as they are statewide (13.9 percent compared to 1.9 percent). Nearly half of the homes in the planning area's wildland-urban interface are second homes, suggesting that many of their owners are part-year residents (Headwaters Economics 2020).

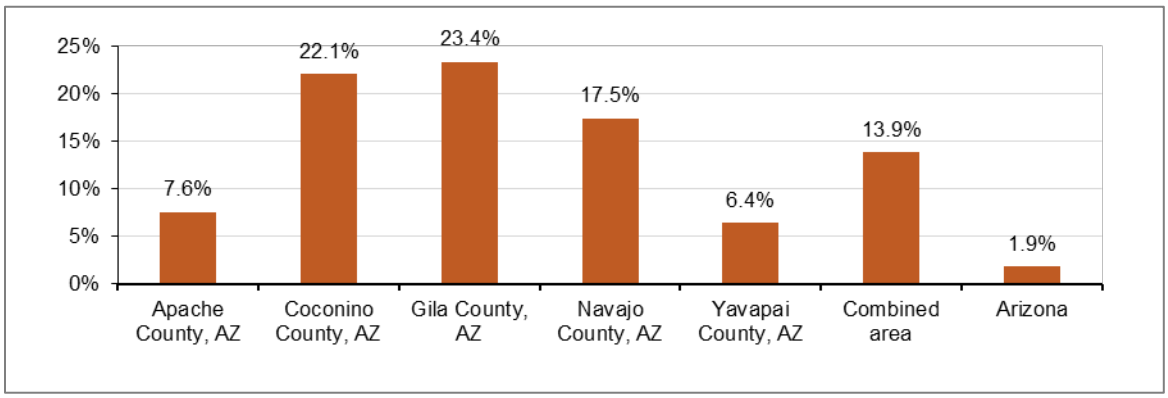


Figure 33. Percent of total homes built in the wildland-urban interface, 2010 Source: Headwaters Economics, 2020

Table 26 represents the risk of wildfire for lands already developed in the wildland-urban interface. This risk is measured using the 11 westernmost states in the contiguous U.S. and their counties. There are 414 counties, therefore, a rank of 1 in 414 indicates that it is considered the most at-risk county for wildland fire, whereas a rank of 414 would indicate very low risk.

Coconino County is the most at-risk county in the planning area; however, all counties are extremely vulnerable to wildland fires in the wildland-urban interface and rank among the top quartile for all 414 counties. In addition, all three counties rank in the top five for the 15 counties in the state of Arizona.

Table 26. Wildfire risk to development, West-wide and statewide county rankings, 2010

Location	West-wide Rank by Existing Risk	Statewide Rank by Existing Risk
Apache County	97 of 414	3 of 15
Coconino County	65 of 414	1 of 15
Gila County	101 of 414	5 of 15
Navajo County	99 of 414	4 of 15
Yavapai County	87 of 414	2 of 15

Source: Headwaters Economics, 2020

Wildfire Costs

In 2015 and 2016, Federal wildland fire suppression cost approximately $2 billion annually, $1.7 billion of which was spent by the Forest Service (NIFC 2017). That is a nearly 300 percent increase in cost (inflation adjusted) since 1985 (NIFC 2017). Much of the cost increase has been attributed to the further development of the wildland-urban interface, climate change, and management of forests (suppression, prescribed burns, etc.). Past large wildfires in and around the Rim Country project area have cost tens of millions of dollars to fight. The 2005 Cave Creek Complex Fire alone cost the Forest Service approximately $18 million to fight. In 2016, the Forest Service spent $12 million on the Juniper and Fulton Fires (N. Hale, personal communication, June 7, 2017). Between 1995 and 2015, the percentage of

the Forest Service budget spent on fire expanded from 16 to 52 percent (USFS 2015b). Furthermore, suppression costs account for only a fraction of the total cost of wildfires. Wildfires often entail costs associated with rehabilitation, lost property, decreased business revenue, and human health effects. The Western Forestry Leadership Coalition estimates that total wildfire-related expenses, when accounting for a variety of direct and indirect costs, range from two to thirty times the reported suppression expenditures (WFLC 2010).

The rising cost of Federal wildland fire operations has caused a shift of agency expenditures from other mission critical activities (for example, restoration, research, and recreation) toward firefighting and fire management (USFS 2015b). Reduced funding for recreation, vegetation and watershed management, wildlife and fisheries habitat management, and other non-fire activities limits the ability of the Forest Service to contribute to improvements in ecosystem services and quality of life in nearby communities (USFS 2015b). For example, between fiscal years 2014 and 2015, the agency's fire suppression expenditures increased by $115 million while non-fire programs were reduced by the same amount (USFS 2015b). Climate change and continued population growth in the wildland-urban interface are expected to contribute to rising fire suppression costs.

Beginning in fiscal year 2020 through fiscal year 2027, the Forest Service fire suppression spending from its regular budget would be capped at just over $1 billion and fire suppression costs in excess of this amount would be funded through an emergency wildland firefighting account rather than through borrowing from other Forest Service program areas (USDA Forest Service 2018c).

Forest Products Industry

Table 27 shows the number of employees in four forestry-related sectors in the project area. According to the IMPLAN data, the counties in the project area currently have few jobs in forestry-related sectors. Navajo County has the largest numbers of employees in commercial logging, biomass generation, and sawmills. Gila County has the fewest employees in these sectors. The four counties in the project area have approximately 42 percent of commercial logging and sawmill employees and seven percent of wood product manufacturing employees in the state. As of 2017, the only biomass power generation facility in the state was in Navajo County (IMPLAN 2017).

Table 27. Employment in forestry-related sectors, 2017

Location	Commercial Logging	Biomass Power Generation	Sawmills	Wood Product Manufacturing
Apache County	16.05	0	22.52	41.9
Coconino County	18.1	0.0	17.9	55.8
Gila County	6.5	0.0	0.0	136.4
Navajo County	40.5	0.6	80.8	132.8
Yavapai County	11.5	0.0	23.4	63.3
Arizona	360.8	0.6	192.8	5,746.9

Source: IMPLAN, 2017

In terms of employment, only Navajo County is more specialized in forestry-related sectors than the nation overall (Headwaters Economics 2017). These data indicate where existing capacity—in terms of infrastructure and skilled labor—to implement 4FRI activities may exist in the project area.

The vast majority (97 percent) of timber harvested in Arizona is processed in the state, though very little timber from other states flows into Arizona for processing (Sorenson et al. 2016). In 2012, there were 25 active wood product manufacturers, including sawmills, house log and viga manufacturers, bioenergy facilities, and other plants (Sorenson et al. 2016). These facilities are concentrated near the Rim Country project area. The number of primary wood processing facilities in Arizona increased by approximately 50 percent between 2007 and 2012 (Sorenson et al. 2016). Proximate wood processing facilities are essential for forest restoration activities, because transportation costs can erode the financial feasibility of removing small diameter and low value forest products.

4FRI Phase One Implementation

Implementation of phase one of 4FRI contributed jobs and labor income to the regional area. This is important because it sets the stage for future implementation activities under the Rim Country Project. This section demonstrates how the social and economic affected environment has changed since phase one was implemented in FY 2017.

Implementation activities for phase one were assessed using primary employment data gathered via surveys of wood contractors in the area. In FY 2017, the economic activities related to implementation of 4FRI phase one were 12,000 acres mechanically thinned and the removal of about 400,000 green tons of sawlogs and biomass for processing. These activities generated almost 1,000 full and part-time jobs and $50 million in labor income in FY 2017 in Apache, Coconino, Gila, Greenlee, and Navajo Counties in northern Arizona (Hjerpe and Mottek-Lucas 2018).

While these economic contributions from phase one 4FRI activities are substantial, the growth in contributions has been limited and are less than original project objectives (Hjerpe and Mottek-Lucas 2018). Hjerpe and Mottek-Lucas (2018) also found that "the main barrier to ramping up 4FRI mechanical thinning accomplishments is the lack of profitability in thinning and processing small diameter ponderosa pine." Ways to boost the economic contributions from 4FRI activities include "to increase the scale of acres treated, which would result in greater thinning and wood utilization employment" and "to decrease the amount of contributions leaked from the region" (Hjerpe and Mottek-Lucas 2018). Contributions leave the region when there is inadequate infrastructure to process the harvested wood in the region. Any regional response to these barriers and solutions would affect how wood is processed and how the resulting economic contributions accrue to the region under this current Rim Country 4FRI.

Ecosystem Services

The economic value of Forest Service resources, uses, and management is not entirely captured in market transactions. Much of the value of national forests is "non-market" in nature – meaning that many of the benefits that forests provide to humans do not have a price. The lack of a price, however, should not be conflated with an absence of value. Indeed, non-market values from forests provide economic benefits to adjacent communities and forest visitors.

Ecosystem services are "components of nature, directly enjoyed, consumed, or used to yield human well-being" (Boyd and Banzhaf 2007). Healthy forests provide numerous ecosystem services, including clean water and air, biodiversity, forest products, and many other goods and services.

Wildfire has the potential to reduce ecosystem service values through: (1) destruction of wildlife habitat, (2) water quality and watershed impacts, (3) damage to cultural and archaeological sites, and (4) soil erosion and impacts to water quality (Morton et al. 2003). Furthermore, post-fire effects, such as flooding, can threaten life and property and further degrade ecosystem services.

Socioeconomic Vulnerability

A social vulnerability index for all counties in the Southwestern Region of the Forest Service reveals that Apache and Navajo County has among the lowest adaptive capacity of counties in the region. Households in these counties are likely to have fewer resources available to them. In contrast, Coconino and Yavapai counties have among the highest adaptive capacity of counties in the region. Households in these counties are likely to have many more resources available to them (Hand et al., 2018). Displacement due to wildfire, for instance, may be more difficult for households in Apache and Navajo County than households in Coconino and Yavapai Counties. These findings reveal a great deal of socioeconomic diversity across the planning area.

Environmental Justice

In 1994, President Clinton issued Executive Order 12898. This order directs Federal agencies to consider the human health and environmental conditions in minority and low-income communities. The purpose of Executive Order 12898 is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations (Executive Office of the President 1994).

Environmental justice is the fair treatment and meaningful involvement of people of all races, cultures, and incomes, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The goal of environmental justice is for Federal agency decision-makers to identify impacts that are disproportionately high and adverse with respect to minority and low-income populations and identify alternatives that would avoid or mitigate those impacts.

Coconino, Gila, and Navajo Counties have high concentrations of American Indian residents, due to the large share of tribal lands in these three counties. The majority of land in Navajo County is tribal land. Yavapai County also contains tribal lands, though the areas are quite small. [12] As a result, environmental justice issues are more likely to occur in Coconino, Gila, and Navajo Counties than Yavapai County. However, a finding of low racial or ethnic diversity does not eliminate the need to consider potential disproportionate impacts of Forest Service management actions. A county may have a low overall concentration of minority residents, but still have areas with a high concentration of minority residents who could be adversely affected by management actions.

Gila and Navajo Counties have meaningfully greater [13] shares of people living in poverty than the state overall. More than one-fifth of Gila County residents and more than one-quarter of Navajo County residents live in poverty.

Based on the minority status and poverty data presented above, Coconino, Gila, and Navajo counties appear most at risk for environmental justice issues. The largest minority group in these counties—

12 Coconino County contains all or part of the Navajo Indian Reservation, Hualapai Indian Reservation, Hopi Indian Reservation, Havasupai Indian Reservation, and Kaibab Indian Reservation. Navajo County contains part of the Navajo Indian Reservation, Hopi Indian Reservation, and Fort Apache Indian Reservation. Gila County contains part of the Fort Apache Indian Reservation, the Tonto Apache Reservation, and the San Carlos Indian Reservation. Yavapai County contains all or part of the Yavapai-Prescott Indian Reservation, the Yavapai-Apache Nation Indian Reservation, the Hualapai Indian Reservation, and the Camp Verde Indian Reservation.

13 In this case, meaningfully greater indicates that the 90 percent confidence interval of the county's poverty rate does not overlap with the 90 percent confidence interval of the state's poverty rate.

American Indians—also experiences a very high poverty rate. Between one-third and one-half of American Indians in the planning area counties live in poverty (U.S. Census Bureau 2016a).

Numerous tribes were invited to consult on the Rim Country project. The process for tribal consultation is outlined in volume 1 of the EIS in chapter 1 under Public Involvement. In addition, the tribal relations section in chapter 3 of the EIS and tribal relations specialist report provide more information and complete documentation of consultation.

The conditions described in this section underscore the importance of evaluating environmental justice consequences. The economic data suggest that Navajo County is both the most underserved county (in terms of economic opportunities) and the most reliant on forest-related employment in the study area. Therefore, Navajo County may be particularly influenced by economic changes related to 4FRI. The potential for disproportionately high and adverse impacts on minority and low-income individuals due to Forest Service management actions are evaluated in the environmental consequences section of this document.

Assumptions and Methodology

This analysis addresses the implementation of Rim Country treatments on the Apache-Sitgreaves, Coconino, and Tonto National Forests. Unless specifically indicated otherwise, all estimates of economic and social consequences are based on only the implementation of 4FRI Rim Country.

Economic Impact Methodology

Economic impacts were modeled using IMPLAN Professional Version 3.1 with 2017 data. The IMPLAN model area includes Apache, Coconino, Gila, Navajo, and Yavapai Counties. Maricopa County is also included in the economic impact model due to the economic linkages between Maricopa County and the project area. The firms and employees that would support Rim Country activities are located in these counties (both primary and supplier firms).

Data on timber volumes under each alternative are based on modeling collected from the forests' resource specialists. The changes are based on the professional expertise of the forests' resource specialists. Regional economic impacts are estimated based on the assumption of full implementation of each alternative over 20 years. The actual changes in the economy would depend on individuals taking advantage of the resource-related opportunities that would be supported by each alternative. If market conditions or trends in resource use were not conducive to developing some opportunities, the economic impact would be different from what is estimated in this analysis.

Economic Efficiency Methodology

Economic efficiency analysis follows Forest Service and Office of Management and Budget guidance. A four percent discount rate is commonly used for evaluations of long-term investments and operations in land and resource management by the Forest Service (FSM 1971.21). This discount rate is used in the calculation of net present value (NPV). Inflation can affect NPV; however, due to the uncertainty of future inflation, OMB Circular A-94 recommends avoiding assumptions about the inflation rate whenever possible. Thus, for the purposes of this analysis, inflation is left at zero. Data on program revenues and program expenditures were provided by the national forests' resource specialists and budget staff.

Assumptions

1. The IMPLAN model assumes a static economy – in other words, the industry composition and trade linkages in the economy today would be the same in the future.
2. The IMPLAN model does not impose supply constraints when estimating employment and labor income effects. It assumes that local industry would be able to harvest and process all of the forest product volume from the Rim Country project. If some of the forest product volume is harvested or processed by firms outside the model area, the employment and labor income effects would be lower than those estimated here.
3. The economic analysis assumes that all project activities are implemented over a 20-year period. If the implementation period is longer, the average annual number of jobs and amount of labor income would be lower than estimated in this report.
4. The economic analysis assumes that firms bid on Rim Country contracts and that the activities are fully implemented. Full implementation relies on private sector interest in bidding on contracts. A slower pace and/or lower forest product volume removal would produce less economic activity than estimated in the analysis.
5. The economic analysis uses forest product distribution data from the 4FRI implementation team to classify forest product types in the economic modeling program. The economic analysis assumes the following distribution: 30 percent sawn products, 6 percent poles, 4 percent firewood, and 60 percent other forest products (including biomass). This assumption is used for modeling and does not preclude any actual distribution of forest product utilization.
6. The economic analysis assumes that forest products are harvested outside of protected activity centers (PACS) with mean slopes less than 40 percent.
7. The economic analysis assumes that the cost of prescribed fire treatment is $175 per acre. Actual costs would vary depending on treatment size and location. Larger and more remote treatment areas may have lower costs, while some landscapes and regions would be more costly. The economic analysis assumes the cost of mechanical treatment is $400 per acre. This assumes ground-based operations. Actual costs would vary based on the value of the timber removed and special conditions of the treatment locations. There are limited areas with very high cost treatment work, for example where helicopter logging is necessary. This analysis does not consider different types of contracting. Contracting is not part of the alternatives or decision. The analysis also assumes that treatments are evenly distributed across 20 years.

Issues, Indicators, and Analysis Topics

Economics is an issue for the Rim Country Project. Stakeholders are concerned that the lack of existing markets and the low value of material generated by proposed treatments may make project implementation economically infeasible. This report analyzes the economically feasibility of proposed activities across a range of alternatives.

Table 28 displays the resource indicators and measures used to evaluate the economic consequences of the Rim Country Project.

Table 28. Resource indicators and measures for assessing effects

Resource Element	Resource Indicator	Measure	Used to address: P/N, or key issue?
Economic feasibility	Forest product volume removal	Forest Products (ccf)) harvested per year	Yes
Economic feasibility	Economic efficiency	Project benefits less project costs	Yes
Economic impact	Employment and labor income	Number of jobs and amount of labor income	Yes
Environmental justice	Effects to low-income and minority populations	Qualitative evaluation of disparate treatment and/or disparate effects	No

Environmental Consequences

Alternative 1 – No Action

Forest Products: Under Alternative 1, the three national forests would continue to provide forest products and support restoration activities. However, the scale of these activities would be substantially smaller than activities under the Rim Country Project. The provision of forest products unrelated to Rim Country treatments would be the same under all alternatives, and therefore are not described in detail in this EIS.

Economic Efficiency: Under Alternative 1, wildfire suppression costs would, on average, increase due to fuel buildup and the expanding wildland-urban interface. The per-acre administrative burden (cost of time and other resources) of planning, implementing, and monitoring forest restoration activities would be highest under Alternative 1. The Rim Country Project benefits from economies of scale – a single environmental compliance document addresses more than one million acres. Furthermore, the large project area reduces cost to government through increased private sector interest in engaging in harvesting and restoration activities on the forests. In contrast, restoration activities under Alternative 1 would occur piecemeal – requiring numerous environmental compliance documents and increased administrative costs.

Employment and Labor Income: The three national forests would continue to provide opportunities for forest product harvesting, livestock grazing, recreation, and other activities that support employment and labor income in communities in the project area. The extent of these contributions are not expected to differ from current conditions. Forestry-related sectors would remain a relatively minor part of the project area's economy.

Environmental Justice: The communities that surround the project area, particularly in Apache and Navajo County, have large minority populations, high poverty rates, and individuals vulnerable to smoke. Minority and low income residents may experience differential exposure to wildland fire, changes in employment opportunities, or changes in the provision of ecosystem services. None of the alternatives eliminates smoke – either from wildfire or prescribed burns. Alternative 1 would treat the fewest acres with prescribed fire; however, it would also do the least to restore fire-adapted forests. As a result, smoke from uncharacteristic wildfire is most likely under Alternative 1. Wildfires produce out of control smoke emissions. Smoke emissions from prescribed burning would be lower under Alternative 1. Smoke emissions resulting from wildfires and prescribed burns may produce health and quality of life consequences. Smoke is most likely to affect vulnerable populations – children, the elderly, and individuals in poor health. The Air Quality Effects Analysis discusses smoke impacts in greater detail as well as the regulatory framework of the ADEQ in order to protect human health and safety.

Alternative 1 would not affect the potential for wildland fire to threaten human safety and property in the project area. Low income individuals have fewer resources to engage in averting behavior (for example, leaving town during a wildfire to avoid smoke emissions). However, because approximately half of homes in the wildland-urban interface in the project area are second homes, the individuals with the highest exposure to wildfire risk are expected to be relatively affluent (Headwaters Economics 2017).

Alternative 1 would not affect employment or labor income in the project area. Therefore, no disproportionate or adverse effects related to changes in economic opportunities would occur as a result of this alternative.

The provision of ecosystem services may be affected by Alternative 1; however, these effects would not disproportionately affect low income and minority residents.

Table 29. Resource indicators and measures for alternative 1

Resource Element	Resource Indicator	Measure	Alternative 1
Economic feasibility	Forest product volume removal	Forest Products(ccf) harvested	Forest products would continue to be harvested from all three national forests, consistent with current conditions
Economic feasibility	Economic efficiency	Project benefits less project costs	No direct project benefits or costs; no economies of scale in forest restoration activities
Economic impact	Employment and labor income	Number of jobs and amount of labor income	Three national forests would continue to support local employment and labor income associated with harvesting, grazing, and recreation at levels similar to current conditions
Environmental justice	Effects to low-income and minority populations	Qualitative evaluation	Smoke emissions from wildfire are most likely to adversely affect vulnerable populations, including children, the elderly, and individuals in poor health

Effects Common to All Action Alternatives

Environmental Justice: The employment and labor income associated with the Rim Country Project are expected to have a small, but positive, effect on employment and labor income in minority and low income communities.

None of the alternatives eliminates smoke—either from wildfire or prescribed burns. Smoke emissions from both prescribed fire and wildfire can have health effects, particularly on the young, elderly, and individuals with existing health issues. Smoke emissions from prescribed burning would be higher under the action alternatives. Tribal elders may be more likely to experience acute health effects. Technological and cultural constraints to effective communication would make smoke effects more pronounced, as averting behavior is limited. Smoke emissions from prescribed burns have the advantage over wildfires of being controlled and regulated by the ADEQ in order to protect human health. Burn plans written for implementation of the proposed prescribed fires would include modeling to determine the most appropriate conditions under which to burn in order to minimize smoke impacts. Burn plans also specify mitigation measures, such as notification strategies to contact people known to be sensitive to air pollution prior to the ignition of the prescribed fire. The action alternatives, through increased treatment acres would do more to restore fire-adapted forests. As a result, smoke from uncharacteristic wildfire is less likely under the action alternatives. The Air Quality section discusses smoke and fire in more detail.

Land Management Plan Amendment: Amending the Tonto National Forest Land Management Plan is not expected to have any additional effects to social or economic resources, other than what is already analyzed. The harvest volumes and treatment acres (and associated costs) are not expected to differ than what is proposed and analyzed under alternative 2 and alternative 3. Costs of treatment may be higher on steeper slopes (due to amendment exception 3, mechanical treatments on steep slopes), however, this is uncertain and the best cost estimates are used in the analysis.

Effects Unique to Each Action Alternative and Differences among Them

Forest Products: Alternative 2 would produce approximately 5.4 million ccf of forest products over the life of the project. The economic analysis assumes that volume is harvested evenly over a 20-year period. Approximately 269,280 ccf would be harvested annually.

Alternative 3 would produce approximately 3.6 million ccf of forest products over the life of the project. The economic analysis assumes that volume is harvested evenly over a 20-year period. Approximately 181,120 ccf would be harvested annually.

Economic Efficiency: Under Alternatives 2 and 3, the per-acre administrative burden (cost of time and other resources) of planning, implementation, and monitoring forest restoration activities would be lower than for Alternative 1. The Rim Country project benefits from economies of scale—a single environmental compliance document addresses hundreds of thousands of acres across three forests. Alternative 2 would mechanically treat up to 873,420 acres of vegetation and treat up to 991,060 acres with prescribed fire. Alternative 3 would mechanically treat up to 466,290 acres of vegetation and treat up to 528,850 acres with prescribed fire.

The present net cost to taxpayers to conduct restoration treatments equivalent with those proposed under Alternative 2 would be approximately $340 million, and approximately $170 million under Alternative 3, over 20 years. As stated in the assumptions, these costs are an approximation. Per acre treatment costs can vary depending on a number of factors including forest structure, silviculture method, topography, treatment size, haul distance, and existing road condition. Actual costs would also vary based on the value of the timber removed.

Infrastructure costs, including roads, would be highly variable depending on the existing condition of roads and the implementation of the treatments or timber removal. For example, for all merchantable timber removal, the cost associated with improving National Forest System roads, and conducting road maintenance would be paid for by the purchaser of the contract. In other cases, road costs may be shared under cooperative road maintenance agreements. Although additional traffic would occur over paved county or other government agency roads, the anticipated traffic from this project would not affect routine maintenance schedules due to being a small percentage of total traffic volume on those roads.

The Rim Country Project would provide a stable supply of forest products to encourage private sector engagement in forest restoration activities, which would reduce the cost to taxpayers. Furthermore, the treatments would reduce the risk and hazard of uncharacteristic wildfire. The costs of a single large fire routinely amount to millions of dollars in direct suppression expenditures alone. The Forest Service, for instance, spent approximately $14.4 million responding to the 2010 Schultz Fire (Combrink et al. 2013). Furthermore, the total cost of the Schultz Fire and subsequent flooding – including decreased property values, loss of life, cleanup, evacuation, and habitat destruction – is estimated to be between $133 million and $147 million (Combrink et al. 2013). For the 2002 Rodeo-Chedeski Fire, estimated suppression costs ranged between $43 and 50 million. Other direct costs, including the loss of homes and property, totaled

$122.5 million. Rehabilitation costs were projected over a three-year period for a total cost of $139 million (WFLC 2010).Compared to Alternative 2, Alternative 3 would treat fewer acres more intensively. More concentrated treatments could lower the operating costs associated with treatments. Fixed costs associated with site preparation would be lower, site infrastructure needs (for example, processing, roads) would be reduced, and costs associated with transporting forest products would be lower than under Alternative 2. Given the relatively low market value of most of the wood products to be removed from the project area, keeping operating costs low is critical to the financial feasibility of forest treatments.

Employment and Labor Income: The direct, indirect, and induced economic effects of forest product removal under Alternative 2 are estimated to support approximately 2,020 jobs and $86 million in labor income, or approximately $43,000 per job, on an average annual basis over the life of the Rim Country Project.

Alternative 3 would produce somewhat lower wood product volume than Alternative 2. Therefore, Alternative 3 would support fewer jobs and less labor income than Alternative 2. The direct, indirect, and induced economic effects of forest product removal under Alternative 3 are estimated to support approximately 1,360 jobs and $58 million in labor income, or approximately $43,000 per job, on an average annual basis over the life of the Rim Country Project.

Both Alternatives 2 and 3 may temporarily displace other forest users (for example, recreation visitors) due to treatment activities. Alternative 2 would lead to more displacement of forest visitors than Alternative 3 due to the larger number of acres to be treated under Alternative 2. Displaced recreationists are expected to visit another site on one of the three forests to participate in another activity in the local area. Therefore, recreation visitor expenditures are not expected to change.

Likewise, forest restoration activities may affect ranchers who graze livestock in the project area. The brief duration and advance notice of disturbances due to Rim Country treatments would make it easier for ranchers to adapt to changes. As a result, no reductions in grazing-related employment are expected. However, minor reductions in rancher income are possible if ranchers purchase more expensive private forage or reduce their stocking levels. However, post-treatment soil and forage quality is expected to increase. Therefore, over the long-term, ranchers would benefit from Rim Country activities.

Table 30. Resource indicators and measures alternative comparison

Resource Element	Resource Indicator	Measure	Alternative 2	Alternative 3
Economic feasibility	Forest product volume removal	Forest products (ccf) harvested	Volume from trees < 5" = 284,520 CCF Volume from trees 5" -12"= 2,385,770 CCF Volume from trees > 12"= 2,715,220 CCF	Volume from trees < 5" = 194,370 CCF Volume from trees 5" -12"= 1,507,420 CCF Volume from trees > 12" = 1,920,690 CCF
Economic feasibility	Economic efficiency	Project benefits less project costs	$340 million present net cost; Avoided costs from forest restoration and reduced risk of high-severity wildfire	$170 million present net cost; Avoided costs from forest restoration and reduced risk of high-severity wildfire; more concentrated treatments (compared to alternative 2) would lower operating costs
Economic impact	Employment and labor income	Number of jobs and amount of labor income	2,020 jobs and $86 million in labor income	1,360 jobs and $58 million in labor income
Environmental justice	Effects to low-income and minority populations	Qualitative evaluation	Employment and labor income may have a small, but positive, effect on economic opportunities in low-income and minority communities; smoke emissions may have a disproportionate effect on low-income and minority communities	Same as alternative 2

Effects from Rock Pit Use and Expansion

The Rim Country Project would authorize the use and expansion of rock pits to supply material for road construction and improvement. Rock pits on the national forests provide a low cost source of material for road work. In particular, rock pits avoid the need to purchase and haul roadbed material from more distant sites. The 2016 Rock Pits Environmental Assessment for the Coconino and Kaibab National Forests found that haul costs were approximately four times higher for material purchased off-site than for on-forest rock pits. Rock pit use and expansion would increase the financial feasibility of road work needed to support Rim Country project activities.

Effects from Use of In-woods Processing and Storage Sites

A key barrier to the financial feasibility of forest restoration is that the costs of hauling raw material from the harvest site to mill locations may exceed the value of the timber harvested in the project area (Aguilar and Garrett 2009; Conrad 2018; Pan et al. 2002; Riquelme et al. 2020).

Processing sites may serve many purposes. Reducing the moisture content of timber can reduce haul costs because drier trees are lighter in weight. A review of transpirational drying case studies of various tree species around the country demonstrate different weight reductions after various drying schedules (Requelme et al. 2020). One study in the project area showed that moisture content in ponderosa pine bunches decreased from 45 percent to 38 percent and 36 percent within two and four weeks of cutting, respectively (Riquelme 2019). A reduction in weight by volume can allow trucks to carry more volume while remaining under weight thresholds, resulting in fewer truck trips and reducing total haul costs.

Processing sites may allow for storage and sorting. The value of wood removed can be enhanced if the trees are evaluated and sorted for quality and value to allow for better utilization and a diversity of products (Dramm et al. 2002; Han et al. 2011). Some processing may also occur at the sites, such as chipping, as desired by the materials and markets.

To address this challenge, the Rim Country Project would authorize 12 in-woods sites (in addition to the eight sites analyzed in the Cragin Watershed Protection Project (USDA FS, 2018b)) for processing, sorting, storing, and the refinement of raw material. In-woods processing and storage sites could offset haul costs by increasing the value of material either by hauling dried material or secondary products.

In-woods processing and storage site selection criteria—including at least ¼ mile from hiking trails, campgrounds, group recreation sites, and private property—would reduce the potential for effects on forest visitors and nearby residents.

Cumulative Effects for all Alternatives

Past management activities, including mechanical vegetation treatments, fuels treatments, and prescribed fire, have affected economic activity in the communities in and around the project area. The socioeconomic consequences of these actions are captured in the baseline data presented in the affected environment section of this report. Therefore, these activities are not included in the cumulative effects analysis.

The temporal boundary is 20 years of implementation activities and the spatial boundary is the planning area (Apache, Coconino, Gila, Navajo, and Yavapai Counties).

Restoration activities would continue to occur in the region regardless of the Rim Country decision. Current and foreseeable activities include approximately 470,000 acres of mechanical vegetation treatments and approximately 650,000 acres of fuels treatments. The acreages of mechanical vegetation management and fuels are not all mutually exclusive. There are many acres on which proposed fuels treatments (mechanical and prescribed fire) overlap with proposed mechanical vegetation management treatments. Reasonably foreseeable actions on private, state, and other federally-managed lands include mechanical treatments, fuels treatments, and prescribed fire. These actions would occur regardless of the selected Rim Country alternative.

The effect of past, present, and reasonably foreseeable treatment activities in the project area would improve forest health relative to existing conditions even without the implementation of the Rim Country Project.

Forest Products: Forest products available for harvesting under the Rim Country Project would contribute to an increased supply of forest products available from national forests in the region. When harvest volumes are low, harvesting and processing industries are unlikely to locate in the region. However, the cumulative effects from both Alternative 2 and Alternative 3 would be to improve the financial viability of locating forest product industries—including logging firms, sawmills, and biomass facilities—in the project area. The no action alternative would have the least cumulative effects to forest products industries because no forest products would be harvested.

Economic Efficiency: Present net costs are greatest under alternative 2, so the cumulative effects (costs) of the Rim Country project, in addition to other projects, would be the greatest. The no action alternative does not have any costs of treatment for Rim Country, so cumulative costs would be the least.

Observational evidence and fire modeling indicates that large-scale fuel treatments are necessary to meaningfully reduce the risk of high-severity wildfire and produce fire suppression cost savings (Thompson et al. 2017). The proposed Rim Country treatments, in combination with the current and foreseeable mechanical and prescribed fire treatments, would conduct fuel treatments across a large

landscape. The cumulative effects of Alternative 2 are most likely to reduce wildfire suppression costs in the project area.

Employment and Labor Income: The increase in jobs and labor income during implementation of the Rim Country project would be greater under alternative 2 than alternative 3 and the no action alternative, which would be additive to job contributions from other current and foreseeable projects in the area. Therefore, the cumulative economic impacts would be greatest under alternative 2.

The increased forest product supply from Rim Country and other current and foreseeable projects would contribute to the development of a local forest products industry. Cumulatively, the development of a local industry, as a result of Rim Country and other projects, would have several economic effects, including (1) lower costs of transporting wood products for secondary processing thereby increasing the financial viability of treatments, (2) increase the probability that employment and labor income associated with forest restoration activities would occur in the local area, and (3) contribute to the growth of supporting industries (for example, construction and retail trade).

As described in the Affected Environment section above, there has been limited growth of jobs and income from 4FRI phase one implementation activities. With more acres treated from the Rim Country 4FRI project, this would add to the wood utilization employment. Cumulative effects of increasing wood volume could increase the amount of economic contributions that stay in the region if the activity boosts the infrastructure and capacity to process the harvested wood in the region. For example, if the wood produced from both phases of 4FRI implementation creates enough demand (or the funding mechanism is collaboratively resolved) for a company to install a biomass facility, the jobs and income from restoration activities are more likely to stay in the region.

Environmental Justice: Ongoing and reasonably foreseeable prescribed fire treatments would contribute to smoke emissions, which may affect the health and quality of life of individuals who live near or visit the forests. Because Alternative 1 would not prescribe additional treatments, it would not cause cumulative effects related to smoke emissions from prescribed fire. However, the risk of uncharacteristic wildfire and associated smoke emissions in the project area would be highest under this alternative.

The proposed treatments under Alternatives 2 and 3, combined with other ongoing and foreseeable treatments, could increase exposure to smoke emissions, which could cause cumulative effects to health and quality of life for individuals who are sensitive to smoke. However, the cumulative effect of these treatments would be to decrease the risk of uncharacteristic wildfire, which would decrease the probability of smoke emissions associated with these events. The no action alternative would have lower additive effects to smoke exposure but in the longer term would contribute to a greater risk of wildfire.

Lands and Minerals

Affected Environment

Lands

The acquisition and disposal of National Forest System lands are designed to consolidate interest and management of the Federal estate to enhance public benefit, and to consolidate the management and ownership of Federal, State, and private lands within the proclaimed forest boundary. The establishment of rights-of-way throughout the forest is needed to create easy accessibility to both public and private lands within the proclaimed boundary of the national forest.

Land subdivision and development is increasing the need for accurate and reliable surveys. Numerous conflicts between past surveys have occurred, leading to an unknown number of unauthorized occupancies and use violations on national forest lands. Identification of property boundaries is an increasing expense to resource programs, especially fuel treatments. Increasingly, additional expenditures would be necessary in order to fully utilize national forest resources and to prevent claims against the Federal government. Although land acquisition eliminates the need for land line location in some areas, many miles of property boundary still need to be surveyed and posted.

Property boundary location involves all activities necessary to identify the boundaries of National Forest System lands, including the search for survey corners, surveying and marking of land lines, and maintenance of the same. Marking and posting boundaries identifies or locates National Forest System lands for public use and enjoyment and prevents and controls trespass upon the forests.

There are many private land inholdings within the Rim Country project area. To ensure any treatment is not done on private land and to meet Forest Service policy, the boundary lines between Forest Service and private lands should be marked by a professionally-licensed land surveyor prior to implementation. This would also ensure the lines are adequately marked so the Forest Service can meet objectives stated in the Apache-Sitgreaves Land Management Plan for Community-Forest Intermix and Wildland-Urban Interface, as well as similar direction in the other forests (Coconino and Tonto National Forests) within the Rim Country project area. Boundaries are considered marked to standard if they have been surveyed and posts set at approximately 250-foot intervals along the boundary line and have been set with boundary signs attached. Some historic boundary lines can be maintained, which entails ensuring posts and signs are in good condition and replacing any that are not. This can be accomplished with surveys that have been recently completed. Any posting older than 15 years may be questionable because of age. The current status of boundary lines in the project area is shown in Table 31 below.

Table 31. Miles of boundary lines within the project area

Forest	Total Miles	Marked	Unmarked	Marked over 15 years ago
Apache-Sitgreaves	374	231	143	182
Coconino	110	55	55	42
Tonto	132.5	125	7.5	75

Overall, it is important to provide ample time to existing land surveying staff to analyze implementation areas and access needs, and provide feedback on necessary time and funding to complete work.

In addition to marking and posting boundary lines before resource work is completed, there are also numerous pieces of direction in the Land Management Plans on how land within the Wildland Urban Interface and Community-Forest Intermix should be treated. This direction calls for lower basal areas, treatment of slash, and retention of fire-resistant tree species. There is very little restriction on what kind of treatments are used, but Land Management Plans do convey the message of minimized smoke effects, reduction of fuel load, and working with communities on defensible space.

The existing access routes through the project area may travel across both forest system and private lands. It is important for the ensure rights-of-way are properly obtained in order to protect existing or new roads crossing private property by describing type and duration of use. If a permanent easement for standard use can be obtained in an area that was not historically documented, this would be beneficial to both parties to guarantee the road's protection in the future.

Lands Special Uses

Lands special use authorizations include permits, term permits, leases, and easements that authorize occupancy and use of National Forest System lands. Authorized activities include uses such as utility corridors, roadways, communications sites, research projects, and many other uses. The terms of these authorizations vary based upon the type of use.

Table 32. Lands special use authorizations within the project area

Permit Type	Total
Fish Hatchery	2
Fence	2
Cemetery/Church/Monument	3
Waste Disposal Site (solid/liquid)	2
Sewage Line	3
Weather Station	9
Observatory	1
Research/Non-Disturbing Use	8
Warehouse/Storage Yard	4
Processing Plant	1
Powerline	10
Easement	85
Road	21
Communication Site	42
Irrigation/Water Transmission/Conveyance	35
Dam/Reservoir/Well/Storage Tank	20
Wildlife Water Supply	10
Stream Gauge	2
Water Treatment Plant	1
TOTAL	261

As of August 29, 2017, there were 261 active lands special use permits within the project area. Of these, 219 (85 percent) are communication sites, water storage or conveyance, powerlines, roads/easements, or water or waste treatment facilities (Table 32). These uses have direct effects on human populations and therefore carry greater risks from fire danger than other uses.

Recent years show an increasing demand for lands special uses. As communities in and around the forests increase in development, their need to utilize public lands in support of their infrastructure also increases. Proposals for power lines, rights-of-way, communication sites, water transmission lines, and roadways have increased steadily and would continue to do so in future years. Increased interest in renewable energy sources, such as wind and solar, has also contributed to the increased demand.

Solar energy potential is high and future development would be related to demand. There may be a need for additional energy corridors or developments (for example, electric transmission lines, pipelines, wind turbines) because of the expected demand for electricity to serve the growing populations of Arizona and

the Southwest and to provide reliable and consistent services. As communities expand and as non-Forest Service lands surrounded by Forest Service lands are developed, there may be increased demand for energy development on Forest Service lands.

Minerals

Minerals of economic interest are classified as leasable, locatable, or salable. Coal, oil shale, oil and gas, phosphate, potash, sodium, geothermal resources, and all other minerals that may be acquired under the Mineral Leasing Act of 1920, as amended, are referred to as leasable minerals. Common varieties of sand, stone, gravel, pumice, and clay that may be acquired under the Materials Act of 1947 are considered salable minerals. Any minerals that are not salable or leasable, such as gold, silver, copper, tungsten, and uranium, are referred to as locatable minerals. These mineral deposits include most metallic mineral deposits and certain nonmetallic and industrial minerals. Locatable minerals are subject to the Mining Act of 1872.

Apache-Sitgreaves

Mineral resource activity on the Apache-Sitgreaves National Forests has historically been low. Mineral activity is presently concentrated in a few scattered areas. Commodity use and production have shown declines from the past. However, these forest uses contribute to sustaining the lifestyles and traditions of local communities. The potential for locatable minerals on Apache-Sitgreaves National Forests lands may be much greater at depth than surface geology would otherwise suggest. The potential for leasable minerals on the Apache-Sitgreaves National Forests is low because of the existing geology. There are no known leases on the forests for the following leasable mineral resources: oil and gas, oil shale, coal or geothermal (BLM 2009/2013). Should valid leasable mineral proposals be submitted, the Forest Service would respond as a cooperating agency when requested by the Bureau of Land Management, which acts as the lead agency for subsurface mineral extraction. There are no current leases for oil and gas, geothermal, or coal on the Apache-Sitgreaves National Forests.

Coconino

The Coconino National Forest has very few locatable mineral resources, and no oil and gas leases or developments, but has potential geothermal resources (no current leases, no developments) associated with the San Francisco Volcanic Field. Locatable minerals with past or current production have included manganese, gypsum, flagstone and pumice. The forest has a small amount of common variety mineral materials production including cinders, crushed and pit run aggregate, rock and fill dirt, and landscape rock/decorative stone. Most of the use of mineral materials on the forest is by the Forest Service or authorized contractors or permittees for projects and by Coconino County under permits or other agreements. Aggregate production and salable minerals are anticipated to increase with future forest restoration activities. Some areas are withdrawn from locatable mineral entry.

Tonto

No leasable mineral authorizations or applications are currently located on the Tonto National Forest. The potential for development of leasable minerals in the planning area is low; the geologic depositional environment of the planning area is not conducive to hydrocarbon generation. The Tonto National Forest has a long history of mining across the national forest.

Although numerous prospects on the Payson Ranger District were identified from the Arizona Department of Mines and Mineral Resources database, most of the gold and silver deposits were found within veins found fairly close to the surface with visible mineralization. Most of the metals could be

extracted with minimal milling effort, usually with a stamp mill. Most if not all of the mineralization occurred within "quartz stringers" of a granodiorite intrusion (Botsford 1933). Once these narrow dikes (bands) are mined out, only the "non-visible" or disseminated mineralization is left behind, which requires a much greater milling process and larger scale operation to be profitable.

Arizona is well known for its large porphyry copper deposits, which are low-grade disseminated type deposits that require mining by large-scale, low-per-ton cost methods. The copper minerals are distributed uniformly through large sections or blocks of the deposit, that must be mined by bulk methods, rather than selective or vein mining methods. These bulk mining methods consist of either open-pit or block caving mining methods. Gold and silver occur as secondary metals that are associated with porphyry-type deposits. Based on historic activity of this district, further exploration efforts may have merit. As a result, the favorability for mineral potential within the Green Valley Mining District and two other districts, the Polk and the Rye Creek, is determined to be moderate (Ellis 1983). Although no exploration activity is currently taking place on the Payson Ranger District, the potential for such activities remains.

Assumptions and Methodology

Assumptions

The following assumptions were made for this analysis:

- Land Management Plan direction would be followed when planning or implementing site-specific projects and activities resulting from this decision.
- Applicable laws, regulations, and policies would be followed when planning or implementing site-specific projects and activities resulting from this decision.
- With population growth in the communities within and surrounding the forest, as well as throughout the State of Arizona, there would be increased demand for uses such as alternative energy development, utility corridors, and transportation systems.
- Community and public needs for use of Federal land for services and infrastructure, including roads and energy corridors, would continue.
- Proposals for lands special uses, mineral exploration, and energy development on the national forests would increase in the foreseeable future.

The primary assumption for the analysis of effects on lands, lands special uses, and minerals is that the number of acres treated under each alternative corresponds directly to a reduced risk of uncharacteristic wildfire behavior within the project area. This in turn corresponds to a reduced risk of damage to structures and facilities within the project area. Therefore, the greater the number of acres treated, the greater the reduction in uncharacteristic fire behavior, and therefore the greater positive effect to these resources. This correlation holds true regardless of the mix of treatment methods used (such as, mechanical thinning, prescribed burning).

Methodology

The Special Uses Database System was used to generate a list of all special use authorizations within the project area. This report was sorted by use type; recreation special uses were then removed from the analysis. The remaining lands special use authorizations were then sorted by status. They were considered as part of the existing condition if they had statuses of application accepted, pending signature, or issued.

Some inaccuracies are commonly known to exist in the Special Uses Database System. Permits are sometimes shown as "issued" even after they have expired, or sometimes are shown as expired when in fact they have been reissued and the activity continues. Where it was known or suspected that these permits were still in place and in the process of reissuance, they were considered in the analysis.

Mineral resources were identified using the specialist reports and supporting materials for the Forest Land and Resource Management Plan Revisions for each forest in the project area.

Issues, Indicators, and Analysis Topics

None of the significant issues for Rim Country relate to the potential effects on lands, lands special uses, or minerals, and therefore they do not serve as indicators for analyzing the effects of the project on these resources. However, the project would have an indirect effect in the form of reduced risk of uncharacteristic fire behavior. Uncharacteristic fire behavior presents a threat to the facilities authorized by special use permits and to any structures that may lie on non-forest lands within the project area. Therefore, the indicator used for this analysis is the reduced risk of uncharacteristic fire behavior, as represented by the number of acres treated under each alternative.

Environmental Consequences

Alternative 1 – No Action

Under this alternative, no large-scale restoration activities would occur. Stand and vegetation structures would be improved only in accordance with each Land Management Plan, and with the data available at the time of this report, this would include 129,917 acres of other projects, with completed NEPA documents, within the Rim Country Project Area. This would make the landscape in the project area less resilient to disturbance and would provide increased fuels for wildland fires and uncharacteristic fire behavior. Increased fire danger would impact lands special uses by threatening the structures they authorize in both the short term (10 years) and long term (20 years and more). Any structures associated with active minerals sites and those located on non-National Forest Service lands would be similarly threatened. Long-term effects could be the destruction of these facilities by fire, and possibly the closure of fire-damaged areas for rehabilitation. There may be short-term, temporary effects in the form of restricted access to sites during fire suppression activities or post-fire rehabilitation.

Many of these authorized land uses serve and support local communities. If infrastructure is damaged by wildfire, there could be a delay in providing utilities such as power, phone, and water. Emergency service providers could be delayed in providing for health and safety if communication equipment is damaged. Private property has the potential to be impacted as a result of wildfires in the area as fires may burn at a higher severity and would be more difficult to control. Existing land uses would continue to be managed under the current Land Management Plan direction and under the terms of their authorizations and other laws, policies, and regulations such as power line clearance requirements and vegetation management along highway corridors for safety purposes and utility reliability.

Effects Common to All Action Alternatives

All action alternatives would improve forest health by restoring forest ecosystems toward their natural, pre-fire-suppression states. While they vary in specific approaches, the overall effect on lands, lands special uses, and minerals would be the same. Increased forest health would lower the risk of undesirable fire behavior, which would reduce the threat to the structures authorized for lands special uses and mineral projects and to those on private lands.

Effects from Rock Pit Use and Expansion

The Rim Country Project would require the use of mineral materials for the surfacing of temporary roads and possible resurfacing/maintenance of roads after their use in the implementation of this project. The scope of work proposed in the action alternatives exceeds the mineral materials currently available in existing rock pits within or near the project area. Therefore, the use of one additional rock pit and the expansion of some existing rock pits are being analyzed in the Rim Country EIS.

On the Coconino National Forest, the development, expansion, and use of 10 rock pits in the Rim Country Project area were analyzed in the Rock Pits Environmental Assessment for the Coconino and Kaibab National Forests (USDA 2016). These pits are: Oak Grove, Turkey, Knob, Brushy Knoll, Snafu, Macks, Salmon Lake, Cinch Hook, Lockwood and Buck Butte. One additional rock pit, Park Knoll is currently developed by Coconino County and under a contract; the Forest Service would have access to approximately 20,000 cubic yards (rectangular footprint of about 20 feet wide by 100 feet long with a peak of 20 feet height) of material from this pit.

On the Apache-Sitgreaves National Forest, two ranger districts are within the project area, the Lakeside and Black Mesa Ranger Districts. Surfacing material needs on the Lakeside Ranger District are met by a large county-operated rock pit under contract, as well as other commercial sources. On the Black Mesa Ranger District, 11 existing rock pits in the Rim Country project area could be expanded to provide future material for implementation of Rim Country. Each of these rock pits is proposed for a 30 percent expansion of their current footprint. The 11 rock pits for expansion are shown in figure 12 in volume 1 of the FEIS.

On the Tonto National Forest, all road surface material needs would be met by local commercial sources. Therefore, no effects from rock pit use on the Tonto are analyzed for Rim Country implementation. Figure 12 in volume 1 of the FEIS displays the locations of these rock pits in the Rim Country project area.

Rock pit use and expansion would be the same under both action alternatives. There would be no effects on lands or lands special uses. Residents living within the project area boundaries could be affected by the increased noise, traffic, and emissions produced by active operations at rock pit sites. These effects would be greater the closer rock pit sites are to any private lands or special use facilities with residents. These effects can be mitigated by advance communications with any residents and notifying them of potential active operation timeframes.

Table 33. Apache-Sitgreaves, Black Mesa Ranger District Rock pit expansion

Pit Name	Current Acreage	Possible Increase in Acreage	Possible Future Total Acreage	Maximum Expansion in Feet from Existing Pit
34T	14	4	18	500
213	7	2	9	500
Pias Farm	6	2	8	500
115	7	2	9	500
717E	2	1	3	400
34B	2	1	4	500
Promontory	16	5	21	700
Carr Lake	12	4	16	600
Brookbank	1	1	2	400

Pit Name	Current Acreage	Possible Increase in Acreage	Possible Future Total Acreage	Maximum Expansion in Feet from Existing Pit
Borrow	12	4	16	600
Cottonwoods Wash	6	2	8	500
Total	85	289	11414	N/A

The effect on minerals would be that, once used, these resources would no longer available for other future projects. The consumption of mineral resources for road surfacing needs for the Rim Country Project must be weighed against the cost of purchasing these materials from a commercial source in the future. As budgets continue to shrink, this would be an important consideration. The Coconino and Tonto National Forests receive very high levels of use, and road surfacing would continue to be an ongoing need. Reclamation of the rock pits would need to take place once the utilization of the pit is complete. It may take many 20 or more years to achieve utilization of the pit.

Effects from Use of In-woods Processing and Storage Sites

The western parts of the project area are far from businesses that are able to process the wood products that would result from either of the action alternatives. To make the business opportunities more viable, the project identifies multiple on-forest sites that could potentially be used by contractors for processing wood products.

The closest mill to Rim Country is the Lumberjack Mill, approximately 13 miles from Heber, Arizona, just north of the eastern edge of the project area. The Lumberjack Mill is operated by Good Earth Power. The mill underwent an extensive upgrade in 2017 and is currently processing dry kilned and finished lumber. On the western side of Rim Country, the closest wood processing facility is Canyon Wood Supply, approximately 25 miles from the western boundary of the project area in Camp Verde, Arizona. Canyon Wood Supply processes ponderosa pine into bundled fuelwood for retail consumption.

Processing sites serve many purposes. Tasks accomplished at processing sites would include drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, scaling and weighing logs, and creating poles from suitable sized logs. Equipment commonly used at processing sites would include circular or band saws, various sizes and types of front-end loaders, log loaders, and several types of chippers. Equipment may include timber processors, planers and mechanized cut to length systems, associated conveyers, and log sorting bunks for accumulation and storage of logs. Electric motors and gas or diesel generators would also be used to provide power.

Eight processing sites were proposed and analyzed for environmental effects in the Cragin Watershed Protection Project (CWPP) (USDA 2018b, Figure 11 in volume 1 of the FEIS). These sites are carried forward for potential use in implementing the Rim Country Project. In addition, 12 in-woods processing sites are in this project (see map 6 in Appendix A). For both projects, processing site location and siting considerations reduced the potential for impacts to resources and design features in Appendix C also would further reduce resource impacts.

These 20 in-woods processing and storage sites may be used for implementation of the Rim Country Project over its implementation period of 20 years, or until implementation is completed. Continuous-use processing sites are those where use is expected to be continuous for 10 to 20 years. These sites are typically the larger 10 to 21-acre areas located close to major highways. Sites originally developed and operated for continuous use would frequently change to intermittent use or occasional use following

initial harvest activities in the area. Intermittent use processing sites are those where use is expected to be shorter term and used for one or multiple contract periods, lasting from three to 10 years.

Processing sites may be authorized under timber contract or under special use authorizations. Special use authorizations for processing sites would comply with appropriate policies related to cost recovery and land use fees and other special use regulations (36 CFR 251). A performance bond would be used to ensure that all obligations are fulfilled by the contractor or permittee and would be used if needed to cleanup and rehabilitate the processing sites. Processing site locations and use are the same under both action alternatives. There would be no effects on minerals.

Residents living within the project area boundaries could be impacted by the increased noise, traffic, and emissions produced by active operations at processing sites. These effects would be greater the closer processing sites are to any private lands or special use facilities with residents. These effects can be mitigated by advance communications with any residents and notifying them of potential active operation timeframes.

There would be no effects on lands, lands special uses, or minerals from the proposed 1985 Tonto Land Management Plan amendment.

Effects Unique to Each Action Alternative and Differences among Them

For the purposes of this analysis, the only difference between action alternatives is the number of acres treated which does not impact the number of proposed rock pits or in-woods processing and storage sites as these are the same in both action alternatives (Table 34).

Table 34. Comparison of alternatives by number of total acres treated

Alternative	Acres Treated Under This Project	Total Acres Treated in Project Boundary
1	0	129,917
2	991,060	1,120,977
3	528,850	658,767

Cumulative Effects

The cumulative effects analysis area for lands, lands special uses, and minerals is the Rim Country project area.

Alternative 1 – No Action

Vegetation treatments under other decisions would reduce the risk of uncharacteristic fire behavior on approximately 129,917 acres within the project area. Restoration activities would occur on a project-by-project basis, rather than as a part of a landscape-scale effort. The threat of uncharacteristic fire behavior to lands, lands special uses, and mineral site structures would be reduced somewhat within the project area as a result of these other projects, but not as much as a result of the Rim Country project.

Alternative 2 – Modified Proposed Action

Under this alternative, approximately 991,060 acres would receive vegetation treatments and restoration activities. This is a 60 percent increase over the no action alternative. Alternative 2 would treat the greatest number of acres and therefore contribute the most toward the reduction of fire risk to lands, lands special uses, and mineral site structures. Fire damage to the facilities or structures in these areas would

mean destruction of private property and damage to utility corridors for electricity and water. This would have a significant impact to communities relying on these utilities.

Alternative 3 – Focused Restoration

Under Alternative 3, approximately 528,850 acres would receive vegetation treatments and restoration activities. This represents 44 percent fewer acres than Alternative 2, but a 44 percent increase over alternative 1. The threat of fire to lands, lands special uses, and mineral site structures would be greater than under Alternative 1 but less than under Alternative 2. Therefore, the risk of damage to or destruction of utility corridors and private property are also greater than Alternative 1 and less than Alternative 2. This alternative provides the greatest reduction in fire risk to these resources and therefore the greatest positive effects to the people owning these structures and the communities relying on these utilities.

Range

A summary of the range specialist report is presented here, and the complete report is incorporated by reference (USDA FS 2021e). Refer to the Range Report for additional information on methodology, the grazing history of the project area, and supporting information. This analysis incorporates questions designed to evaluate movement toward desired conditions and concerns brought up by the public during scoping: (1) How would project activities affect livestock grazing management in the project area? (2) How would project activities affect livestock forage in the project area? (3) Would livestock grazing affect the restoration of understory species?

Affected Environment

The affected environment for the range analysis is the Rim Country project area, approximately 1,240,000 acres. Only allotments within the project area are considered. Within the project area, approximately 1,129,000 acres are within grazing allotments and 109,000 acres are not within an allotment. The majority of the understory vegetation within the grazing area is dominated by Arizona fescue, mountain muhly, pine dropseed, blue grama, and squirreltail grasses.

Within the project area there are 70 livestock grazing allotments, with 69 active allotments and one vacant. Of these 70 allotments, 68 permit cattle grazing and two permit sheep grazing (one being a sheep driveway). The amount of each allotment lying within the project area varies from less than 1 percent to 100 percent.

Assumptions and Methodology

Annual planning occurs prior to the livestock grazing season. During this planning the livestock numbers and the grazing season are developed based on several factors including the previous year's management plans and outcomes, current year's predictions, and current resource conditions. During the grazing season, changes may be needed to the rotation or numbers, due to unexpected changes in conditions, such as those caused by drought or fire. This is a piece of the adaptive management cycle. Annual monitoring typically includes an assessment of current conditions, a measure of livestock usage and actual use. Long-term monitoring usually consists of condition and trend monitoring every five to fifteen years measuring plant canopy cover, plant frequency, species composition, and/or ground cover.

Design features, best management practices, mitigation and conservation measures have been developed to be used during implementation to protect range resources as well as other resources from grazing effects they are found in appendix C.

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects

In Alternative 1, there would be no management activities occurring within the project area as a result of the Rim Country Project. Because no activities would occur, tree densities and canopy cover would remain high and understory plant cover would stay the same. Over time, tree densities and canopy cover would continue to increase, under which understory vegetative cover and production would decline. Understory species would also be reduced because of the buildup of pine needles and the lack of nutrient cycling.

The reduction in understory vegetation over time would reduce the amount of forage available to livestock. Over time, livestock numbers may need to be reduced. This reduction in forage and decrease in livestock numbers has been recorded throughout the project area. There is no reason to believe that this trend would not continue under Alternative 1.

Under Alternative 1, additional prescribed fire would not occur in the project area. Without these acres of prescribed burning, no pasture rest periods would be necessary after burning.

Because no treatments are planned in Alternative 1, grazing management would continue as has generally been planned and actually carried out in the past. However, this alternative would not adequately reduce the increased risk of uncharacteristic wildfire.

Uncharacteristic wildfires can burn with high-severity and burn through multiple pastures, burning fences and other structural range improvements. Uncharacteristic wildfire would have an adverse effect on livestock grazing management and forage until the area recovers and structural improvements are replaced.

Effects Common to Both Action Alternatives

The environmental consequences for Alternatives 2 and 3 are based upon the application of design features and other resource protection measures (Appendix C), and are based upon the environmental consequences in the silviculture, fire and air quality, and wildlife sections.

Tree thinning and prescribed burning would increase understory vegetation. Understory species and composition would change primarily by increasing shade-intolerant understory species and decreasing shade-tolerant species. Understory species would also be increased because of the reduction of pine needles and the increase in nutrient cycling provided by burning. All these factors would improve forage production for livestock within the areas treated.

Both Alternatives 2 and 3 would directly decrease tree density by mechanical tree thinning and prescribed burning. An increase in the groupy/clumpy arrangement would substantially increase herbaceous species production by creating openings between these groups. The indirect effect of cutting trees in a groupy/clumpy arrangement would increase herbaceous vegetation because of the overall increase in sunlight reaching the soil. The increase in forage would have short-term (within three years) and long-term 10-year beneficial effects on livestock grazing.

In research near the project area, herbaceous production dropped from greater than 650 pounds per acre to 100 pounds per acre when basal area increased above 50 square feet/acre (Pearson and Jameson 1967). In

another study, grasses increased by more than 470 percent cover in high-intensity harvest units compared to a 53 percent increase in pre-treatment control units (Stoddard et al. 2011). Griffis et al. (2001) also found that the abundance of native grasses increased significantly along with treatment intensity throughout thinned and burned stands.

The increase in forage within treatment areas would improve allotment conditions and allow for more flexibility in grazing management systems. Livestock distribution would improve because forage is more available in uplands. An increase in pasture graze periods would allow for additional pasture rest or deferment in other pastures within an individual allotment.

Prescribed burning would have an adverse effect on livestock grazing by removing forage available to livestock. This effect would be short term until the forage plants regrow, typically within one year. This effect would be offset by the long-term increase in forage after burning. The prescribed burning would be phased throughout the project area to minimize effects on individual allotments. Most allotments in the project area have the ability to rest a pasture for one year after a burn with little effect on overall allotment grazing management. However, livestock numbers or season of use might have to be adjusted in some allotments because of the combined effects from prescribed burns and other factors like wildfire and drought. If the burned areas do not recover within a year, then livestock would likely continue to run in the same pastures, reducing the amount of rotational grazing on an allotment. Adaptive management would continue to be used to adjust livestock management to meet annual forage production, with or without the burns.

Adjustments in grazing of livestock after prescribed fires are a mitigation (appendix C) to reduce effects on forage species. These mitigations have shown to maintain static understory conditions in grazed areas. Adjustments needed, such as rest or deferment are difficult to determine because each pasture's response to ground-disturbing treatments (including mechanical thinning and prescribed fire) is unique. Climatic conditions, soils, vegetation, the severity of fire effects, burn amount, intensity of vegetation treatments, and pasture management may vary greatly from year to year or from pasture to pasture.

The removal of trees during mechanical thinning operations would have little effect on livestock grazing. Mitigations would be implemented to maintain structural range improvements and keep livestock within designated pastures during these operations. Pastures may be deferred during operations to minimize equipment and livestock conflicts, but it is not mandatory. Mechanical thinning has been conducted throughout the project area for many years with few effects on livestock grazing operations, although post-treatment inspections may result in changes to annual pasture rotations (such as deferment).

Mechanical and prescribed fire treatments (Stand Improvement, and Uneven-aged) would leave tree groups with differing sizes of interspaces between the tree groups. Treatments in the 40 to 55 percent and the 55 to 70 percent interspace ranges would result in an increase in herbaceous cover and production, and the treatments in 10 to 25 percent, 10 to 40 percent, and 25 to 40 percent interspace ranges would still result in an increase in herbaceous cover and production, but less of an increase than the higher interspace treatments.

Single-tree selection treatments leave fewer tree groups and more randomly spaced trees. They are designed to increase or maintain age class diversity and reduce understory brush and shrub response, creating small openings less than or equal to 1/4 acre in size. This type of treatment would result in an increase in herbaceous cover and production in the openings created. Aspen restoration treatments, mechanical and prescribed fire facilitative operations, and savanna, grassland, and meadow restoration treatments would result in an increase in herbaceous cover and production. Severe disturbance area

treatments, have an objective of restoring forest cover, which if it involves tree planting, would reduce herbaceous cover and production slowly over time.

Spring exclosure areas would not be available for livestock grazing and would have an adverse effect on available forage within a pasture. However, these exclosures would not be large enough and would not amass in any particular pasture to reduce pasture stocking rates. In addition, by the time these exclosures would be completed, it is anticipated the increase in pasture forage by the tree thinning and burning would help to offset the forage lost within the exclosures. Spring projects would not have a measurable impact on the capacity of allotment or grazing management.

Stream and riparian area restoration would have a long-term benefit to livestock grazing management by increasing forage and by improving bank stability.

Aspen exclosure areas would not be available for livestock grazing and would have an adverse impact on available forage within a pasture. However, the majority of these exclosures would not be large enough or amassed in any particular pasture to reduce pasture stocking rates. Aspen projects would not have a measurable impact on the capacity of an allotment or grazing management.

Road decommissioning would have a beneficial effect on livestock grazing by growing additional forage in the old roadbed. Constructing temporary roads would have a temporary adverse effect to livestock grazing when the forage on the road was disturbed. No road project would have a measurable impact on the capacity of allotments or grazing management.

Effects from Use of In-woods Processing and Storage Sites

The development and use of the proposed processing areas would make any potential forage unavailable to livestock grazing for approximately 20 years from their initial development. These processing sites would reduce the amount of forage available in these areas which could last up to 20 years. This effect would be small compared to the size of the allotment, and would likely have no noticeable effect on livestock management.

Alternative 2 – Modified Proposed Action

This alternative has the largest amount of acres proposed for treatments, leading to the biggest increase in forage production. This alternative also proposes the most acres of severe disturbance area treatments, which could include treatment options such as tree planting. These areas are generally within previously burned areas, such as the Rodeo-Chediski fire area. If the tree planting treatment is chosen, a decrease in production would occur overtime, in these areas.

This alternative contains the largest amount of acres proposed for mechanical treatment and prescribed fire. Therefore, this alternative would have the most livestock management adjustments, such as pasture rest or deferment, following treatments.

Alternative 3 – Focused Restoration

This alternative would also have an increase in forage production resulting from the proposed treatments. Due to less proposed acres of treatment, the overall forage production would be less than with Alternative 2. This alternative also proposes less acres of severe disturbance area treatments than is proposed in Alternative 2, which could include treatment options including tree planting. These areas are generally within previously burned areas, such as the Rodeo-Chediski fire area. If the tree planting treatment is chosen, a decrease in production would occur overtime, in these areas.

This alternative has acres proposed for mechanical treatment and prescribed fire. Therefore, this alternative would have the fewer adjustments needed, such as pasture rest or deferment, following treatments than with alternative 2.

Cumulative Effects

The area considered for cumulative effects analysis includes 100 percent of the acres within allotments that occur within the project area. This is a logical boundary because changes to grazing management in one pasture of an allotment affect the management in the entire allotment.

The time frame for these combined effects is 23 years, 20 years for project implementation and three years following implementation for the forage to respond to treatments. Changes in condition of the vegetation depend on the presence or absence of favorable growing conditions. If growing conditions are favorable, plant height and canopy cover would completely recover from the effects of the proposed forest management activities within one to two years. If growing conditions are not favorable, plant recovery may occur more slowly (up to two or more years). Vegetation recovery from the other activities and natural events may take this long depending on annual weather conditions particularly annual precipitation.

Continuation of current management, absent the proposed treatments in the Rim Country project area, would result in further reductions in forage production over time with the increase in tree density. Past restoration projects within and close to the project area have increased forage and understory vegetation. Forest Service policy and land management plan direction is to manage for uneven-aged stands and allow fire to return to its nature role in ecosystems. Current grazing management uses adaptive management to meet objectives established in existing allotment management plans. Past vegetation and prescribed fire projects have resulted in the current resource conditions.

The cumulative effects on livestock grazing management and livestock forage from Alternative 1 would be no change in the short term but would result in a long-term decrease in forage with the increase in tree density. The 4FRI Rim Country project area would not be treated with the additional activities proposed. When other current and foreseeable projects are considered, 282,291 acres would be treated (168,416 acres of mechanical thinning and 113,875 acres of burning), which would increase forage production. Livestock grazing management decisions such as if pastures would be rested or deferred would be determined through inspections. With fewer treatment acres, there would be fewer adjustments on pasture rotations.

The treatments proposed in Alternatives 2 and 3 would overlap with the other current and reasonably foreseeable projects in the project area. Any overlap, when added to forage production improvements from other projects, the understory species in Rim Country would result in a positive cumulative increase in production, more in alternative 2 than in alternative 3. Livestock grazing management decisions such as pasture rest or deferred rotations would increase with the acres of treatments in both action alternatives, more in alternative 2 than alternative 3, and would be determined through inspections.

Transportation

A summary of the transportation report is presented here. The transportation specialist report (USDA FS 2021e) is incorporated by reference.

Affected Environment

Forest system roads within the analysis area are managed in accordance with current management objectives that are based on a variety of needs for access and use of forest resources. The system of roads ranges from primitive, unsurfaced roads (maintained for resource protection and not user comfort), aggregate surfaced roads (maintained for varying degrees of user comfort), and double-lane asphalt-surfaced Forest Service. There are other roads in the project area that are maintained by either state, county, or private parties. These roads form a transportation system that provides access to the area for a variety of uses, including vegetation treatments, fuel treatments, fire suppression, and recreation. The majority of these system roads were planned and constructed during past commercial timber harvest activities and are not accessible year-round by all types of vehicles. The majority of arterial roads were designed for lowboy use and local spurs were designed for a standard log truck. In addition to passenger vehicles and high clearance vehicles, many of these roads are used by off-highway vehicles, hikers, mountain bikers, and horseback riders.

Some roads within the project area are poorly located. They may be overly steep and difficult to drain, located in drainages, too close to streams, or a number of other situations. Many of these roads are difficult to maintain and are causing soil and water resource damage.

The number of miles of county, state, and Federal highways outside the project area and that provide access to the project area and link it with potential wood processing facilities is not estimated. Because the location of potential future processing facilities is unknown it is not possible to identify all public roads which may or may not be used for accessing the area.

Current National Forest System Roads within Rim Country

Currently there are approximately 5,983 miles of Forest Service roads within the project area on National Forest System lands. Table 35 displays the miles of road by operational maintenance level.

Table 35. Summary of existing road mileage

Maintenance Level	Apache-Sitgreaves	Coconino	Tonto	Total
1- Basic Custodial Care (closed)	1,697	192	295	2,184
2 - High Clearance	998	1,438	619	3,055
3 - Suitable for Passenger Vehicles	352	244	77	673
4 - Moderate Degree of User Comfort	27	11	30	68
5 - High Degree of User Comfort	0	0	3	3
Total System Roads	**3,075**	**1,886**	**1,022**	**5,983**

Current Roads within Rim County by Jurisdiction

Currently there are approximately 351 miles of road within the project area that is not primarily maintained by the Forest Service. These roads range from local, county, or state highways to roads privately owned. Table 36 displays the mileage of road by jurisdiction.

Table 36. Rim Country project area by jurisdiction mileage summary

Jurisdiction	Apache-Sitgreaves	Coconino	Tonto	Total
Forest Service	3,075	1,886	1,022	5,983
State	42	46	63	151
County, Parish, Borough	83	34	44	161

Jurisdiction	Apache-Sitgreaves	Coconino	Tonto	Total
Local	0	1	0	1
Private	2	11	19	33
Other	0	0	5	5
Grand Total:	3,202	1,997	1,154	6,334

Assumptions and Methodology

The Rim Country project area consists of 1.24 million acres on the Apache-Sitgreaves, Coconino, and Tonto National Forests. Within this area, several other environmental analyses have been conducted in recent years. These previous analyses affect the type of transportation analysis conducted in this document.

Two environmental assessments, totaling 61,101 acres, were recently analyzed for transportation needs for mechanical thinning and for road decommissioning. No additional transportation analysis was conducted in these areas within the Rim Country EIS project area. These projects are:

- Larson- 29,921 acres- Apache-Sitgreaves National Forests
- Upper Rocky Arroyo- 31,180 acres- Apache-Sitgreaves National Forests

Six other environmental assessments totaling 192,187 acres, analyzed only for transportation needs for timber harvesting and did not analyze for any road decommissioning. These projects are:

- Upper Beaver Creek- 48,245 acres- Coconino National Forest
- Clints Well- 16,825 acres- Coconino National Forest
- CC Cragin- 63,867 acres- Coconino National Forest
- Rim Lakes- 33,746 acres- Apache-Sitgreaves National Forests
- Show Low South- 4,624 acres- Apache-Sitgreaves National Forests
- Timber Mesa-Vernon- 24,880 acres- Apache-Sitgreaves National Forests

On the Coconino National Forest, 185,596 acres are identified for mechanical treatment as part of the Rim Country EIS. On the Apache-Sitgreaves National Forests, 212,487 acres are identified for mechanical treatments. On these two forests, all mechanical treatments are assumed to require adequate road access to facilitate the removal of forest product resulting from forest restoration work.

On the Tonto National Forest, 164,397 acres have been identified for mechanical treatment as part of Rim Country; however, many of these acres are dominated by chaparral, juniper, or other vegetation with less ponderosa pine present. While these areas may be mechanically treated, it is unlikely that mechanical thinning would be carried out on all of these acres due to the small amount of merchantable material present.

Areas not proposed for mechanical treatments with wood products removal would not need the same level of access as those areas where forest products would be utilized. A minimum of 100 square feet of basal area per acre of ponderosa pine was used to determine which acres would likely need adequate road access to remove forest products. Based on this analysis, 48,589 acres on the Tonto were analyzed for temporary road construction needs. The remaining 115,808 acres on the Tonto were not analyzed for temporary road construction needs, as removal of forest products is considered to be unlikely.

As a result of the previous analyses in the 4FRI footprint, and the basal area threshold of 100 square feet per acre on the Tonto National Forest, temporary road needs are only analyzed for 212,487 acres of the Apache-Sitgreaves National Forests, 185,596 acres of the Coconino National Forest, and 48,589 acres of the Tonto National Forest, for a total of 446,671 acres within the Rim Country project area.

Road decommissioning is analyzed for 1,080,341 acres within the Rim Country EIS project area. This represents the entire project area outside of the Larson and Upper Rocky Arroyo analysis areas, which have already been analyzed for road decommissioning. Inventoried Roadless Areas would have no temporary roads.

Issues, Indicators, and Analysis Topics

The following significant issue was identified for the Rim Country Project:

> The miles of temporary roads in the proposed action may negatively affect watershed and stream conditions, and wildlife habitat and connectivity. Commenters asked that the Forest Service limit road networks to those roads needed for access and management. Commenters requested an alternative that dramatically reduces temporary road mileage.

Indicators and Measures

Indicators would include the range of temporary roads that may be needed in each of the alternatives, measured by the approximate number of miles of temporary roads proposed in each alternative.

Environmental Consequences

For all alternative analyses, the sections Use of Existing Roads, Road Maintenance, Road Decommissioning, Rock Pit Use and Expansion, and Use of In-woods Processing and Storage Sites were added for consistency from the specialist report that was published with the DEIS, gray highlights in these sections indicate new additions to the analyses.

Alternative 1 – No Action

Use of Existing Roads

Under Alternative 1, no new restoration activities would take place and no additional use of existing roads would occur. Current rates of public and administrative use would continue.

Road Maintenance

Under Alternative 1, maintenance to provide public and administrative access would continue, contingent upon funding. This funding is generally devoted to the higher standard roads within the Analysis Area. No increase in road maintenance to accommodate restoration activities would occur. Current sediment delivery from road segments in need of maintenance would continue to have an impact on stream turbidity.

Road Decommissioning

Under Alternative 1, no road decommissioning would occur within the project area unless it is analyzed under separate NEPA analysis. System roads that are rutting, are no longer needed, or difficult to maintain would continue to deliver sediment and resource damage. Unauthorized routes would continue to erode and cause resource damage on the landscape.

Temporary Roads

Under Alternative 1, no new temporary roads would be constructed, unless constructed under separate NEPA analysis.

Rock Pit Use and Expansion

Under Alternative 1, there would be no expansion of existing pits. Current use of existing and new pits analyzed under separate NEPA would continue.

Use of In-woods Processing and Storage Sites

Under Alternative 1, no in-woods processing and storage sites would be created or used; therefore there would be no effects resulting from them.

Effects Common to Both Action Alternatives

An adequate transportation system to provide access for restoration work and for removal of forest products generated from restoration activities is critical for accessing stands identified for mechanical treatment. Listed in the following paragraphs are practices that are common to all action alternatives.

Use of Existing System Roads

It is assumed that nearly all of the existing roads within the Rim Country analysis area may be used to provide access for a variety of restoration activities, including hauling of forest products resulting from mechanical treatments. Nearly all of the forest system roads within the project area are ML 1, 2, or 3 roads with less than 1 percent of the total mileage ML 4 or 5. This analysis addresses temporarily opening existing closed roads (ML 1) to utilize them for the time period they are needed to provide access for restoration work. These roads would be closed upon completion of thinning activities and related restoration work and returned to a closed status (ML 1).

During project implementation, traffic would increase from moving equipment in and out, hauling forest products, and worker travel to and from the project area. Traffic management in accordance with standard contract provisions would mitigate risks to workers and provide for safe public traffic. Short-term temporary route closures to public travel would be implemented to provide for worker and public safety during project implementation.

The preferred alternative in the Tonto Travel Management EIS proposes that 354 miles of ML 2 roads be converted to motorized trails. These roads have received minimal maintenance over the years and their current condition is not anticipated to improve (narrowing, roughening up, or otherwise modifying the road as it's redefined to a motorized trail). Full size vehicles would be authorized to use these routes under Tonto Travel Management and they would be managed as motorized trails. It's anticipated that pre-haul maintenance is all that would be needed in the future to prepare the motorized trails for use to access mechanical treatment areas.

Roads used for hauling of forest products under this analysis would be maintained or reconstructed to meet road management standards under National Best Management Practices for Water Quality Management on National Forest System lands. Alternative 2 would reconstruct/maintain up to 5,127 miles and Alternative 3 would reconstruct/maintain up to 4,165 miles.

Road Maintenance and Reconstruction

Road maintenance is defined as, "The upkeep of the entire transportation facility including surface and shoulders, parking and side areas, structures, and such traffic-control devices as are necessary for its safe and efficient utilization. This work includes brushing of roadside vegetation, falling danger trees, road blading, cleaning ditches, cleaning culvert inlets and outlets, etc." (36 CFR 212.1). Maintenance activities generally do not disturb ground outside of existing roadway (toe of fill to top of cut) other than removing materials around culvert inlets.

When there is a substantial increase in use of a road by a Forest Service contractor for uses such as hauling, this contractor is required to perform maintenance both during and after their use of the road commensurate with their use. Road maintenance on roads that are closed to the public would be performed by the logging contractor.

Some roads may require more substantial work outside of road maintenance. These improvements would be done to improve and restore National Forest System roads. Improvements would provide serviceability for project haul vehicles and harvest equipment, as well as proper hydrologic function and stream protection according to applicable best management practices. Actions could include clearing, excavation, adding or replacing culverts, constructing drain dips, road widening, or riprap fills.

Maintenance and Reconstruction would protect or improve soil and water quality and improve access for timber harvest, recreation, administration, and other uses. Following implementation, the combination of road maintenance and reconstruction would provide long-term public and administrative access within the project area. These improvements would leave the road system in a more stable and functional condition, minimizing adverse resource impacts.

Roads used for hauling of forest products or other restoration activities under the Rim Country Project would generally be maintained by contactors. This maintenance would likely be done while the road is being used and at the completion of hauling. All maintenance performed by contractors would be in accordance with Forest Service maintenance standards.

Road Decommissioning

Road decommissioning is defined as: "Activities that result in the stabilization and restoration of unneeded roads to a more natural state." (36 CFR 212.1, FSM 7705 – Transportation System) The Forest Service Manual (7734.1) identifies five levels of treatments for road decommissioning which can achieve the intent of the definition. These include:

- Block entrance
- Revegetation and water barring
- Remove fills and culverts
- Establish drainage ways and remove unstable road shoulders
- Full decommissioning, recontouring and restoring natural slopes

These five treatments provide a wide range of options to stabilize and restore unneeded roads. Depending on ground conditions and road location, restoration may be achieved by a combination of the treatments listed.

This analysis only provides estimated mileage and does not identify specific road segments for decommissioning. Rather it would provide the NEPA coverage over the project area to decommission roads and road segments at the time that task orders or other projects are implemented. Roads may be decommissioned for a variety of reasons, including but not limited to roads that are:

- No longer needed for future management
- To protect cultural resources
- Causing soil or water resource damage
- Not useable without significant investment beyond current and future funding levels
- An ongoing road maintenance challenge
- An unauthorized road (an unauthorized roads is defined as road that is not a forest road or a temporary road and that is not included in a forest transportation atlas).
- Other unique situations

Under this alternative, both National Forest Systems roads that are not open to the public and/or no longer needed for administrative and/or permittee use and unauthorized roads, all of which are not open for public use, could be decommissioned. Transportation Analysis Process reports (which determines the minimum road system), and Travel Management Rule for the Apache-Sitgreaves, Coconino, and Tonto National Forests and site-specific on-the-ground evaluations would be adhered to in selecting roads for decommissioning.

On the Tonto National Forest, decommissioning of system roads has been analyzed as part of the Tonto Travel Management EIS and roads for decommissioning are identified. Roads identified for decommissioning under the Tonto Travel Management EIS, Final Record of Decision could be physically decommissioned as part of restoration work undertaken to implement the Rim Country EIS. Unless already identified for decommissioning under the Tonto Travel Management, roads on all three forests in Rim Country that are needed to provide reasonable skidding distances for future harvesting would not be decommissioned. Roads that are needed to provide access for leases and other special uses on National Forest lands would not be decommissioned unless other suitable access is provided. If these roads are needed for future management but are a problem for soil and water resources, they would instead be relocated, and the existing road template would be decommissioned.

Unauthorized roads within the project area on all forests could be decommissioned under this decision. Unauthorized roads are not open for public use, were never designed to be on the landscape, and are currently causing resource damage. Roads currently designated as open on a forest's motor vehicle use map would not be decommissioned or closed under the action alternatives. Any road currently not designated as open under a forest's motor vehicle use map is not open to the public.

Road Relocation

Road relocation is defined as moving an existing road from its current location and re-locating it to a new location. Unfortunately, many roads within the project area are poorly located and were never properly designed. As a result, these roads are in need of relocation. Roads that could be considered for relocation include those that are:

- Too steep, resulting in significant erosion
- Below the level of the surrounding land and are difficult to drain

- Are too close to a seasonal or perennial waterbody and contributing sediment to the waterbody
- Other unique situations
- Any combination of the reasons listed above

When roads are relocated, their former location would be decommissioned. This would result in little if any net gain or loss in road mileage in most cases. Road relocation of a system road is not considered construction of a new permanent road. It is considered a relocation of an existing road.

This analysis does not identify specific road segments for relocation. Rather it provides the basis to relocate roads and road segments at the time that task orders or other projects are implemented. Roads would be evaluated for relocation at that time using the criteria listed above. The purpose of road relocation is to reduce adverse environmental effects and allow for a safer, more economically feasible transportation system that has minimal effects to the surrounding area.

Temporary Roads

The Collaborative Forest Landscape Restoration Program (CFLRP), does not allow for the construction of new permanent roads in CFLR projects. Though the Rim Country Project is no longer a CFLRP project, the project still meets the intent of the CFLRP and any new road constructed must be a temporary road and cannot be added to the national forest road system. All new road construction in this project is temporary and would be decommissioned immediately following thinning and related restoration work.

A temporary road is defined as: "A road or trail necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road, or trail and that is not included in the transportation atlas" (36 CFR 212.1).

In order to provide adequate access to the project area for timber removal, temporary roads would need to be constructed in some locations, and are intended to provide short-term access to a specific area for wood products removal and/or follow up treatments, such as prescribed burning. Temporary roads are often used to provide economically feasible skidding distances in harvest operations. The Forest Service and contractor have to agree on a temporary road plan that is based upon each contractor's available equipment, making it impossible to accurately predict the exact location at this time. However, design criteria is followed in determining the amount and locations of these roads. Immediately following thinning and related restoration work, temporary roads would be decommissioned and made impassable to vehicles per the design features in Appendix C. Decommissioning would be accomplished with one or more of the five levels of treatments described above.

Temporary roads might be either new construction or utilize existing road prisms of unauthorized roads. Temporary road mileage for each action alternation is listed under that alternative. If new temporary roads need to be constructed, they would be placed in locations that minimize environmental effects to the greatest possible degree and constructed in the shortest distance possible.

When constructing new temporary roads:

- Follow contour lines as much as possible, making gradual transitions between,
- Be outside of Aquatic Management Zones, protected activity centers, and inventoried roadless areas,
- Avoid stream crossings where practical and install necessary drainage features when unavoidable,

- Consider soil types and any landslide potential,
- Be the shortest distance possible and used for a minimal amount of time
- Only constructed when no other feasible option is available

Appendix C, design features contains all of the mitigation measures pertaining to temporary roads.

Rock Pit Use and Expansion

Rock pit use and expansion could require a limited amount of temporary road in order to achieve expansion. This mileage is included in the estimated temporary road mileage under each action alternative.

Use of In-woods Processing and Storage Sites

In-woods processing and storage sites could require a limited amount of temporary road. This mileage is included in the estimated temporary road mileage under each action alternative.

Effects Unique to Each Action Alternative

Alternative 2 – Modified Proposed Action

Use of Existing Roads

It is assumed that nearly all, if not all system roads within the project area could be utilized at some point in time to carry out restoration activities.

Table 37 displays the miles of road by maintenance level that could be used for timber harvest activities. This mileage is based upon all potential timber harvest units and could be reduced depending on ground conditions at implementation.

Table 37. Alternative 2 timber haul road mileage summary

Maintenance Level	Apache-Sitgreaves	Coconino	Tonto	Total
1- Basic Custodial Care (closed)	1,226	160	298	1,683
2 - High Clearance	846	1,194	650	2,690
3 - Suitable for Passenger Vehicles	334	250	98	682
4 - Moderate Degree of User Comfort	21	10	39	69
5 - High Degree of User Comfort	0	0	3	3
Total System Roads	2,426	1,614	1,087	5,127

The remaining mileage in the project area could be used to complete other restoration activities.

Road Maintenance and Reconstruction

Roads that would be utilized for restoration work and hauling of forest products would likely see pre-haul maintenance or reconstruction if needed to make the roads passable to truck traffic, as well as

maintenance during hauling and post haul maintenance. This maintenance would be in addition to a forest's regular schedule of maintenance.

Under Alternative 2 in the project area, approximately 79 percent of the Apache-Sitgreaves, approximately 86 percent of the Coconino, and approximately 94 percent of the Tonto National Forests' roads would receive some form of maintenance and/or reconstruction related to timber removal. The remaining mileage would see maintenance and/or reconstruction work for other restoration activities.

Road Decommissioning

Under this alternative up to 200 miles of system road on the Coconino and Apache-Sitgreaves National Forests could be decommissioned. These system roads are currently not on any forest's Motor Vehicle Use Map and not open for public use. The Tonto National Forest Travel Management EIS has identified approximately 290 miles of road within the Rim Country project area for decommissioning. In addition to system road decommissioning, up to 800 miles of unauthorized roads on all 3 forests may be decommissioned under this alternative. All 800 miles of unauthorized roads are currently not open for public use. All road decommissioning would be done in accordance with Travel Management Rules.

Road Relocation

Roads may be relocated as needed under this alternative in order to reduce adverse resource effects, to facilitate use for restoration activities and improve public safety. Although the exact location of these roads are not identified at this moment, the criteria previously listed would dictate which sections get relocated.

Temporary Roads

Under this alternative up to 330 miles of temporary road could be created and utilized to facilitate mechanical treatments. These temporary roads might be new construction or utilize existing unauthorized roads. Temporary roads would be decommissioned immediately following project use including thinning and related restoration work is completed in the areas they access.

Alternative 3 – Focused Restoration

Use of Existing Roads

It is assumed that nearly all, if not all roads within the project area could be utilized at some point in time to carry out restoration activities.

Table 38 displays the miles of road by maintenance level that could be used for timber harvest activities. This mileage is based on all potential timber harvest units and could be reduced depending on ground conditions at implementation.

Table 38. Alternative 3 timber haul road mileage summary

Maintenance Level	Apache-Sitgreaves	Coconino	Tonto	Total
1- Basic Custodial Care (closed)	863	145	233	1,241
2 - High Clearance	643	1,015	561	2,219
3 - Suitable for Passenger Vehicles	300	250	98	647

Maintenance Level	Apache-Sitgreaves	Coconino	Tonto	Total
4 - Moderate Degree of User Comfort	7	10	38	55
5 - High Degree of User Comfort	0	0	3	3
Total System Roads	1,812	1,420	932	4,165

The remaining mileage in the project area could be used to complete other restoration activities.

Road Maintenance and Reconstruction

Roads that would be utilized for restoration work and hauling of forest products would likely see pre-haul maintenance or reconstruction if needed to make the roads passable to truck traffic, as well as maintenance during hauling and post haul maintenance. This maintenance would be in addition to a forest's regular schedule of maintenance.

Under Alternative 3 in the project area, approximately 59 percent of the Apache-Sitgreaves, approximately 75 percent of the Coconino, and approximately 91 percent of the Tonto National Forests' roads would receive some form of maintenance and/or reconstruction. The remaining mileage would see maintenance and/or reconstruction work for other restoration activities.

Road Decommissioning

Under this alternative, up to 200 miles of system road on the Coconino and Apache-Sitgreaves National Forests could be decommissioned. These system roads are currently not on any forest's motor vehicle use map and not open for public use. The Tonto National Forest Travel Management EIS has identified approximately 290 miles of road within the Rim Country project area for decommissioning. In addition to system road decommissioning, up to 800 miles of unauthorized roads on all 3 forests could be decommissioned under this alternative. All 800 miles of unauthorized roads are currently not open for public use. All road decommissioning would be done in accordance with Travel Management Rules.

Road Relocation

Roads may be relocated as needed under this alternative in order to reduce adverse resource effects, to facilitate use for restoration activities and improve public safety. Although the exact location of these roads are not identified at this moment, the criteria previously listed would dictate which sections get relocated.

Temporary Roads

Under this alternative up to 170 miles of temporary road could be created and utilized to facilitate mechanical treatments. These temporary roads might be new construction or utilize existing road prisms of non-systems roads already present. Temporary roads would be decommissioned immediately following when thinning and related restoration work is completed in the areas they access.

Cumulative Effects

The spatial boundary for this cumulative effects analysis is the Rim Country Project Area. The time frame for the analysis begins in 2010, and was selected because it captures all the decisions that include the applicable transportation system activities in the cumulative effects spatial boundary. The timeframe

extends to 20 years into the future because that is what is reasonably foreseeable for implementation of the Rim Country Project.

Alternative 1 – No Action

Under Alternative 1, there are no proposed activities so there would be no cumulative effects in the project area from: use of existing roads, road maintenance, road decommissioning, temporary roads, rock pit use and expansion, and use of in-woods processing and storage sites.

Cumulative Effects Common to Both Action Alternatives

Additional road maintenance performed during project implementation, road reconstruction that would improve surface conditions, drainage feature function, hazard tree removal, and roadside clearing would provide long-term safe efficient travel with high user comfort that would have minimum adverse effects on resources. Road decommissioning would improve surface conditions and drainage feature functions, providing long term resource benefits to all resource areas. Road relocation would provide for less resource damage, moving the road to a location that would require less maintenance.

Under both proposed alternative actions, short-term traffic from harvest operations and forest product removal would require traffic control and temporary public road closures in areas with harvest operations activities. Trucker communications would maintain safe and efficient traffic flow. A short-term public access closure would minimize user conflicts during project implementation. Main collector and arterial forest roads would receive the majority of traffic and would have surface wear proportionate to traffic volume. Road maintenance would ensure drainage feature function and improve surface conditions.

Recreation

A summary of the Recreation Report is presented below and the specialist report (USDA FS 2021e) is incorporated by reference. The potential effects of the 4FRI Rim Country Project on recreational opportunities was not raised as a concern by the public.

Affected Environment

Recreation Trends

The Apache-Sitgreaves, Coconino, and Tonto National Forests provide diverse outdoor recreation opportunities connecting people with nature in a variety of settings. Forest users can hike, bike, drive motorized vehicles, camp, fish, view wildlife and scenery, and explore historic and prehistoric places. They enjoy opportunities for year-round recreation activities from birding and wildflower observing in the spring, hiking in summer months, fall color viewing and hunting, to cross country skiing in the winter.

Forest users may occasionally experience short-term or temporary disruptions in their recreation activities as a result of other groups currently occupying a preferred site, forest management activities such as current thinning or prescribed fire projects, fire restrictions or fire closures due to hot, dry weather and extreme fire danger, as well as natural occurrences such as fallen trees blocking a roadway or trail, and so on. When asked how visitors would react to such disruptions in their plans, they reported in the National Visitor Use Monitoring survey (NVUM) using substitution behaviors such as coming back another time, going elsewhere for a different activity, going elsewhere for the same activity, going to work, some other substitution or staying at home (Forest Service 2021a, USDA Forest Service 2021b, USDA Forest Service 2021c). The number one response for all three Rim Country forests was by far going elsewhere for the same activity.

Demographic shifts and lifestyle changes have affected the demand for recreation opportunities on national forests. Today about 80 percent of the population lives in urban settings (United States Census Bureau 2021b) Both of these trends have created challenges to Forest Service recreation managers to meet demands for an ever-increasing number of recreation users as well as a diverse number of desired recreation activities. Population growth is expected to continue into the future and will increasingly affect national forest management activities, as well as ability to provide satisfying recreation opportunities.

The NVUM data highlights that the Coconino National Forest is the most popular national forest in the southwestern region, but the data also shows that the forest serves an interesting niche. The Coconino National Forest is heavily used by non-local and international visitors; it is estimated that 60 percent of the 4.7 million visitors come a long distance (over 100 miles) to visit the National Forest (USDA Forest Service, 2021d). While large numbers of visitors to the Apache-Sitgreaves National Forests come from areas (primarily the Phoenix metropolitan area) to visit the area mainly for the change of scenery, ideal climate, and relief from extreme summer temperatures in nearby major metropolitan areas. The Rim Country project area covers a wide array of recreationists coming from different places within Arizona and from other states and countries. This reflects the desire of many recreationist to participate in the extensive possibilities of recreation activities in the area.

Recreation Activities within the Project Area

There are several Forest Service trails and developed recreation facilities within the Rim Country Project analysis area, including developed campgrounds. Most of the recreation facilities are located on the Apache-Sitgreaves National Forests.

There are 30 developed campgrounds in the Rim Country Project area. Campgrounds generally operate from May to October depending on weather. These campgrounds see high use on weekends typically from mid-May to mid-September.

There is a total of 728 miles of trail identified in the project area, ranging from most primitive to fully developed. The Apache-Sitgreaves National Forests contain the most miles of trail, with more than double that of the Coconino and Tonto National Forests. In addition, the Apache-Sitgreaves is the only forest to have snow trails. The Rim Country Project area contains parts of four national trails: the Arizona National Scenic Trail (70 miles in the project area), the entire Blue Ridge National Recreation Trail (9.4 miles), the General Crook National Recreation Trail (95 miles in the project area), and the Highline National Recreation Trail (44 miles in the project area). Figure 36 illustrates the locations of the national trails in the project area.

There are currently no designated segments of wild and scenic rivers in the Rim Country project area. There are however, currently 9 segments of eligible wild and scenic rivers on the Apache-Sitgreaves and Coconino National Forest in the project area. Five eligible wild and scenic rivers occur on the Tonto National Forest and were identified in a 1993 eligibility report covering all the national forests in Arizona (USDA Forest Service 1993). As part of its ongoing Land Management Plan Revision process, the Tonto National Forest is completing a wild and scenic river eligibility study that will replace the 1993 study (USDA Forest Service 2017). For analysis purposes and to be consistent with the Land Management Plan revision, the Rim Country FEIS includes the eligible rivers listed in the most current eligibility study based on comments received from the 2017 Tonto National Forest Draft Wild and Scenic Rivers Eligibility Study.

Dispersed recreation includes the full suite of outdoor non-motorized and motorized recreation opportunities available throughout the year. Dispersed camping requires no additional facilities other than road or trail access, though the relatively unconstrained nature of dispersed camping can cause resource impacts such as soil compaction and erosion, loss of vegetation, increased fire risk, displacement of

wildlife, and accumulation of trash and human waste. The number of dispersed campers in the analysis area is also difficult to estimate.

As Arizona's population has grown, the state has also seen a dramatic increase in ownership and use of personal off-highway vehicles (OHVs). Arizona Trails 2010 reported a 623 percent increase in sales of off-highway motorcycles and all-terrain vehicles (ATVs) in Arizona between the years 1995 to 2006 (McVay et al. 2010). NVUM indicates a particular great increase of OHV use to recreate from 3.6 percent to 27.5 percent activity participation for the Tonto National Forest. The Coconino and the Apache-Sitgreaves National Forests show a slight decrease in OHV use. The growth in ownership and use of OHVs has greatly influenced how users recreate in the project area.

The 2018-2022 Arizona Statewide Comprehensive Outdoor Recreation Plan reports that based on the Arizona Trails 2017 Plan, 13 percent of adult Arizona residents have used a motorized trail at least once during their time in Arizona.

In November 2005, the Forest Service announced new Federal regulations called the Travel Management Rule, requiring each national forest to establish a designated system of roads, trails, and areas by vehicle type and time of year. Designated roads, trails, and areas would then be identified on a Motor Vehicle Use Map, made available to the public for free (36 CFR 212.56). The 4FRI Rim Country Project would adhere to the current Travel Management Rule decisions for the Apache-Sitgreaves, Coconino, and Tonto National Forests.

The Forest Service uses the recreation opportunity spectrum (ROS) to provide a framework for defining classes of outdoor recreation environments, activities, and experience opportunities (USDA Forest Service, 2011c). The ROS is a land classification system that categorizes national forest land into six classes, each class being defined by its setting and by the desired opportunities and characteristics the setting offers. The six ROS classes are Primitive (P), Semi-Primitive Non-Motorized (SPNM), Semi-Primitive Motorized (SPM), Roaded Natural (RN), Rural (R), and Urban (U). There is no wilderness or recommended designated wilderness area within the proposed project area. Opportunities for experiences along the spectrum represent a range from very high probability of solitude, self-reliance, challenge and risk, to a very social experience where self-reliance, challenge and risk are relatively unimportant.

The purpose of the ROS is to identify desired conditions across the Forest so that different parts of the forest may facilitate different recreational experiences. The ROS represents management objectives, which may not always reflect actual user experiences. Most of the Rim Country project area falls into the SPM and RN classes. Approximately 418,680 acres or 35 percent of the project area is SPM. RN makes up 418,675 acres or 50 percent, and SPNM makes up 13 percent of the area. The recent revised land management plans for the Coconino and the Apache-Sitgreaves National Forests contain updated ROS maps that represent the desired conditions for ROS classes across the forests. Not all acres on the forests currently meet these desired conditions. The desired conditions are meant to guide project design, alternative development, and assessment of potential project effects. ROS classifications are also used to determine if project activities would help move toward desired conditions for recreation opportunities at the forest level.

All three national forests in the project area offer numerous developed recreation opportunities as illustrated in Figure 34. The Rim Country Project does not include restoration activities in developed recreation sites, special areas, or designated Wilderness. Outside of these areas, many forest users engage in dispersed recreation including hiking, dispersed camping, driving motorized vehicles, rock climbing, cross-country skiing, and snow play. There may be restoration activities in many places where dispersed recreation occurs.

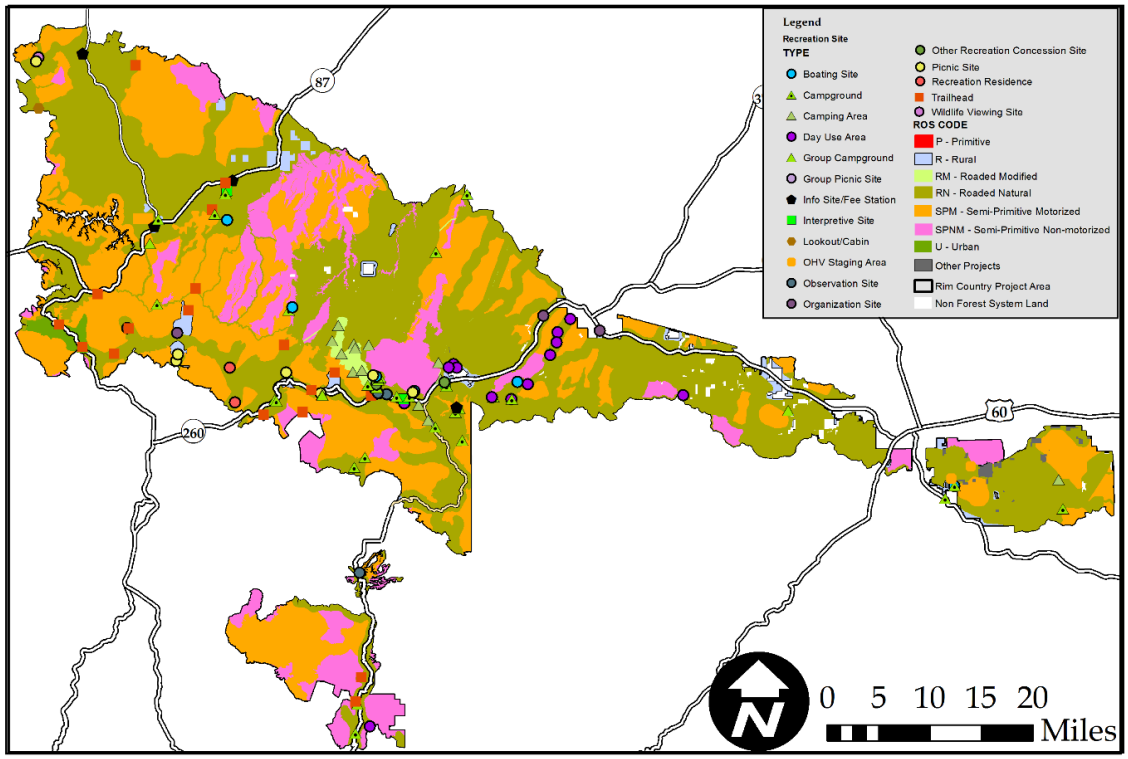


Figure 34. Rim Country developed recreation sites

A spectrum of high-quality outdoor recreation settings and opportunities would be made available in the project area.

Management activities on National Forest System lands are consistent with recreation setting objectives that provide opportunities for the public to engage in a variety of developed and dispersed recreational activities, in concert with other resource management and protection needs.

Assumptions and Methodology

This assessment includes use of the best available science, based on relevant peer-reviewed literature, published reports from regulatory and land management agencies, existing resource inventories, field visits, and the professional judgment of interdisciplinary and cooperating agency team members.

The recreation opportunity spectrum (ROS) is the guiding system that land management plans direct be considered when planning projects to properly manage and balance recreation opportunities. The ROS provides a framework to assist managers in identifying different outdoor recreation environments, settings, activities, and experiences desired by the public, and deciding how to provide these different recreational opportunities over the landscape within the forest (USDA Forest Service, 1986). ROS classifications are identified to distinguish the desired conditions across the landscape. ROS classifications within the project area were referenced to determine if project activities would affect the potential for meeting or moving toward desired conditions identified in the ROS classifications.

The Special Uses Database System was used to generate a list of all recreation special use authorizations within the project area. This report was sorted by status. The authorizations were considered part of the existing condition if they had statuses of application accepted, pending signature, or issued.

Data and experiences from both the 4FRI first EIS (USDA FS 2015c) and the Cragin Watershed Protection Project (USDA FS 2018b) were used in this analysis because of proximity to the project area, probability that users would recreate in all these project areas, and the similarity of terrain and vegetation.

The timeframes for direct and indirect effects include the potential for up to 20 years of project implementation. The thinning treatments may take up to 20 years to complete, with each thinning contract generally completed within a three-year timeframe. Implementation may include prescribed burning over a 20-year period, with multiple burn intervals of 2 to 10 years across the project area. Any direct or indirect effects related to the recreationists' scenery perceptive are described in the scenery report.

Issues, Indicators, and Analysis Topics

Analysis topics identified relative to recreation and lands management resources are based on Land Management Plan desired conditions, management approaches, guidelines, and standards. There were very few public comments identifying issues or concerns related to recreation, except for potential effects from treatments on the Arizona National Scenic Trail and its users. Consequently, this resource area was determined to require cursory analysis. The primary issue of concern to recreation resources from the proposed activities is to minimize and mitigate impacts to recreation features (for example, developed campgrounds, signs, trails, and trailheads) and recreation activities (for example, driving for pleasure, dispersed camping, hiking, mountain biking, equestrian use, hunting, boating, special use events, and developed camping).

Environmental Consequences

Alternative 1 – No Action

Alternative 1 does not include any thinning or prescribed burning treatments in the project area under the Rim Country Project, increasing the likelihood of uncharacteristic wildfire that may have lasting effects on recreation areas throughout the Rim Country Project area. Under this alternative, recreation resources would be managed as they are currently without any effects from vegetation treatments and prescribed burning proposed in the Rim Country Project area. Although electing the no action alternative would not result in impacts to these resources from prescribed burning or thinning, this alternative would not reduce the risk of uncharacteristic wildfire that could cause resource damage, damage to recreation and lands infrastructure, and subsequent flooding. Wildfires ignited by lightning could be managed for resource benefit given conditions allow; however, the use of this strategy to decrease future crown-fire risk is unpredictable and unlikely to affect most of the project area. Alternative 1 is the point of reference for assessing action alternatives 2 and 3.

The increased risk of uncharacteristic wildfire resulting from this alternative would contribute to the issue of limited recreational access and opportunities on the national forests. Over the last several years, there have been a number of large high-severity wildfires such as the Wallow Fire, General Fire, which have resulted in area closures and loss of temporary access and recreational use.

Recreation Sites and Uses

Recreation Resources

The threat of uncharacteristically severe wildfire continues to increase with ongoing, unmanaged growth of vegetation. Uncharacteristic wildfire would severely influence recreation values and experiences in the analysis area. Research has demonstrated the negative effects wildfire can have on recreation activities. Vaux, et al. (1984) found that "intense fires may have detrimental effects on recreation values" (p.1).

During NVUM, visitors were asked what they would do if they were unable to visit this national forest due, for example, to closures related to wildfire damage and rehabilitation. Most visitors responded that they would have gone elsewhere for the same activity. This suggests that if the Rim Country Project area was closed due to wildfire or related effects, visitors would seek alternative locations to enjoy the same recreation activities. This could lead to overcrowding in nearby areas, resulting in resource damage and undesirable recreational experiences.

Developed Recreation Facilities

Developed recreation facilities, such as campgrounds and group event sites, could be negatively affected if there is no action to reduce the risk of uncharacteristic wildfire. The changes to landscape character and visual quality following a severe fire would considerably diminish the quality of recreation experiences and activities in affected areas. Effects from severe wildfire on other recreation-related infrastructure such as restrooms, kiosks, bulletin boards, and trail signs would be substantial and would result in high costs to repair or replace damaged facilities. Historic sites such as lookout towers and guard stations could not be replaced if destroyed.

Trails

Wildfire or flood damage to segments of trails within the project area would require closures of affected sections until they could be properly repaired and determined safe for use. In the interim, potentially lengthy re-routes would have to be established for visitors wishing to hike any affected trails, especially for the state-wide Arizona National Scenic Trail.

While short-term effects of uncharacteristic wildfires on recreation are almost uniformly negative, longer-term effects may differentially impact certain user groups. Fire-damaged trees can take many years to fall, and it is likely that any affected trail system would experience increased numbers of downed trees across trails for many years, despite routine maintenance. Crossing downed logs on trails is more burdensome for mountain bikers, who must stop, dismount, and lift their bikes over fallen trees, than it is for hikers, who may be able to simply step over these obstacles. Hesseln et al. (2003) found that the value of net benefits for hikers increased during the 40 years following crown fire, whereas the net benefits for mountain bikers declined over the same period. This demonstrates that different severity fires may impact groups engaged in different recreation activities in different ways.

Overall trail users respond negatively and have a decreased return to forested areas that have experienced uncharacteristic wildfire. “The lack of mature trees and the large numbers of downed trees make the area unattractive to hikers and mountain bikers” (Starbuck et al. 2006). So, the no action alternative, which has no vegetation management activities or prescribed burning treatments to reduce the risk of wildfire, could have negative effects on trails and trail users if an uncharacteristic wildfire was to occur in the Rim Country project area.

Eligible Wild and Scenic River

The opportunities to experience a spectrum of river-related recreational activities on the Wild and Scenic Rivers could be at higher risk of being negatively affected by catastrophic fires. There is the potential for fire-related closures that could prevent access to the rivers. During these fires, closures in areas of the forest could touch some visitors by redirecting them to other areas of the forest. The recreation opportunity spectrum should not be reduced. The Wild and Scenic Rivers would continue their management per the direction in the respective land management plans.

Dispersed Recreation

Following the Rodeo-Chediski Fire in 2002, dispersed camping in the burned area was prohibited for nearly seven years. The major reasons for this restriction was to protect visitors and property from damage due to falling trees and flooding, and to reduce recreation effects to fragile fire-damaged soils. The time it takes a fire-damaged tree to fall is unpredictable and depends on several factors including weather, topography, burn severity, and flooding. Trees that have been killed or damaged by fire may be unstable and parts or all such trees can easily become dislodged and can fall onto forest visitors, vehicles, or camping equipment.

Dispersed camping is popular in the Rim Country Project area and an uncharacteristic wildfire could result in closing a fire area to camping and other activities. This would impact thousands of visitors every summer that visit the project area to camp in the desirable summer temperatures. Should a wildfire result in large, long-term closures for safety or resource protection purposes, activities such as camping, hunting, and other recreational uses would be lost or severely degraded during both short-term (one to five years) and long-term (five years or more) timeframes.

Recreation Special Uses

Although the no action alternative would not produce any effects from vegetation management or prescribed burning on recreation special use activities, the risk of uncharacteristic wildfire would not be reduced. Uncharacteristic wildfire could impact recreation special uses because sites (recreation events) would likely be unsafe and less appealing for recreation special use activities after such a fire and would likely result in closures (short-term and long-term) depending on severity.

Effects on recreation residences at Diamond Point and Elison Creek, and organization camps including Camp Shadow Pines, Tall Timbers County Park, Arizona Cactus-Pine Girl Scout Camp, and Grand Canyon Council Boy Scout Camp could be extreme. In similar post-wildfire situations, such as after the 2005 Cave Creek Complex Fire on the Tonto National Forest, recreation residences were destroyed by wildfire. After five years of planning, 10 residences were approved for reconstruction and the permits for three residences were either revoked or expired without renewal. Thus, this alternative could result in a long-term decrease in recreational use and opportunity in the project area.

Motor Vehicle Use

Motorized travel management implementation in combination with the no action alternative is expected to have no effects on recreation settings. Present and future activities may result in degradation along heavily used camping corridors, but these would be small and localized.

Recreation Opportunity Spectrum

ROS would remain within land management plan guidelines unless stand-replacement wildfire affects a large portion of the analysis area. Locations and results of unplanned fire ignitions are impossible to predict; however, it is likely that an uncharacteristic wildfire would move conditions away from desired conditions for semi-primitive areas where the evidence of humans is meant to be limited (semi-primitive areas). Uncharacteristic wildfire would likely include several alterations to the forest environment such as cutting of dead roadside hazard trees, increased signage to warn of post-fire dangers, re-constructed roads, or recently constructed dozer or hand-built fire line. All of these would result in short and some long-term effects that would move conditions away from desired conditions identified for semi-primitive areas.

Rock Pit Use and Expansion

If Alternative 1 were to be implemented, there would be rock mining, processing, and hauling activities at the existing and currently operational rock pits.

Alternative 1 could cause a short-term disruption of recreation uses and displacement of recreation users at and near the existing and operational pits during times when aggregate materials are being hauled. This would have the effect of concentrating operations and hauling to a relatively small number of locations, and as a result this alternative would concentrate rock mining, processing, and hauling at currently operating pits or on main hauling routes (when aggregate material is purchased from private sources and hauled onto the forests), increasing the amount of time spent in each location because fewer pits would be used.

Alternative 1 would include dust and noise impacts to nearby trails and recreation areas. Portions of the trails and recreation areas in proximity to these rock pits would likely experience increased dust, noise, and perceptions of human activity when the pits are operational. These effects would be temporary and short term.

In-woods Processing and Storage Sites

Alternative 1 proposes no in-woods processing sites and storage sites and initiates no human-caused changes to the recreation resources within the project area. Alternative 1 would meet the ROS in both Coconino and Tonto National Forests.

Effects Common to Both Action Alternatives

General Effects to Dispersed Recreation, Recreation Special Uses, Developed Recreation Sites, Trails and Motor Vehicle Use

Effects from Alternative 2 would include dust and noise effects on these resources. Portions of the trails and recreation areas that are in proximity to these trails would likely experience increased dust, noise, and perceptions of human activity. However, the maximum values of estimated noise levels for most of the heavy equipment associated with pit development would be in the 40 to 50 dB range for locations 0.5 mile away, or comparable to a running computer or refrigerator.

Effects from Alternative 2 would include disruption of recreation use at and near pits where roadbed materials are being mined and processed, and along haul routes that provide recreational access. Access to desired recreation resources could be altered, requiring recreationists to use another route, or go to another recreation resource where access is not disrupted by hauling activities.

There could also be safety impacts if recreationists are using the same roads as those used for hauling. Potential safety impacts to recreationists would be reduced by placing signs at major intersections on hauling routes during periods of active hauling. The effects at, and in proximity to, active pits would be temporary and short term. With the application of recreation design features, effects on trails and recreation areas would be temporary, short-term, and therefore less than significant.

Recreational Opportunity Spectrum

Most of the rock pits are located in Roaded Natural settings. One rock pit is located in the Roaded Modified and two rock pits are located in Semi-Motorized ROS setting. The pits developed in Roaded Natural, Roaded Modified, and Semi-Motorized settings would comply with the setting characteristics. Because the pits are located away from or not in the viewshed of primary (sensitive) travel corridors, these would comply with the setting characteristics.

The pits are similar to a very small mechanical treatment area, which would generally be consistent with natural vegetation patterns. For example, rock pit development would occur at the scale of non-ponderosa pine inclusions such as aspen and meadows that naturally occur in northern Arizona forests. The

development would meet the intent of the management direction in the Apache-Sitgreaves National Forests Land Management Plan.

Developed Sites

Mechanical and prescribed fire treatments could negatively affect developed recreation sites. However, developed recreation sites would not be modified by any alternatives, as design features (Appendix C) have been developed to protect the sites from possible negative effects from proposed treatments in Alternatives 2 and 3.

Recreation Special Use

None of the alternatives would have any effects from vegetation management or prescribed burning on Recreation Special Use activities. All permittees can execute their business as intended by their authorized special use permits.

Eligible Wild and Scenic Rivers

Proposed treatments would diminish the risk of large, high-severity, catastrophic fires that could result in forest closures. This could impact the visitor's trip itineraries but would not change the recreation opportunity spectrum. Short term impacts caused by the sounds and/or smoke of proposed treatments would be mitigated as per the design features, best management practices and mitigations (Appendix C). The recreation Outstandingly Remarkable Value would be protected and possibly enhanced. Wild and scenic river eligibility characteristics (free flow, water quality, and outstanding-remarkable values) are protected.

Rock Pit Use and Expansion

All alternatives would increase the level of noise, dust, and traffic in the project area. All alternatives would cause a temporary loss of access to desired recreation areas when rock pits are being used to process roadbed material and mine. There would also be potential safety issues when recreationists are using roads that are haul routes for roadbed material.

There would be no direct or indirect effects on recreation special use permittees as they could continue their normal operations as directed in their permit. Motor vehicle use should not be affected, as these rock pits would not add any access restrictions or modifications affecting recreationists.

Most rock pits are located in ROS in forested areas making them difficult to view. Under both action alternatives, design features (Appendix C) would help mitigate the impact to recreation from rock pits.

Effects Unique to Each Action Alternative and Differences among Them

Alternative 2 and Alternative 3, which include different amounts of thinning and prescribed burning, would reduce the risk of extensive crown fire and uncharacteristic wildfire. These alternatives would protect the developed campgrounds, lands infrastructure, trails, and dispersed recreation areas within the project area, maintaining open recreation areas and activities for users duringand in the years following the project implementation. Shorter-term impacts would occur to uses during implementation, including the potential impacts from larger processing sites near residences, highways, and dispersed recreation areas.

In the long term, Alternative 2 would support the health and safety of recreationalists and surrounding communities, as well as reduce potential effects on water supplies, utilities, and other infrastructure within and adjacent to the project area.

Trails

Overall, trail users respond negatively and have a decreased return to forested areas that have experienced uncharacteristic wildfire. Trail users would be minimally affected by the proposed treatments in both Alternatives 2 and 3 because design features (Appendix C) are developed to mitigate any issues related to trails. Effects like visitor displacement and possible overcrowding of some areas where visitors choose to go instead of areas closed or disturbed by proposed treatments are difficult to estimate. However, all three alternatives present different possibilities of risks of uncharacteristic wildfires. Alternative 2 has the lowest risk because of its sizeable number of acres treated. Alternative 3 would have lower risk than the no action alternative and higher risks than Alternative 2. The greatest effects on trails would result from uncharacteristic wildfires. This risk can be reduced with proposed treatments. Alternative 1 poses the greatest threat to the trail systems, followed by Alternative 3. Alternative 2 offers the best possible outcome for the current and future use of the trail systems, treating the most acres of forest.

Dispersed Recreation and Motor Vehicle Use

Dispersed recreation and motor vehicle use display the same effects from Alternatives 2 and 3, while. Alternatives 2 and 3 might result in some reduction of recreation opportunities during active forest thinning and prescribed burning, and potentially longer slash treatment duration. Areas may be closed to the public due to hazardous conditions, which would result in forest user displacement and user dissatisfaction. There could also be an increase in crowding in nearby open forest areas.

Alternatives 2 and 3 propose to decommission 200 miles of existing system and unauthorized roads on the Coconino and Apache-Sitgreaves National Forests and 290 miles on the Tonto National Forest. In addition, up to 800 miles of unauthorized roads on all three forests could be decommissioned under these alternatives. The Rim Country Project would adhere to the travel management decisions for the Apache-Sitgreaves, Coconino, and Tonto National Forests. Design features (appendix C) would address any issues related to the construction of temporary roads for haul access, ensuring decommissioning of all temporary roads after treatments are completed. Hence, both alternatives would reduce access or ease of access to recreate in certain areas on the forests. However, decommissioning unauthorized roads could positively affect recreation resources by protecting resources and removing access to motorized recreation where unlawful.

Alternatives 2 and 3 would have similar effects, but would vary proportionally with treatment area size. Minor effects would be mitigated through design features.

Recreation Opportunity Spectrum

Alternatives 2 and 3 might cause temporary effects on recreation users at particular areas during implementation activities, mainly thinning operations and hauling. There would be longer term potential effects of increased traffic and noise near processing site locations. However, because most of the project area is located within Roaded Natural, Semi-Primitive Motorized, and to a lesser amount, Semi-Primitive Non-Motorized ROS settings, these effects would be consistent with recreation opportunity objective settings for the majority of the project area.

Alternative 2 – Modified Proposed Action

Recreation Sites and Uses

Developed Sites

Any vegetation treatments or prescribed burning in developed recreation sites would generally occur in fall, winter, or spring, which are low-use recreational periods. All treatments in recreation sites would be designed to protect and enhance existing vegetative structure, while maintaining the character of the site.

Proposed mechanical treatments and prescribed fire adjacent to developed recreation sites must be reviewed and approved by the district ranger. The district recreation staff may help determine boundaries or no treatment zones around constructed features that need to be protected in campgrounds. Treatments around the perimeter of campgrounds are encouraged. The timing of treatments must be worked out with districts. Treatments would generally avoid summer. Activity slash must be removed within the line-of-sight of developed recreation sites. If campgrounds remain open into fall and winter, information would be provided about upcoming closures and management activities on-site, at Forest Service offices, and on Forest Service websites (see recreation design features in Appendix C – RS014). Firelines would be rehabilitated in the foregrounds (within 300 feet) of developed recreation sites (Appendix C- RS004). In-woods processing sites, landings, temporary roads, and skid trails should be minimized within sensitive viewsheds, such as next to developed recreation sites (Appendix C- RS010).

Facilities at developed sites and campgrounds in the project area would be protected from adverse effects from management activities, and such treatments would protect the developed sites from any short or long-term risk of uncharacteristic wildfire.

Trails

Trail use level is not expected to change. Alternative 2 includes prescribed burning and thinning activities adjacent to the Arizona National Scenic Trail, Highline Recreation Trail, and General Crook National Recreation Trail. Trails within the project area may be temporarily closed during prescribed burning activities but, throughout project implementation, trails and trail infrastructure would be considered and protected, and effects on scenic qualities minimized to the extent practicable. Damage to trails or necessary trail maintenance resulting from prescribed burning or mechanical treatments in the area would be rehabilitated as soon as possible.

In Alternative 2, mechanical thinning activities would avoid national and forest system trails if possible. Coordination with district recreation planners, trails specialists, and local trail stewards, including the Arizona Trail regional national scenic trail administrator, would occur during prescription or burn plan development, layout, marking, thinning, and burning where any treatment would occur on, adjacent to, or near national and system trails. This is to ensure that trails and trail infrastructure are considered and protected and effects on scenic qualities are minimized to the extent practicable. If trails were temporarily closed due to thinning, trails would be returned to pre-treatment conditions (see recreation design features in Appendix C).

Skidding of felled trees would avoid National Forest System trails, if possible. Trail crossing locations, of nationally designated trails would be done sparingly, coordinated with district staff, and rehabilitated after use. Trails would be restored to Forest Service standards and Trail Management Objective prescriptions (pre-project condition) following treatment.

Control lines on National Scenic, Historic and Recreation trails can be used only if the trails are co-located on roads. Heavy machinery on any forest system trail used as a control line would be restricted, unless approved by an authorized Forest Service officer. If these were used for control lines, the district recreation staff and the Arizona Trail regional national scenic trail administrator would help coordinate the implementation. Where new temporary roads intersect existing roads or trails, native materials such as logs, slash, and/or boulders would be placed along the temporary road to line-of-sight or 300 feet.

Road closures, one-way traffic, and area closure restrictions would be implemented as deemed necessary by forest officials for health and safety concerns during any operation. Signs would be placed at major intersections on hauling routes during periods of active hauling. If it is necessary to close forest roads or areas of the forest, notices and signs would be posted at key locations adjacent to and within the project area, such as along major Forest Service roads accessing the area or on kiosks at trailheads, bulletin

boards, electronic sign boards. Closures due to operations would also be posted online and on social media as well as being publicized via news releases. Coordination is required with district recreation planners or trails specialists to ensure well-marked and publicized detour routes for the Arizona Trail, General Crook Trail, Highline Trail, and system trails during operational closures.

Dispersed Recreation

Vegetation treatments, prescribed burning, and fuel treatments, occurring over time and space, would have little effect on the recreating public. Alternative 2 would support the re-integration of low-severity fire as a regulatory process on the landscape. Several cases show low-severity wildland fires yielding virtually no effects on recreational value and in some instances imparting positive social impacts. Both Sanchez et al. (Sanchez, 2016) and Starbuck et al. (2006) show visitations in California and New Mexico increasing under low-severity fire scenarios. The only anticipated effect that Alternative 2 would have on dispersed recreation is when prescribed burning coincides with hunting seasons, especially in the fall of the year, or during brief closures of campsites, roads, or trails.

There may also be temporary area closures while prescribed burns are being implemented. Spring burning would affect fewer people using dispersed campsites. In total, the action alternatives are not expected to considerably affect dispersed recreation within the project area. Treatments would be planned to be staggered throughout the project area in both time and space, so that even during temporary closures from active treatments, there would be many other places to hunt, camp and recreate. Efforts would be taken to limit forest treatment activities within the project area during high-use weekends and holidays, such as Memorial Day, Independence Day, and Labor Day, especially in locations where concentrated use is expected to occur.

Temporary closures from treatments would result in the temporary loss of recreational access or opportunities and could result in decreased satisfaction of nearby recreational sites where there is overcrowding. This is most likely to occur during high-traffic weekends from Memorial Day through Labor Day, which often includes heavy use of dispersed camping sites within the project area. It can also occur during hunting season.

The transportation system proposed for use under Alternative 2 utilizes a combination of existing Forest Service System roads, improved existing non-system roads and new temporary roads. No new permanent roads are proposed. Road use during the project for hauling and prescribed burning would affect dispersed recreational uses such as OHV riding where project activities occur on MVUM open roads. Dispersed camping areas along open roads that are being used for implementation may be affected by noise and dust.

There may be temporary road closures enacted during thinning operations or prescribed burning, but these closures would be short term for burning and mainly on Forest Service administrative use roads. The effects from disturbance and closure would be a minor effect on dispersed recreational uses, because they would be of limited duration and there would be many other open areas to camp and recreate during this time.

Spring restoration and improvements would improve the resilience of these areas and make them more attractive to dispersed recreationists. Water in the Southwest is a rare feature, and people are attracted to it for recreation activities including hiking, picnicking, camping, scenery, wildlife and wildflower viewing.

Recreation Special Uses

The Alternative 2 would reduce the risk of uncharacteristic wildfire in areas with recreation special uses activities. Coordinated efforts would be made with sponsors of recreational special-use events such as

running or mountain biking races, to minimize the effects of such proceedings during Rim Country Project implementation. Appropriate signage would be used to inform the public of thinning or prescribed burning activities. Alternative 2 would allow for continued recreation special use activities at current levels throughout the project area during and beyond the timeframe of project implementation.

Eligible Wild and Scenic River

Proposed treatments would diminish the risk of large, high-severity, catastrophic fires that could result in forest closures. This could impact visitor's trip itineraries but would not change the recreation opportunity spectrum. There are three design features, best management practices and mitigations per Appendix C to protect the eligibility of the possible national designation. The recreation Outstandingly Remarkable Value would be protected and possibly enhanced.

Motor Vehicle Use

There would be log truck and other activity-related traffic on the designated road system, although not all roads would be used as haul routes. Hauling would not occur on all roads at the same time. Recreationists could expect increased noise, dust, and traffic on some haul routes.

There would be short-term disturbance and temporary changes in ROS classes and roadside recreation settings during road improvement activities. Recreation visitors may be inconvenienced and have to wait during some activities, or roads may be temporarily closed causing displacement. Road relocation would result in a safer road to travel on. It would also result in short-term disturbances such as increased bare ground and decreased roadside visual quality in scattered locations. Long-term effects would be improved water quality at stream crossings, and safer and better-maintained roads for forest user enjoyment.

Road decommissioning would occur on approximately 200 miles of existing system roads on the Coconino and Apache-Sitgreaves National Forests and approximately 290 miles of roads on the Tonto National Forest. Up to 800 miles of unauthorized roads on all three forests could be decommissioned under this alternative.

Short-term effects of road decommissioning would include ground disturbance and sedimentation and noise disturbance to recreationists. Short-term effects would last from 3 to 10 years as the project activities rotate across the landscape. There would be a long-term improvement of recreation settings as vegetation is established, soil erosion is minimized, and there is decreased disturbance from motorized vehicles. Once recovered, these former routes are often not apparent to the casual user. Decommissioning 200 miles of roads would improve recreation settings over time and would improve ROS classes, especially in the semi-primitive non-motorized ROS class where all 85 miles of haul routes would be decommissioned.

About 330 miles of temporary roads for haul access would be constructed to support restoration activities. Construction may include tree removal, ground disturbance, and installation of drainage structures, road blading, and other disturbances. Following implementation, the temporary roads would be obliterated using techniques noted for road decommissioning (Forest Service Manual 7712). Temporary road construction would result in short-term disturbance. When possible, there would be relocation and reconstruction of existing open roads adversely affecting water quality and natural resources, or of concern to human safety. This would have long term-positive effects on water quality, natural resources, and human safety.

There may be some increase in illegal motorized vehicle use of these roads until they are decommissioned. Once these roads have been decommissioned, they are usually not apparent to the

casual user. Mitigation measures would be used to close off entrance and exit locations of these roads, as well as the use of design features (see Appendix C).

Recreation Opportunity Spectrum

There may be temporary effects on recreation users at areas during implementation activities, mainly harvesting operations and hauling. There would be longer term potential effects from increased traffic and noise near processing site locations. However, because most of the project area is located within Roaded Natural and a small amount of Rural ROS settings, these effects would be consistent with recreation opportunity objective settings for most of the project area.

Construction of all new temporary roads would be like a primitive, native surface road that would be cleared and opened for short-term use during thinning and hauling operations. The construction and use would be consistent with the Roaded Natural or Semi-Primitive Motorized designations and, after use; the temporary road would be completely rehabilitated and would become naturalized within several years after use. The very slight encumbrance of the Semi-Primitive Non-Motorized area would likely not result in long-term effects to the ability of the area to meet Semi-Primitive Non-Motorized characteristics over the long term.

Mechanical, and prescribed fire, hand thin and prescribed fire and fire only treatments would primarily occur in Roaded Natural (48 percent) and Semi-Primitive Motorized (36 percent) areas, with a lesser amount occurring in Semi-Primitive Non-Motorized (14percent) in the project area. Mechanical treatments would be expected to result in short-term effects (one to two years after treatment) where the sights and sounds of humans are more noticeable on the landscape. However, after a short period of time and subsequent treatments such as prescribed fire, the evidence of treatments would fade and is not expected to affect ROS designations. As a result none of the mechanical treatments would prevent an area from meeting or moving toward ROS classifications over the long term (greater than one year).

Spring restoration and improvements would improve the resilience of these areas and make them more attractive to dispersed recreationists. The proposed improvements may cause short-term changes in the recreation settings but would result in improvements in the setting characteristics and ROS classes over time. In both action alternatives, up to 184 springs would be improved. Mitigations to use native materials or natural-appearing materials appropriate to the ROS setting would result in natural-appearing improvements. The spring improvements would improve and meet ROS classes.

The 647 miles of channel restoration proposed would improve recreation settings over time. Mitigations to use native materials or natural-appearing materials appropriate to the ROS setting and consultation with a landscape architect regarding project design would result in natural-appearing improvements. The channel improvements would improve the settings and meet ROS classes.

Aspen treatments would take longer for recreation settings to be natural appearing in Roaded Natural and semi-primitive settings due to the need to fence or create barriers to ungulate grazing. Aspen groves are popular recreation settings for many users throughout the year, but especially for fall color viewing. The restoration activities would assure that aspen continue as a vital component within the ponderosa pine forest. There would be short to moderate term changes in ROS settings where aspen are treated. Aspen restoration requires that ungulates be kept out of sprouting trees until they are large enough to withstand the browsing pressure. Fencing and jackstraw piling are both proposed methods for keeping the ungulates out.

Up to 200 miles of protective barriers around springs, aspen, native willows, and big-tooth maples, as needed for restoration, would be constructed. This would cause temporary changes in the ROS class setting characteristics because the natural-appearing environment would be somewhat altered. More developed settings would appear altered for a shorter period because human alterations may be visible in these settings. Because the barriers must stay in place for many years, the primitive ROS settings would be altered for at least 20 years or until the trees can survive browsing. When the protective barriers are removed or begin to break up and decompose, treatment areas would meet ROS classes.

Rock Pit Use and Expansion

Portions of the trails and recreation areas that are in proximity to these rock pits would be likely to experience increased dust, noise, and perceptions of human activity. However, the maximum values of estimated noise levels for most of the heavy equipment associated with pit development would be in the 40 to 50 dB range for locations 0.5 mile away or comparable to a running computer or refrigerator.

Disruption of recreation use at and near pits where roadbed materials are being mined and processed, and along haul routes that provide recreational access could occur. Access to desired recreation resources could be altered, requiring recreationists to use another route, or go to another recreation resource where access is not disrupted by hauling activities.

There also could be safety effects if recreationists are using the same roads that are used for hauling. Potential safety effects on recreationists would be reduced by placing signs at major intersections on hauling routes during periods of active hauling. The effects at, and in proximity to, active pits would be temporary and short-term. Based on the application of recreation related design features, effects on the trails and recreation areas would be temporary, short-term, and therefore less than significant.

Most of the rock pits are located in Roaded Natural settings. One rock pit is located in the Roaded Modified and two rock pits are located in Semi-Motorized ROS setting. The pits developed in Roaded Natural, Roaded Modified and Semi-Motorized settings would comply with the setting characteristics. Because the pits are located away from or not in the viewshed of primary (sensitive) travel corridors, these would comply with the setting characteristics.

In-Woods Processing and Storage Sites

The processing sites may be used as part of 4FRI Rim Country Project implementation. Following completion of use of processing sites and removal of all equipment and materials, site rehabilitation would have to be accomplished, including but not necessarily limited to removal of aggregate, restoration of pre-disturbance site grades, de-compaction of soil for seedbed preparation, and seeding and mulching of the site with native grasses and forbs. To hasten recovery and help eliminate unauthorized motorized and non-motorized use of skid trails and temporary roads, physical measures would be used such as re-contouring, pulling slash and rocks across the line, placing cull logs perpendicular to the route, and disguising entrances.

Of the proposed 12 processing sites, nine are in Roaded Natural ROS, 3 are in Semi-Primitive Motorized and 1 overlaps Semi-Primitive Motorized and Semi-Primitive Non-Motorized. Development and operation of the processing sites would not conflict with desired conditions for Semi-Primitive Motorized and Roaded Natural designations where there are occasional or regular sights and sounds of human influence. The processing sites could have a broader effect on ROS experience in the immediate area where operations can be heard and seen (0.14 to 2.4 miles around a site), but these would not be inconsistent with the Roaded Natural, Semi-Primitive Motorized, or Semi-Primitive Non-Motorized settings. During use of a processing site, the appearance of the forest

would change because most of any existing trees would be cleared on the site. The locations of the processing sites have been selected to limit the need for tree removal and would be designed so that there is visual screening from the main roads, thereby moderating the visual effects of the sites. In addition, during use there would be increased traffic and interaction between log trucks, chip vans, or other vehicles and equipment in use at the site and public use of the forest. The time of effects to ROS from the processing sites would be variable: smaller processing sites would be used over a shorter time (5 to 10 years) than the larger sites that could be in use from 10 to 20 years. After use, the areas would be completely rehabilitated and trees and vegetation would slowly be reestablished.

All of the sites are located 100 to 300 feet from forest system roads to provide for visual screening. Effects on dispersed recreational use from the processing sites includes noise disturbance from equipment and increased truck traffic entering and leaving the site. These effects would range from temporary, over a few months when the mechanical operation are active, to several years for the large sites (10 to 21 acres) that would service as focal points for in-woods processing of logs, etc.

There could be longer-term use of some processing site locations under the larger 4FRI implementation effort. Therefore, the authorization of these sites may combine with the effects from other projects occurring within or adjacent to the Rim Country project area, or in the 4FRI footprint, resulting in longer term effects from their use. Those effects would be related to noise and traffic near some processing sites.

Alternative 3 – Focused Alternative

Recreation Sites and Uses

The effects from Alternative 3 would be the same as those described for Alternative 2 with the exception of the number of acres restored. The same design features would be applied for both Alternative 2 and Alternative 3. Alternative 3 would have less potential to reduce the risk of large-scale, high-severity fires in the project area. It would have less of a positive effect than Alternative 2 on protecting and maintaining high quality recreation settings over time because fewer acres would be treated.

Developed Sites

Any vegetation treatments or prescribed burning in developed recreation sites would follow the same design features as in Alternative 2. Consequently, the effects from management activities on developed sites would protect the developed sites from any short or long-term risk of uncharacteristic wildfire similarly to Alternative 2. However, facilities at developed sites and campgrounds in the project area would be less protected from adverse short- and long-term effects from the risk of uncharacteristic wildfire because of the fewer area treated.

The effects explained in Alternative 2 would be the same for the following areas: dispersed recreation, trails, and recreation special use

Motor Vehicle Use

Approximately170 miles of temporary roads for haul access would be constructed to support restoration activities as compared to 330 miles in Alternative 2. As indicated in Alternative 2, following implementation, the temporary roads would be decommissioned using techniques noted for road decommissioning. Temporary road construction would result in short-term disturbance. When possible, there would be relocation and reconstruction of existing open roads adversely affecting water quality and natural resources, or of concern to human safety. This would have long term-positive effects on water quality, natural resources, and human safety. The short-term disturbance would be less than Alternative 2 because there would be 50 percent less temporary roads built in this alternative. Additionally, there would

be less increase in illegal motorized vehicle use of these roads until they are decommissioned. Once these roads have been decommissioned, they are usually not apparent to the casual user.

Eligible Wild and Scenic River

Proposed treatments would diminish the risk of large, high-severity, catastrophic fires that could result in forest closures. This could impact the visitor's trip itineraries but would not change the recreation opportunity spectrum. Short term impacts caused by the sounds and/or smoke of proposed treatments would be mitigated as per the design features, best management practices and mitigations (Appendix C). The recreation Outstandingly Remarkable Value would be protected and possibly enhanced.

Recreation Opportunity Spectrum

Alternative 3 provides for the long-term protection of recreational settings and facilities on 483,160 acres where mechanical thinning and burning would occur, by improving stand conditions and reducing fuel loading, and would lower the risk of high-severity wildfire. Maintaining healthy, green forests and reducing the risk of large-scale, high-severity fires in the project area would have a positive effect on protecting and maintaining high quality recreation settings into the future. Effects from Alternative 3 would be similar to those from Alternative 2 although on an area almost half the size.

Mechanical treatments would primarily occur in Roaded Natural (50 percent) and Semi-Primitive Motorized (35 percent) areas, with a lesser amount occurring in Semi-Primitive Non-Motorized (13 percent). Mechanical treatments are expected to result in short-term effects (one to two years after treatment) where the sights and sounds of humans are more noticeable on the landscape. However, after a short period of time and subsequent treatments such as prescribed fire, the evidence of treatments would fade and would not be expected to affect ROS designations. As a result, none of the mechanical treatments would prevent an area from meeting or moving toward ROS classifications over the long term (more than one year).

Use of In-woods Processing and Storage Sites

Effects on recreation resources would be of the same type as described for Alternative 2, as all proposed in-woods processing sites could potentially be utilized.

Rock Pit Use and Expansion

Effects on recreation resources would be of the same type as described for Alternative 2, as all proposed in-woods processing sites could potentially be utilized.

Cumulative Effects

The cumulative effects analysis area is the Rim Country project area. The timeline for analysis is 20 years because most long-term effects of the alternatives are assessed out to a 20 year timeframe (with the exception of large-scale high-severity wildfire, which is more difficult to project).

The public experiences the cumulative effects of past management activities as the existing conditions.

Alternative 1 – No Action

Given an increasing likelihood of wildfire and a greater likelihood of high-severity wildfire throughout the southwest under predicted climate change scenarios, this alternative would result in a cumulative increase of these effects of risk to permitted infrastructure, limited recreational access, and loss of recreational opportunities and access in project area and surrounding areas. This alternative would also cumulatively combine with the increasing risk of high-severity fire from climate change and result in an elevated risk to lands and events managed under short-term or long-term special use permits.

Uncharacteristic wildfire could impact recreation because sites (recreation events) would likely be unsafe and less appealing for recreation special use activities after such a fire and would likely result in closures (short-term and long-term) depending on severity. Such a fire would also have severe impacts to permitted lands and could destroy infrastructure, limit access to private lands, and degrade water quality in the Blue Ridge Reservoir and other waters such as the eligible Wild and Scenic Rivers.

Increasing population growth is also expected to drive increasing recreational demand, which would further result in decreasing recreational access and opportunity. By 2020, the Coconino National Forest is expected to experience an addition 338,000 national forest visits per year compared to current use (English et al. 2014). Closures resulting from wildfires within or near the project area would combine to further reduce the available supply of recreation opportunities and access compared to demand, and would result in fewer visits to the national forests in some cases, increased crowding, and degradation of user experiences in surrounding areas that forest users travel to as a substitute recreational experience.

Rock Pit Use and Expansion

This analysis includes the potential cumulative effects to recreation during the 20-year implementation of this project. Numerous other projects would require the use of the same roads that are used to access recreational resources on the three national forests. Other restoration projects would still result in a cumulative increase in hauling by heavy machinery on main forest travel corridors and concentrated hauling for periods of several weeks in project areas.

The cumulative effects would be an increase in potential safety hazards such as dust and truck traffic to motorized recreation users, especially during duplicate hauling periods (which includes hauling associated with road maintenance and hauling associated with tree and slash removal). However, this cumulative effect is considered less than significant because of the long period and large area for implementation of the future foreseeable actions. If any activity from a particular project in combination with actions associated with existing rock pit activity were to affect recreational access, recreationists could find other areas on the three national forests with similar recreation opportunities.

The largest cumulative effect from this alternative would be the cumulative effect of hauling, causing traffic, noise, and dust in areas near recreation sites or on the main road system being used to access recreation opportunities. Under Alternative 1, there would still be cumulative effects on the recreational experience for several thousand forest visitors over the next two decades.

Alternative 2– Modified Proposed Action

Alternative 2 would restore the ponderosa pine forest health and sustainability on 991,060 acres; this combined with other restoration activities would decrease the risk of high-severity wildfire or large insect outbreaks. Increasing numbers of recreation users and demand for ponderosa pine recreation settings would continue to strain the agency's capacity and, in some areas of concentrated use, the resource capacity. With increasing demand for ponderosa pine forest settings, the large-scale improvements to forest health and sustainability of this project, as well as similar vegetation and burning projects such as Upper Beaver Creek Forest Restoration, and Rim Lakes Forest Restoration, would be expected to result in cumulative retention of or improvement in the quality of recreation settings and an increase in the ability of the Apache-Sitgreaves, Coconino, and Tonto National Forests to meet recreation demands over the long term.

The current and planned vegetation management treatments and burning projects on all three forests, as well as opportunities for prescribed fire and fires managed for resource benefit, would cumulatively result

in improvements in forest health and sustainability in the ponderosa pine that are large and widespread. In the event of a wildfire or insect infestation, the restored forest would likely experience more typical low-severity fire and smaller scale insect infestation. The cumulative effects on desired recreation settings and ROS class characteristics forest users seek would be to maintain and improve them.

Alternative 2 is expected to have mostly positive effects on recreation settings due to the decommissioning of user-created routes and some existing forest roads. The quality of some recreation settings in ROS classes were declining due to unconfined motorized use. Present and future activities may result in additional degradation along camping corridors, but these would be short term and localized. There would be positive cumulative effects and an overall improvement in ROS classes because of these activities.

No new road construction is proposed now or in the future in cumulative effects projects. Motorized trails projects include new construction, road to trail conversion, and route decommissioning in appropriate ROS classes. This would have positive cumulative effects in more primitive ROS classes when decommissioned routes naturalize, and expected characteristics are re-established.

Desired recreation setting characteristics such as large, mature trees, healthy understory, and diversity of tree age classes, sizes, and species are also at high risk from the effects of climate change. While drought cycles are common in the Southwest, increasing temperatures and decreases in precipitation, in combination with overstocked forest conditions and high fuel loads are predicted to result in an increase in high-severity wildfires (Westerling 2006) (Marlon 2012)(CLIMAS 2011). Unmanaged forests have shown increases in tree stress and mortality as a result of global warming, and old, mature trees are especially vulnerable (Ritchie et al. 2008; Van Mantgem 2009; Williams 2010). When added to other restoration projects in the cumulative effects area alternative 2 may cumulatively result in improved forest structure, composition and diversity, more resilient forest conditions, decreased tree stress, and the potential for decreased mortality creating a more pleasant experience for visitors.

Over time, effects would lessen and the crown fire risk predicted for the project area as a result of climate change would decrease. Recreation structures and environment would be made more resilient to wildfire effects by mechanical thinning and prescribed fire treatments. Because direct or indirect effects resulting from project activities would be mitigated by project design features, there would be no cumulative effects on trails, recreation sites, other structures related to recreation, and recreationists' experience.

Ongoing or planned projects of a similar nature to Rim Country within the project boundary include the Cragin Watershed Protection Project (64,430 acres), Upper Beaver (49,210 acres), Timber Mesa Vernon (41,162 acres), Upper Rocky Arroyo (33,436 acres), Larson (30,041 acres), Rim Lakes (33,770 acres) and Clint Wells (17,741 acres). These thinning and burning projects would have similar effects on recreation as Rim Country and resource impacts would be mitigated similarly. The Rim Country Project, in combination with ongoing and future projects, would not result in any detrimental cumulative effects to recreation.

Rock Pit Use and Expansion

The cumulative effects would be similar to those under Alternative 1, which include the effects of hauling, and causing traffic, noise, and dust in areas near recreation sites or on the main road system being used to access recreation opportunities. However, because more rock pits would be available for use, this would spread the effects to more areas while lessening the effects in areas where rock pits would

be more intensively used without the addition of the new rock pits. The cumulative effects would be less for Alternative 3 because the treatment area is half the size of Alternative 2.

Alternative 3– Focused Alternative

Alternative 3 would have similar minor, short-term, and temporary negative direct and indirect effects on recreation sites and uses as Alternative 2. As noted, less area inside the project boundary would be affected by treatments. Consequently, the predicted crown fire risk because of climate change, would mean more area in the project area than in Alternative 2. This would heighten the danger of disastrous consequence to recreation structures, sites, and recreation settings.

Rock Pit Use and Expansion

The cumulative effects would be similar to those under Alternative 2. The cumulative effects would be less for Alternative 3 because the treatment area is half the size of Alternative 2.

Scenery

A summary of the scenery report is presented here. The specialist report (Fargo 2021) is incorporated by reference. This analysis for the Rim Country Project is consistent with scenery-related Apache-Sitgreaves, Coconino, and Tonto Land Management Plan direction, Forest Service policies, and applicable elements of Forest Service Scenery Management Systems. The potential effects of the 4FRI Rim Country Project on the scenery resource were not raised as an issue by the public.

Affected Environment

The Rim Country Project area is important to many for its unique scenic qualities. These scenic qualities are admired from the panoramic views of the Mogollon Rim, four national trails, and the many developed recreation sites and scenic roads that wind through the project area. Due to the high concentration of visitors to the project area, the scenic resources of this area are critical to their experiences and perceptions.

The Apache-Sitgreaves, Coconino, and Tonto National Forests' natural, cultural, and historic resources provide diverse outdoor recreation opportunities that connect people with nature in a variety of settings. Forest users can hike, bike, drive motorized vehicles, camp, fish, view wildlife and scenery, and explore historic and prehistoric places. They enjoy opportunities for year-round recreation activities from birding and wildflower observing in the spring to hiking in summer months, fall color viewing and hunting, and cross country skiing in the winter. See the Recreation Report for more detail on developed recreation sites, the Recreation Opportunity Spectrum classifications, and other recreation information specific to the Rim Country Project area.

In all three forests in the project area, the existing condition of scenic resources is a result of implementing the land management plans. The management of multiple resources has, to varying degrees, altered the natural landscape character. The most obvious effects on scenic resources within the project area are from vegetation and landform alterations. Resource management activities which have altered scenic resources include vegetation management, mineral extraction, utility corridors, roads and trails, development of recreation sites such as campgrounds and picnic grounds, improvements associated with special use permitted sites, livestock grazing, and fire management (suppression and prescribed burning).

The three Rim Country Project forests have developed a recreation niche setting to provide general context for the importance of inherent scenic qualities that contribute to the landscape character. These

qualities include aesthetic, social, and biophysical features specific to the Rim Country Project. The importance of scenic assets for recreation is described in greater detail, with supporting recreation niche maps in the scenic resource report.

Scenic Character Description

The project area is viewed at foreground, middleground, and background distances from sensitive viewsheds as seen from roadways, trails, and recreation sites located inside and around the project boundary. These areas and routes, outlined in the scenic resource report, receive high use and the users have high concern for scenery. Figure 35 defines the landscape distance zones utilized in the analysis. (USDA Forest Service 2000).

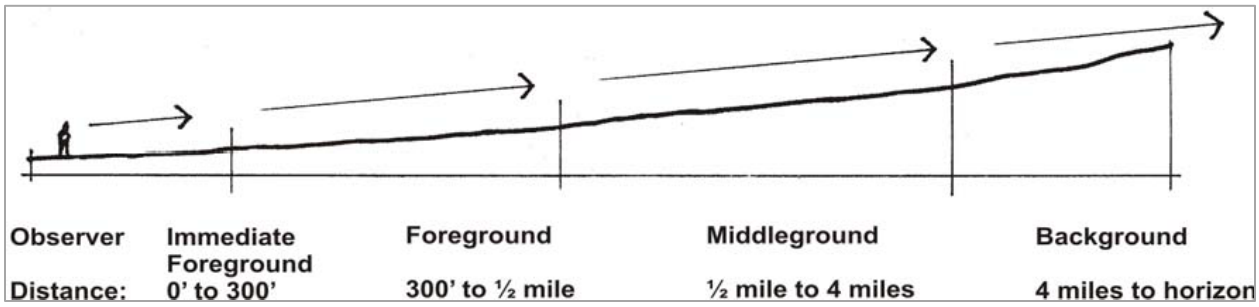


Figure 35. Landscape distance zones

The forested landscapes in the Rim Country Project area are highly departed from desired conditions, lacking desired species composition, spatial arrangement, and structure, and are very dense as measured by basal area, trees per acre, and stand density index. Some of these areas are at high risk for disturbance from undesirable fire behavior, insects and disease, and climate change.

The exclusion of fire has resulted in high canopy cover and high tree density. Consequently, understory vegetation which includes aspen, oak, and other species of shrubs, grasses, and forbs is less diverse and more sparse. In the meadows and grasslands of the Rim Country project area, covering approximately 21,000 acres, conifers and junipers have encroached into these once open grassland habitats, decreasing the size and function of landscapes that were historically grasslands.

Special Areas and Designations

The following special areas and designations exist within the project area.

National Trails

There are 728 miles of trails identified in the project area including four national trails (Figure 36). These trails offer unique recreational opportunities and an opportunity to experience the scenic quality of the project area. The following national trails are located within the project area:

- The General Crook National Recreation Trail is a 138-mile-long historic route. Portions of the trail are located on the Coconino and Apache-Sitgreaves National Forests. The trail follows the Mogollon Rim, one of the more striking geologic features in Arizona, offering spectacular views of the state's central mountains and desert. Approximately 95 miles of this trail are located in the project area.
- The Arizona National Scenic Trail is a continuous, more than 800-mile diverse and scenic trail across Arizona from Mexico to Utah that crosses through the Coconino and Tonto National

Forests. It links deserts, mountains, canyons, communities, and people. Approximately 70 miles of this trail are located in the project area. Approximately 30 miles of its segments overlap with other trails in the project area.

- The Blue Ridge National Recreation Trail is a 9.4-mile loop trail located on the Apache-Sitgreaves National Forests that follows Billy Creek and winds its way through ponderosa pine forest to the top of Blue Ridge Mountain. The entire trail is within the project area.
- The Highline National Recreation Trail offers beautiful vistas of rim canyons, brushy hills, distant mountains, unique rock formations, and wonderful stands of ponderosa pine. The Highline Trail runs essentially east to west below the Mogollon Rim and roughly following it. Approximately 44 miles of this trail are located in the project area.

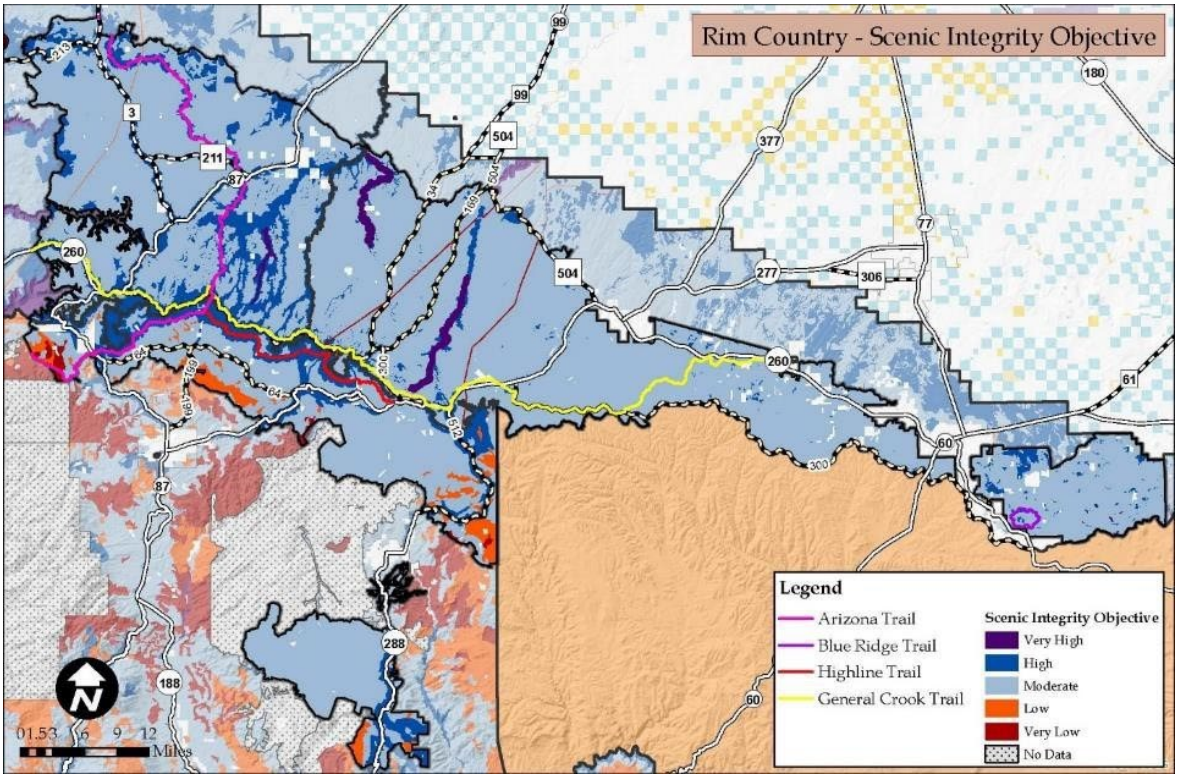


Figure 36. National trails in the Rim Country Project area

Wild and Scenic Rivers

There are seven segments of eligible wild and scenic rivers on the Apache-Sitgreaves and Coconino National Forests that contribute to the scenic quality of the project area. Each system has a buffer of one-quarter mile where a High scenic integrity objective must be maintained per the land management plans. Five eligible wild and scenic rivers occur on the Tonto National Forest and were identified in a 1993 eligibility report covering all the national forests in Arizona (USDA Forest Service 1993). As part of its ongoing Land Management Plan revision process, the Tonto National Forest is completing a wild and scenic river eligibility study that will replace the 1993 study (USDA Forest Service 2017). For analysis purposes and to be consistent with the Land Management Plan revision, the Rim Country FEIS includes the eligible rivers listed in the most current eligibility study based on comments received from the 2017

Tonto National Forest Draft Wild and Scenic Rivers Eligibility Study. Figure 37 displays the locations of the eligible wild and scenic rivers and scenic integrity objectives relative to the project area.

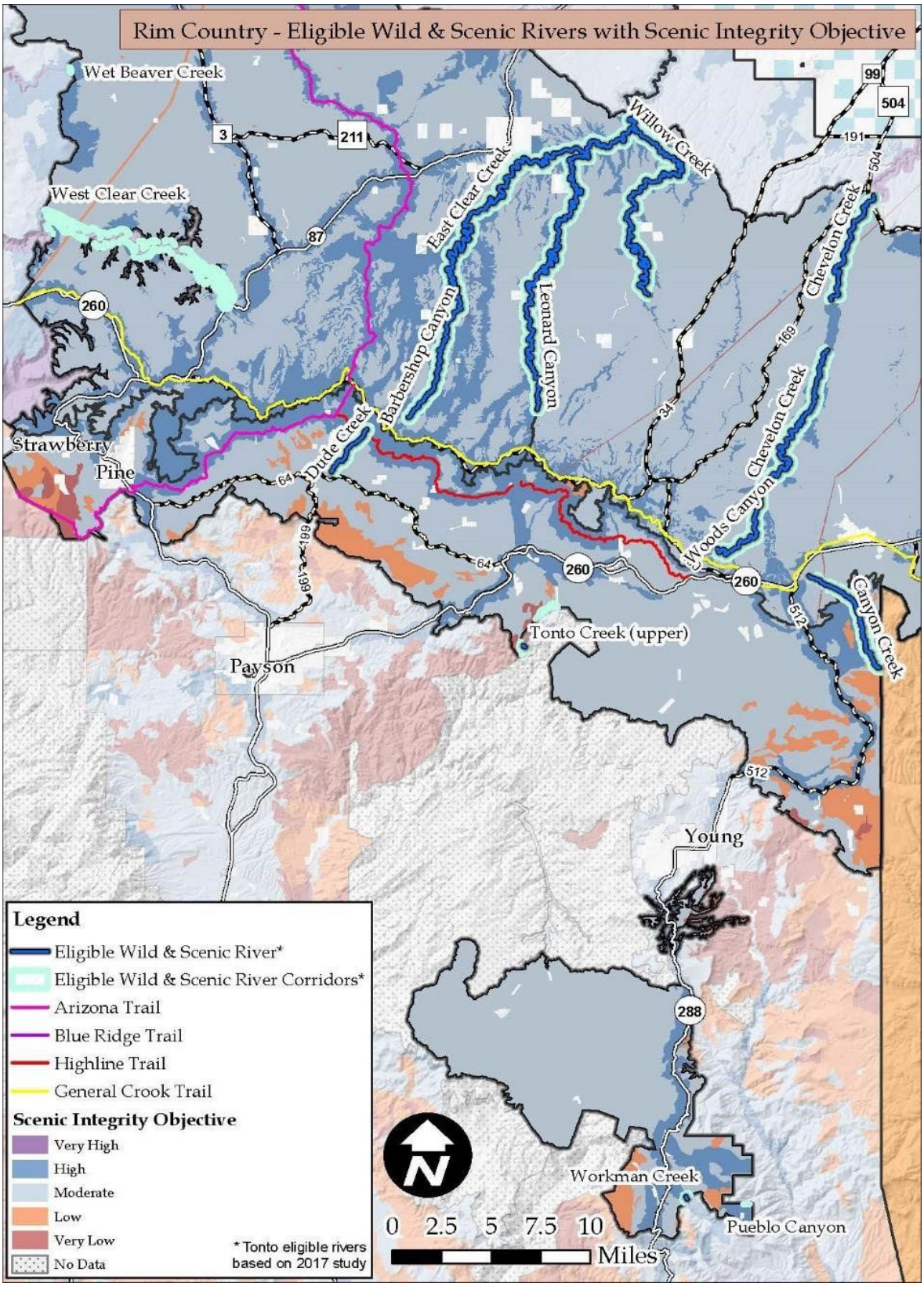


Figure 37. Eligible wild and scenic rivers and scenic integrity objectives

Concern Level 1 and 2 Travelways

Landscape visibility describes the portions of landscapes visible from travelways and use areas important to constituents for their scenic quality, aesthetic values, and landscape merits. Travelways and use areas have identified sensitivity levels for viewing scenery. Concern Level 1, the highest concern for scenery, is given to travelways or use areas that often lead to residential areas, resorts, and recreation areas surrounded by distinctive features and attract a higher percentage of users having high concern for scenic quality, thus increasing the importance of those travelways for viewing natural-appearing scenery (Forest Service 2000). These areas most often have a High scenic integrity objective allocated to the foreground distance zone. Highway 87, Roads 3 and 512, and the From the Desert to Tall Pines Scenic Byway (288 and 512) are Concern Level 1 roads. The national trails are all examples of Concern Level 1 trails. Concern Level 2 is assigned to routes and places that are locally important, where people have a moderate to high concern for scenic quality. Forest Road 64 would be considered a Concern Level 2 route. The existing scenic integrity level ranges from Moderate to High along Concern Level 1 and 2 routes. All routes with a high scenic integrity objective adjacent to them would be considered Concern Level 1 routes.

Ecosystem Context

The vegetation is the dominant scenic attribute in the Rim Country Project area. There are substantial opportunities for improvement of the ecological function and for scenery attributes. The existing vegetation density and lack of high frequency, low-severity fires are inconsistent with the desired scenic character and its sustainability.

- Currently, the dense conifer vegetation often obscures views of existing scenic attributes within the forest canopy and understory, and greatly restricts viewing access to potential scenic attributes. Among the potential attributes are large mature trees; diverse species including aspen, evergreen oak, Gambel oak, and grasslands; as well as other understory shrubs, grasses, and forbs.
- Inter-tree spaces (interspaces) and openings have been filled with small and medium sized trees, where if these were opened up, sunlight would reach the forest floor, adding to the scenic quality as well as helping provide for greater understory vegetation composition and abundance.
- Fire has been suppressed for many years and this, in combination with overly dense forests, departs significantly from reference conditions. Currently there is a risk of large-scale, high-severity fire that could result in elimination of the vegetation scenic attributes that are desired. High frequency, low-severity fire helps to recycle nutrients, keep tree densities lower, and keep fuel accumulations lower.
- Seeps, springs, and ephemeral drainages have had conifers encroach and overtop other species, reducing their function over time. When these features are functioning properly, they provide high scenic quality and auditory, tactile, and visual features not found without the presence of water.
- Throughout the forests, unauthorized routes and redundant roads have been created. These detract from the scenic quality of the area by forming unnatural linear features that are uncharacteristic of the landscape. Decommissioning these roads would restore characteristic forest landscape features.

Assumptions and Methodology

Assumptions

- Scenery Management System terminology will be used in the tables, maps, and environmental consequences section of this report to more uniformly describe effects.
- Treatment location, in relation to terrain and elevation and other vegetative screening, can affect the visibility of management activities. Vegetation treatments on steep slopes, when other landforms do not block the view, can dominate the landscape.
- The duration of view or speed of travel through an area (such as, walking or riding in a vehicle) determine how long a viewer has to study and pick out objects, forms, lines, colors, and patterns in the landscape.
- How well treatments transition from treated to untreated areas can also affect how evident a treatment is in all distance zones.
- Proposed activities, although they may have some short-term negative effects on scenery, also may begin to move the landscape toward the desired landscape character. Effects that would move the vegetation toward the desired landscape character are beneficial to scenic resources in the long term. These beneficial effects are often realized over a long period of time but lead to the lasting sustainability of valued scenery attributes. For example, tree thinning may have short-term effects of ground disturbance, stumps, and slash, but in the long term, if properly mitigated for scenery, may provide visual access into the forest and promote large tree growth and a smooth herbaceous ground cover. In the long-term, the removal of some trees, dependent upon scale and intensity of treatment, may be a beneficial effect for scenery.
- Desired landscape character often includes and is linked to preferred visual settings. Gobster (1994) summarizes visually-preferred settings as having four common attributes: large trees, smooth herbaceous ground cover, an open midstory canopy with high visual penetration, and vistas with distant views and high topographic relief.
- Visual access, or how far one can see into a forest, is also a preferred scenic setting (Ryan 2005). The degree of visual access varies throughout the project area, depending on the amount of understory vegetation present in the forest. Younger ponderosa pine forests may have dense vegetation, which allows very little visual access into the forest. In the long term, scenic resources would have higher scenic quality if visual access is achieved or enhanced.

Methodology

This analysis applies current National Forest Scenery Management methodology in conjunction with existing Apache-Sitgreaves, Coconino, and Tonto National Land Management Plan direction. The Tonto National Forest Land and Resource Management Plan is in the process of being revised at the time of this report. Therefore, the revised Tonto National Forest Land and Resource Management Plan data will be analyzed for this report. ArcMap and GIS data layers were used to analyze the proposed activities in regards to recreation use, sensitive travel corridor locations, areas potentially seen from sensitive travel corridors and use areas, and visual quality objectives and scenic integrity objectives assigned to the area. The potential effects on scenic resources from this project were determined based on a site visit to the project area with members of the interdisciplinary team, review of photos of the project area, use and interpretation of GIS data and aerial imagery, and review of research and analysis of similar projects including the first 4FRI EIS (USDA FS 2015) project analysis and scenic resource report. Direct, indirect, and cumulative effects were considered in this analysis.

Scenery Management System

The Scenery Management System places importance on identifying which scenic elements forest constituency most values, and developing management strategies to maintain or improve those elements. The Apache-Sitgreaves and Coconino Land Management Plans currently use the Scenery Management System. The Tonto National Forest will be transitioning from Visual Management System to the Scenery Management System with the land management plan revision. Table 39 provides a crosswalk between visual quality objectives and scenic integrity objectives. For consistency in this analysis, the Scenery Management System terminology will be used in tables, maps, and the environmental consequences section.

Table 39. Crosswalk between visual quality objectives and scenic integrity objectives

Visual Quality Objective	Scenic Integrity Objective	The Forest's Scenic Integrity as people perceive it
Preservation	Very High	*Unaltered* – Valued landscape character "is" intact with only minute, if any, deviations. The existing landscape character and sense of place is expressed at the highest possible level.
Retention	High	*Appears unaltered* – Landscapes where the valued landscape character "appears" intact. Deviations may be present but must repeat the form, line color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident.
Partial Retention	Moderate	*Appears Slightly Altered* – Noticeable deviations must remain visually subordinate to the landscape character being viewed.
Modification	Low	*Appears Moderately Altered* – Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles outside of the landscape being viewed.
Maximum Modification	Very Low	*Appears Highly Altered* – Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes such as size, shape, vegetative type changes or architectural styles within or outside of the landscape being viewed. However, deviations must be shaped and blended with the natural terrain (landforms) so that elements such as roads, and structures do not dominate the composition.

The Scenic Integrity Objectives (SIOs) are used in the Scenery Management System and are described in more detail in the scenic resources report. They range from Very High, meaning the landscape character is unaltered, to Very Low, meaning the landscape character is highly altered. Intermediate levels include High (landscape character appears unaltered), Moderate (landscape character is slightly altered), and Low (landscape character is moderately altered). Scenic integrity objectives can be applied in two ways: (1) to describe a degree of existing scenic integrity or disturbance, or (2) to describe a minimum objective for future integrity.

Figure 38 displays the scenic integrity objectives for the project area (the visual quality objectives for the Tonto National Forest have been converted to SIO). For the Rim Country Project, these scenic integrity objectives represent the long term goals for the restoration activities proposed. The majority of the project area is mapped as Moderate where the landscape character "appears slightly altered." The areas designated as High or Very High are generally located along sensitive scenic areas such as scenic roadways or highly traveled routes, or along eligible Wild and Scenic Rivers. There is also a small amount of Low on the Tonto National Forest.

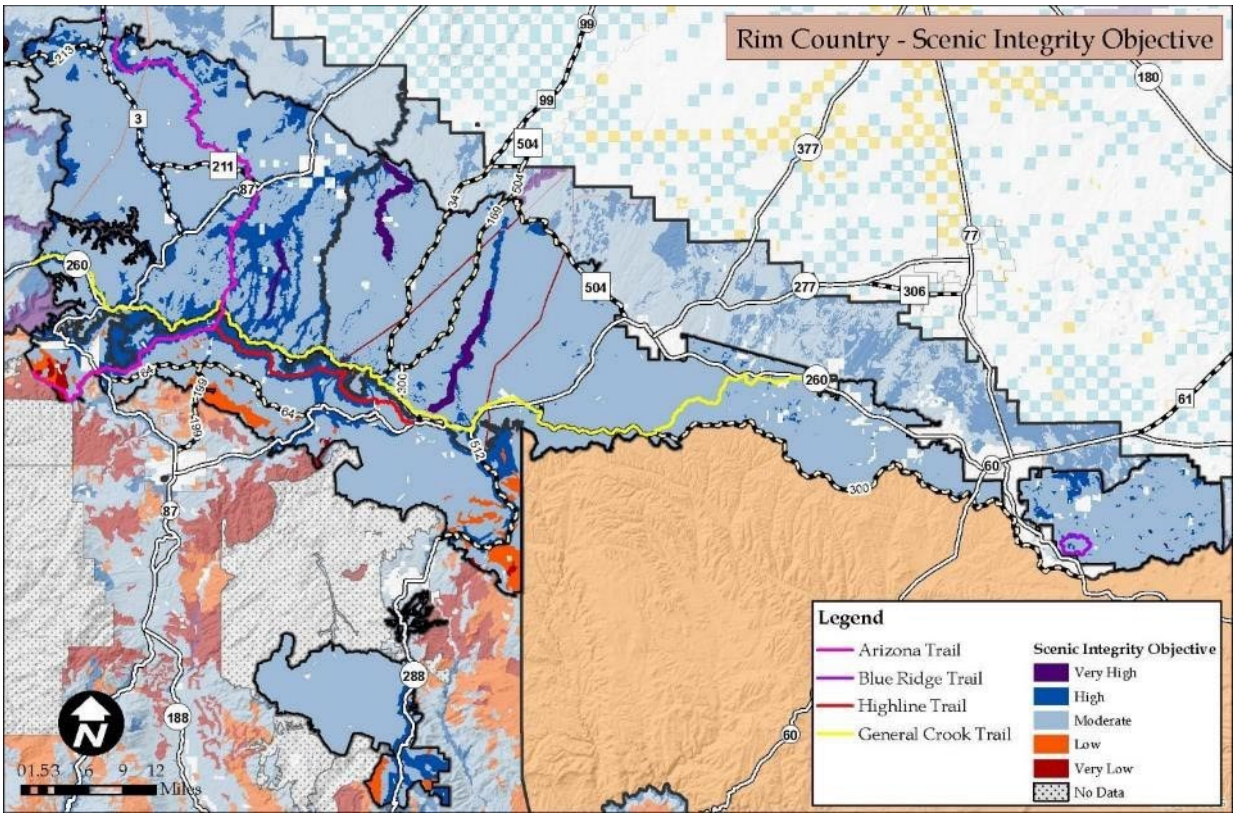


Figure 38. Scenic integrity objectives for the entire project area

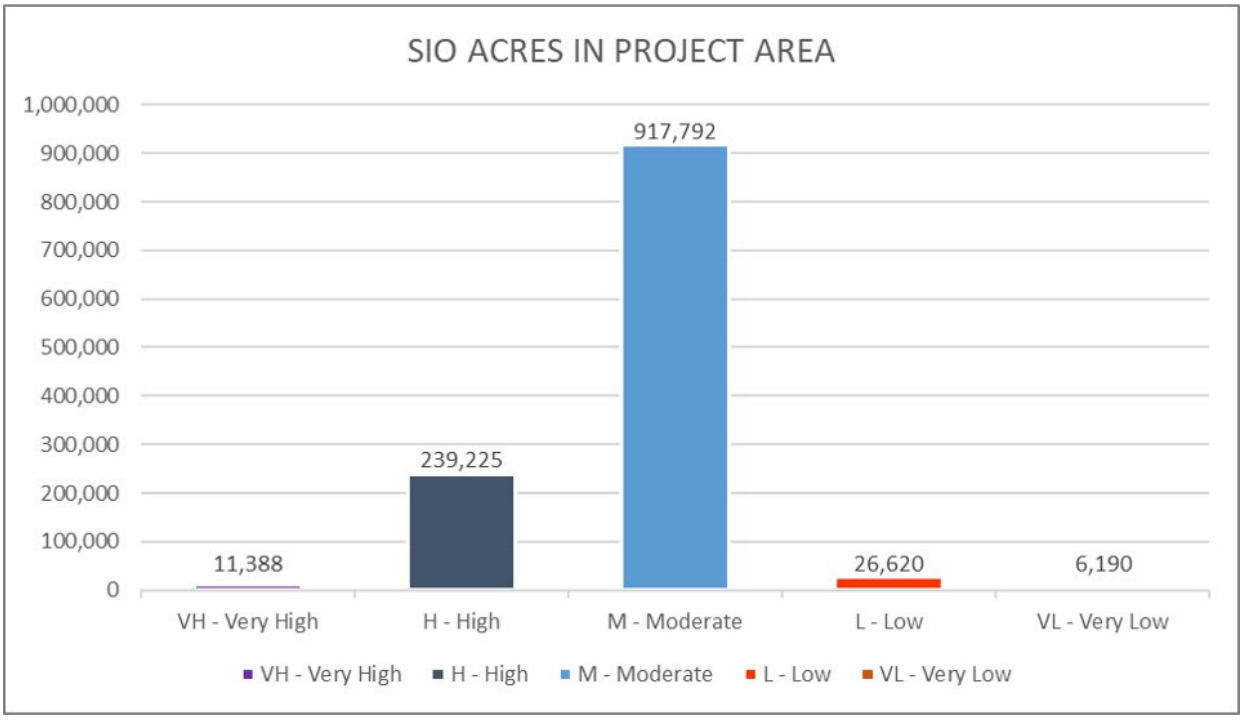


Figure 39. Acres of scenic integrity objective

Spatial and Temporal Context for Effects Analysis

The spatial boundaries for analyzing the direct and indirect effects on scenery are National Forest System lands within the project area boundary because the proposed activities would only occur on National Forest System lands.

Short-term scenic effects from vegetation management are often the most noticeable until the growth of grasses, shrubs, and remaining trees begin to soften the effects of thinning operations. Short-term for this analysis refers to a three to five-year period after all vegetation treatments in an area are complete. Short-term effects are especially noticeable when the viewer has an up-close view of the treatment site, usually in the foreground viewing distance.

Long-term effects, which for this analysis is considered beyond five years, vary by the treatment and the method used.

Past harvest of forested slopes is generally noticeable for 15 to 30 years, depending upon the treatment prescription, soil type, aspect, and vegetative species composition. At the end of this time period, the regrowth of vegetation begins to develop closed canopy characteristics and the area no longer appears altered. The cumulative effects analysis area consists of all lands, including other ownerships inside the 4FRI Rim Country project boundary.

Environmental Consequences

Alternative 1 – No Action

Alternative 1 proposes no additional management activities in the project area and initiates no human caused changes to the scenic resources or visual quality objectives within the project area. In the short term, the scenic integrity would remain unchanged and the project area would continue to be mostly natural-appearing for several years. In the long term, important scenic attributes such as scattered groups of trees of all ages with grassy openings, evidence of frequent low-severity fire, large mature tree character, diverse understory, prominent Gambel oak and grasslands, functioning riparian systems and ephemeral channels that historically contributed to the attractiveness of the area would continue to decline along with scenic integrity.

There is the potential, if dense stands foster beetle outbreaks, more severe mistletoe infections, or other forest health concerns, that tree vitality would decline and there would be a reduction of scenic integrity. If stand-replacing wildfire were to occur, this would also result in the loss of valued scenic character and would continue to be of concern to the Apache-Sitgreaves, Coconino, and Tonto National Forests and residents of the surrounding communities. If a large fire or series of fires occur, views of a fire-altered landscape may begin to dominate. Effects on scenic quality include charred bark on standing trees and down logs, a blackened appearance to the ground plane, and burned understory plants. The visual effects would be reduced within two years, with the regeneration of ground cover plants and the deposition of forest litter over the burned sites. Charred bark, limbs, and other features may be visible for many years. The burned areas would likely regenerate in dense stands of shrubs and seedlings, particularly in moist sites at the bottom of drainages and where root stock and seed sources exist.

These changes would be visible throughout the project area in the foreground of forest roads and trails, and as middle ground and background views from communities within the project area, and developed recreation sites. If a wildfire were to occur near a recreation site, those who use the sites may choose to go elsewhere, if they are sensitive to the appearance of a fire-altered landscape.

Under this alternative there would be no opportunities to enhance and improve scenic resources or achieve the desired conditions, because there would be no thinning, prescribed fire, or other treatments related to restoration. The forests would continue to implement small-scale thinning and prescribed burning, but nothing on the scale of this project. As a result, very little progress would be made toward desired conditions.

Alternative 1 would not meet land management plan desired conditions or land management plan direction. It would not meet long-term scenic integrity objectives because these are dependent upon improving the condition of scenic attributes so that they are more resilient to ecological stressors. In addition, Alternative 1 would continue the current condition outside of the natural range of variability.

Rock Pits: Under Alternative 1, for implementation of other projects and activities, rock pit activities would continue to mine and process roadbed materials from active existing pits either for maintenance of Forest Service roads, temporary road construction, or through permitted use. Direct effects on visually sensitive areas would be views of exposed soil, removed vegetation, and of trucks and other equipment used to mine and process roadbed material. The magnitude of these direct effects would vary depending on the duration of activities at each existing pit, the number of viewers that are able to see the exposed soil, removed vegetation, and equipment, and the distance from which viewers can observe these project-related activities.

Indirect effects would include long–term views of the pits following mining activity and before re-vegetation efforts have been completed.

Mining and processing activities that occur at any of the pits within 0.5 mile of scenic routes or major travelways, or within 0.5 mile of recreation resource areas, could cause adverse, temporary effects. The importance of these effects can be evaluated in terms of their consistency with scenic integrity objectives. Actively mined pits are consistent with the scenic integrity objective of Moderate because the landscape may appear slightly altered and the pits are visually subordinate when viewed from distances of greater than 0.5 mile, which is the breakpoint between the foreground and middle-ground distances.

In-woods Processing Sites: Alternative 1 proposes no in-woods processing and storage sites and initiates no human-caused changes to the scenic quality within the project area. Alternative 1 would meet the adopted High, Moderate, and Low scenic integrity objectives throughout the project area as it does not create any unnaturally appearing elements of form, line, color, or texture.

Effects Common to Both Action Alternatives

The effects on scenery from Alternative 2 would be the same as those from Alternative 3 with the exception of the difference in treatment acres where the effects would occur. Alternative 3 would treat 47 percent less area than Alternative 2, so the following effects can be expected to affect scenic resources in less of the project area with Alternative 3.

Aspen, Native Willows, Big-Tooth Maple, Seep/Spring Protective Barriers

Aspen, native willows, big-tooth maple, ephemeral drainage treatments and spring/seep areas require protective barriers to protect the areas from browsing. Both action alternatives require up to 200 miles of protective barriers. Barrier materials proposed include wire, wood and jackstrawing of trees. All would introduce unnatural linear features into the landscape that would not be natural appearing. Because these are isolated areas scattered around the over 1,240,000-acre project area, introduction of linear features would have minor effects.

Wood fencing materials would have the least effect because they would be in scale, and have texture and color that would look most natural in the seep/spring and aspen settings. Many times wooden fencing is

viewed as an attractive cultural feature. If the fences are maintained, wood fencing would have very low effects and would meet the Scenic Integrity Objective. If they fall into disrepair, this would detract from their appearance, but they would still meet the Scenic Integrity Objective.

Wire fencing materials would be more noticeable than wooden fences. Wire and metal posts can be shiny and their color can contrast with the natural surroundings. Design features would be used to introduce the fewest contrasting elements where wire fencing is used and effort would be made to locate the fencing where it is least noticeable. Wire fencing would have low effects and would meet the Scenic Integrity Objective.

Jackstrawing has been used to a limited extent on the Coconino National Forest in order to protect aspen restoration projects from ungulate browsing. It involves cutting and stacking high numbers of cut trees in an irregular manner to form a wide, tall barrier surrounding the aspen stand. While natural materials would be used to create the jackstraw, the shape and form created at this scale would not normally be found in the characteristic landscape. It would not be completely unnatural however, as it would be similar to large-scale blow down events that may be caused by weather related events. Placement of jackstraw treatment would not meet the requirements for foregrounds of Concern Level 1 roads or the national trails in high Scenic Integrity Objective areas. Even if foreground sites were allowed to drop one Scenic Integrity Objective level, they would still not meet the basic definition of moderate Scenic Integrity Objective that "noticeable deviations must remain visually subordinate to the landscape character being viewed" (Forest Service 2000). Beyond the foreground, jack-straw piling may be suitable, and would be mitigated by carefully locating these barriers. As noted, the short-term effects timeline for jackstrawing around aspen would be longer than for conifers, up to 20 years. Design criteria would be implemented to avoid placement of jackstraw within the foreground of high concern level roads or national trails. As jack-straw barrier begins to deteriorate, trees lose their brown needles, branches break off, and logs lose their bark and grey out, the jack-straw piles compress and become less noticeable. It is anticipated that the aspen would also be large enough to withstand ungulate browsing when the jack-stray piles deteriorate or are burned in follow up prescribed burning activities. These areas would improve over time to the mapped Scenic Integrity Objective.

Biomass Removal Methods

Biomass removal methods for trees, pruned limbs, and shrubs include cable and skyline systems, ground-based machine, helicopter, and hand removal. Units have the option of using one or more of these methods.

Cable Operations: Cable systems are used to transport cut logs to centralized processing areas and typically have extensive, short term effects to scenery. Trees are cut and limbed, and then cables pull the trees to the landing area. Many cut trees are transported along a common corridor which can be up to 1000 feet long and are about 14 feet wide with wider exceptions as needed.

Cable operations would potentially be applied to units throughout the project area. For analysis purposes, an estimate of acres that may be treated using cable operations was developed under the following assumptions.

- Proposed for mechanical treatment under Rim Country
- Acres where cover type is ponderosa pine, ponderosa pine evergreen oak, and dry mixed conifer
- Outside Mexican spotted owl protected activity centers and Severe Disturbance Treatment Areas
- Outside of areas designated as Inventoried Roadless Areas and Eligible Wild and Scenic River
- Stand average slope greater than 30 percent

Under both action alternatives, the majority of potential cable operations would occur on the Tonto National Forest, however it is possible for cable operations to occur in the Apache-Sitgreaves and Coconino National Forests. Fewer total acres potentially treated with cable operations occur under Alternative 3.

Effects typically include scraping and loss of limbs on remaining trees as a result of adjacent trees being felled or transported, creation of linear corridors, slash, creation of large, cleared landings where logs are decked, and equipment can be accommodated (moved and turned).

Ground contact by transported material would occur resulting in minor ground disturbance which would go unnoticed one growing season after project activities are complete. Skyline removal units are located around. Ground contact by the transported material would not occur. Landings associated with these systems would be located as much as possible in areas with existing openings and out of visually sensitive areas.

Skyline and cable corridors have the potential to create straight lines through a normally continuous canopy of forest. Effects of skyline logging removal to scenic resources include the potential to view into the skyline corridor from roads or trails. In general, cable logging tends to be less visually impactful than tractor logging. The one exception with cable logging is if edges of cable corridors are not feathered to blend with features of the natural landscape and/or the corridor is placed inappropriately in a viewshed so as the distinctive line of the corridor is obvious from key viewpoints. In the long-term, density and line and form conditions from cable corridors would diminish in appearance and the viewshed would be improved once these segments are fully revegetated.

Design features are included to minimize the number of cable operations in visually sensitive areas, prohibit cable operations in inventoried roadless areas, to select systems with lateral yarding capabilities, and to utilize existing openings and clearing vegetation to promote meandering edges. Corridor widths would be 14 feet to reduce scenic impacts with 20 feet as the maximum exception and rarely occurring.

Ground Based Removal: Ground based removal methods would occur in units throughout the project area. Landings associated with ground-based removal would be located away from view where possible and in areas with existing openings. Effects to scenic resources from ground- based removal include skid trails which often create lines of exposed soils across the forest floor.

Hand Removal: Hand removal methods would occur in units throughout the project area. Effects to scenery resources by hand removal are minimal and would not be noticeable to the casual observer. Biomass removal by this method would meet scenic integrity objectives.

Landings and In-woods Processing and Storage Sites

Landing sites, where logs are processed for removal, are a primary short term visual effect. These sites are cleared, scraped, and leveled. Slash, log decks, and equipment dominate the immediate foreground view, and may be evident from a foreground view. Ground disturbance occurs from trucks, loaders and skidders moving over the site. After harvest is complete and slash has been removed, the site disturbance may be evident for approximately five years following use of the site. Sometimes landing sites require additional tree clearing. Design features are written specifically to help mitigate the impact of landing sites. There are no in-woods processing sites proposed in Inventoried Roadless Areas.

A total of 12 in-woods processing sites are proposed for consideration in this project. Tasks that would be carried out at processing sites include drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, producing wood cants, scaling and weighing logs, and creating poles from suitably sized logs. Equipment types commonly used at processing sites include circular or

band saws, various sizes and types of front-end loaders, log loaders, and chippers of several types, and may include processors, planers and mechanized cut to length systems, and associated conveyers and log sorting bunks for accumulation and storage of logs.

Eight processing sites were proposed and analyzed for environmental effects in the Cragin Watershed Protection Project (USDA FS 2018b). These sites are carried forward for potential use in implementing the Rim Country Project. An additional 12 processing sites are being analyzed that range in size from 4 to 21 acres. Most processing sites are located in forested areas making them difficult to view even from a foreground distance (0 feet to 0.5 mile).

Potential sites were screened so as to be located outside of meadows, where some of the most productive forest soils are found, and in relatively flat areas. Other sites are located in existing clearings and flat areas. The siting of processing sites in relatively flat areas would minimize the need for extensive site grading. Processing sites were located to provide for a buffer of 100 to 300 feet from forest roads and state highways to provide for visual screening from Concern Level 1 and 2 travelways. Site boundaries are approximate and may be further modified during implementation and layout. There are no in-woods processing sites proposed in IRAs.

Following completion of use of processing sites and removal of all equipment and materials, site rehabilitation would have to be accomplished, including removal of aggregate, restoration of pre-disturbance site grades, de-compaction of soil for seedbed preparation, and seeding and mulching of the site with native grasses and forbs.

Rock Pits

A total of 21 rock pits were identified for use and potential expansion up to 30 percent of their existing footprint. A total of 10 rock pits on the Coconino National Forest would be used to provide fill material. The material from the rock pits may be used for a variety of road maintenance activities, from general maintenance of primary roads to construction or rehabilitation of temporary roads. The proposed use and expansion of rock pits would include hauling of equipment and aggregate materials to and from the pits for use in road maintenance, road construction, and erosion control to aid in implementation of the 4FRI Rim Country Project and other projects in the 4FRI footprint.

Effects common to all alternatives include views of exposed soil at active rock pits locations, and removed vegetation. Active pits would also have processing and mining equipment, and trucks for hauling roadbed material to desired locations. In addition to space for processing equipment, pits requiring processing would also need space to store stockpiles of processed and partially processed materials. The space needed for processing equipment, stockpiling of materials, and loading is included in the footprint of each rock pit site.

Most rock pits are located in Moderate scenic integrity objective in forested areas making them difficult to view even from a foreground distance (0 feet to 0.5 mile). Under both action alternatives, design features would help mitigate the effect on scenery from rock pits.

Trails

People are often more sensitive to changes in the landscape along trails, than along roads and recreation developments. This is because they travel at a slower pace, and are immersed in the environment, and tend to have an expectation for a natural appearing setting. Smaller details, such as stumps and slash, are more likely to be noticed.

As a result, a decrease in the sense of solitude and diminished scenic quality would likely occur while traveling the trails within the project area. Most viewers may perceive diminished scenic quality along area trails until slash is reduced, and the remaining trees have matured. Temporary roads and skid trails may potentially cross the trails. There may be a reduction in the natural appearance of the forest as viewed from the trail. There may be increased encounters with people and machinery until the project is completed. Many of the trails provide access to unmanaged areas; this negatively affects visitor's experience when they anticipated a more natural, unmanaged environment. This would be reduced over time and should be a minimal effect over 10 to 15 years, once ground cover and understory are reestablished and the slash has been reduced.

The Scenic Integrity would likely be reduced in the foreground and middleground because viewers would more likely be aware of details as treatments. A decrease in the sense of solitude could lead to displacement of trail users in the short term (1 to 5 years.) They may opt to visit other areas where they would have the experience of a landscape that appears unmanaged.

National trails, specifically the Arizona, Highline and General Crook Trail would have similar short-term effects on scenery as described above. However, additional design criteria specific to national trails would help protect the scenic integrity, especially in the foreground of the trail, during project implementation. Ultimately, in the long term, the vegetation activities would move the vegetation adjacent to trails toward desired conditions outlined in the Land Management Plan. Below (Table 40, Table 41, and Table 42) is a summary of mechanical, hand thin and prescribed fire treatments along each national trail and quantified by miles affected.

Table 40. National trail miles with treatment under Alternative 2

Trail Name	No Proposed Treatments	Mechanical/Hand Thin & Prescribed Fire	Grand Total
Arizona Trail	22	48	70
Blue Ridge Trail	8	-	8
General Crook Trail	35	60	95
Highline Trail	10	34	44
Grand Total	**76**	**142**	**218**

Table 41. National trail miles with prescribed fire only under Alternative 2

Trail Name	No Proposed Treatments	Prescribed Fire Only	Grand Total
Arizona Trail	17	53	**70**
Blue Ridge Trail	8	-	**8**
General Crook Trail	19	76	**95**
Highline Trail	0	44	**44**
Grand Total	**45**	**174**	**218**

Table 42. National trail miles with treatment, Alternative 3

Trail Name	No Proposed Treatments	Mechanical/Hand Thin and Prescribed Fire	Grand Total
Arizona Trail	44	26	**70**
Blue Ridge Trail	8	-	**8**

Trail Name	No Proposed Treatments	Mechanical/Hand Thin and Prescribed Fire	Grand Total
General Crook Trail	69	26	**95**
Highline Trail	15	29	**44**
Grand Total	**137**	**81**	**218**

Table 43. National trail miles with prescribed fire only under Alternative 3

Trail Name	No Proposed Treatments	Prescribed Fire	Grand Total
Arizona Trail	39	31	**70**
Blue Ridge Trail	8	-	**8**
General Crook Trail	69	26	**95**
Highline Trail	5	39	**44**
Grand Total	**122**	**96**	**218**

Developed Recreation Sites

Mechanical and prescribed fire treatments could negatively affect developed recreation sites. However, developed recreation sites would not be modified by any alternatives as design features have been developed to protect the sites from possible negative effects from proposed treatments in Alternatives 2 and 3.

For campsites, it is desirable to provide and retain privacy and screening, screen other constructed features such as restrooms, provide shade, retain unique character trees, and so on. Per the design criteria for recreation campgrounds, these areas would be treated, but require coordination with the district recreation staff in order to determine places where no treatment would occur in order to protect constructed features. In addition, prioritizing treatments, treatment timing and slash pile locations would be agreed upon. Immediately adjacent to the campgrounds (outside of fenced or otherwise delineated campground boundaries), prescribed burning or mechanical treatments combined with prescribed burning would be appropriate.

For other developed recreation sites, it is appropriate to include burning or mechanical treatments combined with prescribed burning outside of an established boundary that would protect the constructed features at these sites. Per the mitigations for recreation (Appendix C), these boundaries would be established in conjunction with the district recreation staff prior to treatment.

Effects of treatments in developed recreation sites would be similar to those analyzed for mechanical treatments and prescribed burning discussed in this report under Alternatives 2 and 3. There would be short-term reductions in scenic quality as a result of treatments. In the long term, the treatments would help to reduce risks to scenic stability and would improve the overall scenic integrity.

Eligible Wild and Scenic Rivers

The overall objectives for management within the project area are to bring the landscape closer to the desired conditions outlined in the land management plan. Wild and scenic rivers are managed to protect the outstandingly remarkable values for which they were designated in the National Wild and Scenic River Preservation System and to protect their free-flowing nature. Rivers determined to be eligible for the System are also managed to protect the outstandingly remarkable values for which they are eligible. There are currently seven eligible wild and scenic rivers on the Apache-Sitgreaves and Coconino National Forest and an additional five eligible segments on the Tonto National Forest from the 2017 eligibility

study. The tables below include the classifications of each eligible wild and scenic river segment as well as the treatment type and acres affected for each alternative.

Table 44. Eligible wild and scenic river corridors for alternative 2

Eligible Wild & Scenic Rivers by Class	Prescribed Fire Only	Mechanical & Prescribed Fire	Hand Thin & Prescribed Fire	Total Acres
Barbershop Canyon (Wild)	1,503	2,153	-	3,656
Canyon Creek (Recreational)	129	1,785	-	1,914
Chevelon Creek (All Classes)	4,554	2,229	-	6,782
Chevelon Creek (Recreational)	-	*617*	-	*617*
Chevelon Creek (Scenic)	-	*1,611*	-	*1,611*
Chevelon Creek (Wild)	*4,554*	*1*	-	*4,554*
Christopher Creek (Recreational)		890	-	890
East Clear Creek (Scenic)	2,086	3,289	-	5,375
Leonard Canyon (Recreational)	2,701	3,209	3	5,913
Pueblo Canyon (Wild)	9	-	-	9
Tonto Creek (Upper) (Scenic)	-	208	-	208
West Clear Creek (Wild)	352	1,008	-	1,360
Wet Beaver Creek (Wild)	-	8	-	8
Willow Creek (Wild)	4,806	0	-	4,806
Workman Creek (Recreational)	-	82	-	82
Total	**16,140**	**14,860**	**3**	**31,003**

Table 45. Eligible wild and scenic river corridors for alternative 3

Eligible Wild & Scenic Rivers by Class	Prescribed Fire Only	Mechanical & Prescribed Fire	Hand Thin & Prescribed Fire	Total Acres
Barbershop Canyon (Wild)	1,503	2,153	-	3,656
Canyon Creek (Recreational)	129	1,785	-	1,914
Chevelon Creek (All Classes)	3,410	236	-	3,645
Chevelon Creek (Recreational)	-	*66*	-	*66*
Chevelon Creek (Scenic)	-	*169*	-	*169*
Chevelon Creek (Wild)	*3,410*	*1*	-	*3,410*
Christopher Creek (Recreational)	-	890	-	890
East Clear Creek (Scenic)	1,832	2,465	-	4,297
Leonard Canyon (Recreational)	2,701	3,209	3	5,913
Pueblo Canyon (Wild)	-	-	-	-
Tonto Creek (Upper) (Scenic)	-	117	-	117
West Clear Creek (Wild)	297	691	-	987
Wet Beaver Creek (Wild)	-	8	-	8
Willow Creek (Wild)	3,504	0	-	3,504

Eligible Wild & Scenic Rivers by Class	Prescribed Fire Only	Mechanical & Prescribed Fire	Hand Thin & Prescribed Fire	Total Acres
Workman Creek (Recreational)	-	7	-	7
Total	**13,375**	**11,559**	**3**	**24,937**

As noted in the Interagency Wild & Scenic Rivers Coordinating Council Technical Paper (IWSR Coordinating Council 2014), "Timber management activities on Federal lands within WSR corridors must be designed to help achieve land-management objectives consistent with the protection and enhancement of the values that caused the river to be added to the National System. Management direction needed to protect and enhance the rivers values is developed through the river planning process. WSR designation is not likely to significantly affect timber management activities beyond existing measures to protect riparian zones, wetlands, and other resource values as guided by other Federal requirements." In addition, "Timber management activities on Federal lands outside the corridor are managed to protect and enhance the values that caused the river to be designated. Measures needed to protect and enhance the rivers values are developed through the river planning process and include management direction as necessary for lands adjacent to the corridor."

The treatment areas that overlap the proposed WSR boundary have specific design criteria for scenery, recreation and other resource protection. The design features have been included in this document and in Appendix C specifically for the purpose of adjusting proposed treatments in the future as eligibility and suitability are determined. The design features emphasize slash treatment, the treatment of landings, skid trails and stump heights within the corridors and emphasize no tree cutting within eligible wild corridors. Some of the specific design criteria for resource protection to outstandingly remarkable values and to maintain eligibility of wild and scenic rivers are found in the following design features: RS010 (d), RS010 (e), RS010 (f), RS011 (c), RS022, RS023.

As intended with the design features and specifically addressed in feature RS022, any management activities proposed in eligible wild and scenic river corridors in the Rim Country project area would have the purposes of restoring natural geomorphic and ecological processes and the specific outstandingly remarkable values (ORVs) of the river. These activities are proposed to move the vegetation within the corridors toward desired conditions outlined in the land management plan and according to the standards and guidelines for the river corridors. In addition, the proposed activities would help to protect potential scenic values of the eligible wild and scenic river from the effects of wildfire. For both alternatives, there are expected short term effects to scenery associated with mechanical treatment and prescribed fire within the eligible wild and scenic river corridors, and in the foreground looking outside the wild and scenic boundary. The short-term effects to be anticipated from those specific treatment types would be apparent in the landscape and have a low to moderate effect on scenic integrity in the short-term depending on the treatment type. The effects for each treatment type are described in detail later in this report under Alternative 2 Mechanical Treatment and Burning. These effects would be the same within each eligible wild and scenic river corridor depending on the treatment type for each segment as analyzed in the tables. In the long term and with the treatments implemented per the design criteria for eligible wild and scenic rivers, the proposed vegetation treatments would increase diversity for scenery and overall maintain and enhance the scenery outstandingly remarkable value.

Wilderness

There are no treatments proposed in wilderness therefore, there would be no direct effects within wilderness areas. However, at the viewpoint toward or from the wilderness, there would be a change in the texture between the forested area that would be treated outside the wilderness, and the untreated forest within the wilderness. There would be increased areas of ground seen between the remaining trees, giving a coarser appearance to the landscape and slopes. In the case where the wilderness boundary crosses on a slope, it is possible that this boundary may be evident to observers because of the change in the forest texture. Because of the increased dominance, the scenic integrity looking outward from within a wilderness boundary would likely be reduced in the short term. In addition, smoke from prescribed burning would be heaviest during the initial burns and would reduce visibility of the scenic landscape in the short term. The sounds of chainsaws and heavy equipment may potentially be heard from within the wilderness boundary during project implementation. In summary, the sights and sounds of treatment activity outside the wilderness boundary could potentially disrupt the sense of solitude and visitors wilderness experience in the short term within the wilderness areas including Mazatzal and Hellsgate Wilderness.

Large Mature Trees

The proposed actions would meet land management plan requirements for large mature trees across the landscape. Some allocated acres may not meet all old growth characteristics, but would move conditions toward requirements for large trees, downed woody debris, and snags. The more open, groupy character of the conifer forest would help make the trees more visible and as a result, more prominent. Use of the old tree strategy would help recruit and retain large trees. The treated areas would have more of the desired landscape characteristics and would make progress toward meeting Scenic Integrity Objectives.

Proposed Activities for Mexican Spotted Owls

As a result of the treatments proposed under alternatives 2 and 3, stands throughout most of the project area would appear more to have the desired conditions of open, groups of trees of all ages and sizes. In some areas, treatments are modified for Mexican spotted owls. These changes are designed to meet other laws, regulations and policies.

Mexican spotted owl treatments proposed incorporate the need for “Improving habitat structure in addition to managing for fire risk abatement” is consistent with the USFWS Mexican spotted owl recovery plan that focuses on desired conditions and provides for treating PACs to meet restoration and fuels reduction objectives. A key recovery objective is to maintain habitat conditions necessary to provide roosting and nesting habitat (USDI 2012)”. This treatment would result in stands appearing slightly more open and more diverse over time when compared to the existing condition, although the difference may not be noticeable to the casual forest visitor, particularly when driving along the roads. The treatments proposed for Mexican spotted owl would move the habitat toward desired conditions, but scenic attributes in these areas would continue to be at risk from ecological stressors.

Alternative 2 – Modified Proposed Action

Mechanical Treatment and Burning

Approximately 991,060 acres would be mechanically thinned or burned under this alternative. Mechanical treatments include but are not limited to the use of chainsaws or feller-bunchers to cut trees and lop slash, skidders to move material to landings, bulldozers to pile slash, and specialized equipment such as feller-bunchers or track-type hot saws, and tree shears to cut, chop, break, and lop fuel material.

Hand thinning usually has little or no short-term effects on scenery. Trees are cut down, then cut into segments that can be treated. Effects may include slash from limbing and topping trees. Project mitigations require slash to be treated.

Conventional mechanical treatments typically have moderate short-term effects on scenery. During implementation, in most cases whole trees are cut and moved to a "landing" near a haul road. At the landing, the limbs and tops are removed, and the clean logs are decked to be loaded and hauled away. After vegetation has been thinned, the slash is piled using bulldozers. Effects typically include trampling of vegetation where equipment is operating, creation of linear skid trails where vegetation is trampled or completely removed exposing bare soil, creation of linear log landings where vegetation has been removed and bare soil is exposed, and piles of cull logs not suitable for commercial uses. After logs or useable material is removed, slash would be treated as per mitigation measures. This may include bulldozers pushing slash into large piles (10 to 20 foot wide piles, often 10 feet tall), which can trample vegetation and cause bare soil to be exposed, and hand piling. Design criteria would prioritize treatment of slash along high concern level roads (those in High Scenic Integrity Objectives), require trails to be returned to pre-treatment conditions, and cull logs be removed from landings and potentially used to help close off entrances to decommissioned roads.

There would be a low to moderate effect on scenic quality during and immediately following mechanical treatments. In sensitive areas, stumps are typically left no more than 6 inches high and are often cut flush with the ground unless prevented by rocks or other natural features. In other cases, stump heights are left at 8 inches on the uphill side if possible. The presence of skid trails, landings, and piled or scattered slash would also result in a moderate reduction of the scenic quality until harvesting activities are completed and design features are implemented. The effects in these areas would be short term (lasting one to five years after treatment) because skid trails would be rehabilitated and activity-generated slash would be treated or mostly removed to be utilized. The ground disturbance resulting from using machines to pile slash would be noticeable for one to three years after project completion, depending on how quickly the areas revegetate. Scraped trees would heal or scars would become less noticeable over time.

Prescribed burning would likely result in short-term, moderate reduction in scenic quality, but with ground vegetation recovery, can enhance scenic beauty within five years. Where prescribed fire is limited to slash reduction, isolated areas of burned piles would be evident. Once these piles have been scattered there may be some short-term evidence of darkened litter and soil that would be reduced within five years and generally only be noticeable within the immediate foreground. Greater visual effects would occur in areas where prescribed fire is used as a tool to regenerate aspen or reintroduce fire. This includes charred bark of standing trees and down logs, and a blackened appearance to the ground plane and burned understory plants. The visual effects would be reduced within two years, with the regeneration of ground cover plants and the deposition of forest litter over the burned sites. Charred bark, limbs, and other features could be visible for many years.

Smoke from prescribed burning would be heaviest during the initial burns and would reduce visibility of the scenic landscape in the short term. Some residual smoke could be expected to continue in small, localized areas where stumps or roots smolder for up to a few weeks. The residual smoke would have little if any effect on visibility of scenic attributes.

The restoration treatment areas should be recovered and moving toward reference conditions after the first thinning and prescribed burning activities. These would be further improved after follow-up prescribed fire treatments. The restoration treatments would meet the purpose and need of the project and would help move the forest structure, pattern and composition toward reference conditions.

Road Reconstruction and Decommissioning

Approximately 150 miles of existing roads would be reconstructed with Alternative 2. There would be few to no effects from road improvements. Improvements may include, but are not limited to, drainage improvements, tree removal, slight realignments, and addition of surfacing materials. Potential effects include exposure of bare soil, tree stumps, and contrasting color and texture of surfacing materials. These effects are usually short term (one to five years) and become less noticeable as natural vegetation is re-established and the surfacing material begins to be incorporated into the soil horizon. Road relocation would have more noticeable effects on scenery. Effects of the newly constructed roadbed would include newly exposed bare ground, damaged vegetation, tree stumps, root wads, and contrasting color and texture of surfacing. There would also be effects associated with the old roadbed. It would appear newly disturbed as well if associated drainage features such as culverts are pulled, new drainage ditches established, the surface roughened to promote vegetation establishment, and slash, brush, boulders or other devices are used to close off the entrance. There would be a strong contrast between the existing forest floor and the new and old roadbeds that would detract from scenic quality. Design features, best management practices, and mitigation measures would be used during road reconstruction. The old roads would naturalize over time and become less noticeable to the casual observer.

Approximately 330 miles of temporary roads would be constructed for haul access. These would be decommissioned when treatments are finished. The new temporary roads would add new, unnatural linear features to the landscape on a temporary basis. Trees would be removed, soil exposed, and roadbeds constructed including minimal drainage features. This would have moderate effects on the mapped scenic integrity objectives. In High scenic integrity objective, the new temporary road construction would drop these areas one level to Moderate until the roads are decommissioned and begin to naturalize, about five years later. Design features and best management practices would be used to rehabilitate decommissioned roads and this would hasten their recovery. Under Alternative 2, there would be no road alignment or reconstruction within IRAs.

Under this alternative up to 200 miles of system road on the Coconino and Apache-Sitgreaves National Forests could be decommissioned. The Tonto National Forest Travel Management EIS has identified approximately 290 miles of road within the Rim Country project area for decommissioning. In addition to system road decommissioning, up to 800 miles of unauthorized roads on all three forests could be decommissioned under this alternative. Following decommissioning, all roads would be allowed to naturalize. There would be short-term effects (up to five years) as the roads have drainage established, the surface area roughens, are seeded and mulched with pine needles and slash, and boulders and other devices are used to close off entrances to the roads. Design criteria and best management practices would be used to rehabilitate these roads. Once decommissioned, the existing closed roads would naturalize over time and become unnoticeable in the landscape to the casual observer, improving the scenery, landscape character, and resulting in beneficial effects to scenic integrity.

Rock Pits

Due to the relatively small footprint and locations of the proposed rock pits on the landscape, most direct and indirect visual effects would be very limited to where the pit can be seen from forest roads. Out of the proposed 21 pits, there are 8 pits that are located within 0.5 mile of major travelways or trails. Most of the pits that are located next to a major roadway, recreation site, or trail were initially used to provide material to construct these same roadways, recreation site, or trail. Often the rock pit was built very near the road or trail but in an area not visible to provide for a convenient material source without affecting the viewshed.

Mining and processing activities that occur at any of the pits within 0.5 mile of scenic routes or major travelways, or within 0.5 mile of recreation resource areas, could cause adverse, temporary effects. The

importance of these effects can be evaluated in terms of their consistency with scenic integrity objectives. Actively mined pits are consistent with a moderate scenic integrity objective because the landscape may appear slightly altered and the pits are visually subordinate when viewed from distances of greater than 0.5 mile, which is the breakpoint between the foreground and middleground distances. In situations where a proposal does not meet scenic integrity objectives or visual quality objectives, the land management plan allows for "one classification movement downward" (USDA FS 1987, p. 60).

In-Woods Processing Sites

The scenic integrity objectives, adjacent scenic resources, and the visibility of the proposed processing sites were considered from foreground, middleground, and background perspectives. The highest level of detail would likely be perceived from the foreground perspective. However, due to the size and scale of the sites, particularly those of larger acreage, there is the potential for the proposed openings and associated infrastructure to be seen from a distance from sensitive viewing platforms. Thinning around the edges of the processing site boundaries would promote a more naturally appearing landscape when these sites are seen from a distance.

Low interim scenic integrity objectives would be assigned to these locations during implementation. During implementation, the proposed processing sites would likely be noticeable to the casual observer and, depending on the perspective of the viewer, may dominate the view. Visitors would notice the lack of vegetation and the aggregate surface. Built structures such as fencing, sanitation facilities, office trailers, fuel storage containers, or other temporary structures would likely be noticeable to the casual observer. Heavy equipment, and associated conveyers and log sorting bunks for accumulation and storage of logs may be highly visible from sensitive viewing platforms. For safety, most of the equipment would likely be a yellow color to ensure visibility for the workers, which would create a notable contrast for visitors. The concentration of wood and slash for sorting and drying would be evident to visitors to the near vicinity. Design features would ensure that scenic integrity objectives are met post implementation and effects on scenery are minimized during implementation to the extent practicable. Due to the potential for the soils to be heavily compacted form the operations at these sites, recovery post-implementation may take up to 10 years, depending on the duration and extent of usage of the processing site. The scenic integrity objectives would be met after the sites have been reclaimed and restored to a naturally appearing landscape character, likely 10 years post treatment.

Alternative 3 – Focused Alternative

Mechanical Treatment and Prescribed Burning

Alternative 3 treats 47 percent less area than Alternative 2. Approximately 39 percent fewer acres would receive mechanical and prescribed fire restoration treatments, about 26 percent less prescribed fire only. Additionally, the Severe Disturbance Area Treatment area is 78 percent less in Alternative 3 than in Alternative 2. Approximately 528,850 acres would be mechanically thinned or burned with prescribed fire under Alternative 3. For Alternative 3, there would be less prescribed burning activity that would likely result in less short-term, moderate reductions in scenic quality relative to Alternative 2. As a result, there would be fewer visual effects in the project area where prescribed fire is used as a tool to regenerate aspen or reintroduce fire, resulting in fewer areas of reduced visibility of the scenic landscape in the short term. However, Alternative 3 would treat significantly fewer acres of grasslands, savannah, and open canopy cover, resulting in fewer acres of improved understory species abundance and composition. Ultimately, this alternative would have less potential to reduce the risk of large-scale, high-severity fires in the project area. Because high-severity fire is a risk factor for most scenery attributes, the fewer proposed mechanical and prescribed fire treatments in Alternative 3 would result in fewer improvements to scenic quality in the long term.

Road Reconstruction and Decommissioning

Approximately 150 miles of existing roads would be reconstructed with Alternative 3. There would be little to no effects from road improvements. Improvements may include, but are not limited to, drainage improvements, tree removal, slight realignments and addition of surfacing materials. Potential effects would be the same as described under Alternative 2.

Approximately 170 miles of temporary roads would be constructed for haul access. These would be decommissioned when treatments are finished. Although the effects of temporary roads would be the same as in Alternative 2, this alternative proposes nearly 50 percent fewer temporary roads, resulting in fewer unnatural linear features in the landscape on a temporary basis. Similar to Alternative 2, this action would have moderate effects on the mapped scenic integrity objective. In High scenic integrity objective, the new temporary road construction would drop these areas one level to Moderate until the roads are decommissioned and begin to naturalize about five years later. Design criteria and best management practices would be used to rehabilitate decommissioned roads and this would hasten their recovery. Under Alternative 3, there would be no road realignment or reconstruction within Inventoried Roadless Areas.

Under this alternative up to 200 miles of system road on the Coconino and Apache-Sitgreaves National Forests could be decommissioned. The Tonto National Forest Travel Management Plan has identified approximately 290 miles of road within the Rim Country project area for decommissioning. In addition to system road decommissioning, up to 800 miles of unauthorized roads on all three forests may be decommissioned under this alternative. Following decommissioning, all roads would be allowed to naturalize. Effects would be as described for Alternative 2. Design features and best management practices would be used to rehabilitate these roads. Once decommissioned, existing closed roads would naturalize over time and become unnoticeable in the landscape to the casual observer, improving the scenery, landscape character and resulting in beneficial effects to scenic integrity.

Rock Pits

Effects on visually sensitive areas and consistency with scenic integrity objectives would be of the same type as described for Alternatives 1 and 2. As discussed for Alternative 2, these proposed activities would result in some adverse effects on scenic integrity objectives.

In-woods Processing Sites

Effects on visually sensitive areas and consistency with scenic integrity objectives for Alternative 3 would be similar to those for Alternative 2, as all proposed in-woods processing sites could potentially be utilized. As discussed for Alternative 2, proposed activities would result in some adverse effects on scenic integrity objectives.

Cumulative Effects

The cumulative effects analysis area is the Apache-Sitgreaves, Coconino, and Tonto National Forests within the Rim Country project area. The timeline for analysis is 20 to 30 years because most long-term effects of the alternatives are assessed out to a 20-to-30-year timeframe (with the exception of large-scale high-severity wildfire which is more difficult to project). The following is a list of actions relating to scenic attributes, landscape character, and scenic integrity considered in the cumulative effects analysis for this project:

- Past activities that created the current conditions include grazing, the evolving forest management practices related to timber harvest and fire suppression, drought, disease and insect infestations, and dispersed recreational use.

- Present and future activities such as vegetation management, fire and fuels management, utility corridor clearing and new utility corridors, and other management activities (for example, noxious weeds treatments). These activities could occur on private lands as well.

The cumulative effects of past management activities are visible as the existing conditions. In some areas, past vegetation management practices, fire suppression, and over-grazing have resulted in the current overly dense forests, even-aged forest structure, and sparse understory trees, shrubs, grasses, and forbs.

Alternative 1 – No Action

The short-term cumulative effects (1 to 5 years) from the Alternative 1, combined with similar current and future restoration treatments and prescribed burning projects, are expected to be negligible unless additional large-scale, high-severity wildfires occur in the ponderosa pine type in the project area. If wildfires burn large areas, the scenic quality would be decreased and there would be long-term negative changes in scenic character. The scenic attributes that contribute to high scenic integrity, such as an open forest with tree groups of varying ages, sizes and shapes; large, mature trees; and healthy, diverse understory would decline or not be present. The scenic effect of a high-severity wildfire would combine with scenic effects from adjacent land development, utility development and/or maintenance, and effects from dispersed recreation use to result in a cumulative effect so that scenic integrity is greatly diminished in areas burned for up to a decade or more. In some places there would be a chance that climate change could contribute to type changes in parts of the ponderosa pine forest so that these characteristics would be replaced with difference landscape characteristics, which would also cumulatively effect scenic attributes.

In the absence of large, high-severity wildfires, long-term cumulative effects of Alternative 1 and present and future vegetation management activities would be relatively small and localized. In the absence of large-scale treatment, the scale of treatments that are currently accomplished would not result in improvement to scenic integrity. The desired landscape character of an open forest with tree groups of varying sizes, shapes and ages; presence of large, mature trees; and healthy, diverse understory would not be met.

Alternative 2 – Modified Proposed Action

Vegetation management projects would alter the appearance of the landscape where ground-disturbing activities are conducted. Similar to the action alternatives, activities that are very close (300 feet or less) to scenic highways, major travelways, and recreation resources, would have temporary adverse effects on visually sensitive areas. This would increase the chance that people would be exposed to evidence of fire and mechanical thinning activities. Once slash and/or the evidence of fire are reduced, the forest would have a more managed appearance until understory shrubs and trees have provided a more varied appearance, which could be 30 to 40 years.

Individuals who are sensitive to the visual changes of vegetation management and fire-altered landscapes would likely perceive diminished scenic quality. There would be an increased visual presence of roads. When roads are obliterated, the prism would remain for many years. However, once vegetation grows in the road prism, especially trees, it would be less noticeable, and probably only noticed by people walking across or near the roadbed. The length of time for recovery ranges from two or three years, to over 50 years, depending on the effectiveness of the decommissioning at deterring travel by off-highway vehicles.

Cumulative effects on scenery resources in the Rim Country project area are expected to meet the visual quality objectives of the land management plans in the short term. In High scenic integrity objective areas, it is expected that any human activities would not be visually evident. In Moderate scenic integrity objective areas, any deviations present would be expected to be subordinate to the characteristic

landscape. In Low scenic integrity objective areas any deviations present may dominate the characteristic landscape but would utilize naturally established form, line, color, and texture, and appear natural or compatible to the natural surroundings.

Alternative 2, along with the other past, ongoing, and reasonably foreseeable projects and activities, may have cumulative effects on scenery resources. However, these cumulative effects are expected to meet the visual quality objectives of the land management plans in the short term; no long-term effects are anticipated if the scenery project design features are applied.

Alternative 3 – Focused Alternative

The cumulative effects from Alternative 3 would be similar to those from Alternative 2. There would be slightly fewer negative short-term cumulative effects in localized areas (areas with landings, temporary roads, ground-disturbing activities), because this alternative would mechanically treat and burn fewer acres and require fewer temporary roads. However, there would also be slightly fewer positive long-term cumulative effects in terms of, counteracting drought and insect damage likely to occur as a result of climate change, improved stand structure, and understory improvement, because there would be less mechanical treatment and burning to facilitate greater forest resiliency.

Inventoried Roadless Areas

Affected Environment

Inventoried Roadless Areas (IRAs) are a special area designation found within the project boundary. The project area contains 8 inventoried roadless areas totaling 17,290 acres within the forests and districts. An overview map of existing Inventoried Roadless Areas is included in chapter 1 (volume 1 of this EIS). The tables and maps below highlight the location of each IRA within the project boundary, acreage within the project area and associated scenic integrity objective.

The 2001 Roadless Area Conservation Rule (2001 Roadless Rule) prohibits road construction and reconstruction and timber cutting, sale, and removal in inventoried roadless areas on National Forest System lands, with some exceptions (36 CFR 294). Exceptions for timber cutting, sale and removal are allowed provided they are used infrequently, generally of small diameter timber, and if the actions will maintain or improve one or more roadless characteristics. Use of exceptions is approved by a responsible official (36 CFR 294.13(b)(1)-(4)). On November 2, 2021, the Southwestern Region Regional Forester concurred that the activities proposed as part of the Rim Country Project qualify for a Roadless Rule exception under 36 CFR § 294.13 (b)1(ii) - Timber, (Ecosystem); and will protect and maintain the nine roadless area characteristics and approved the project to proceed within the IRAs under this exception (see IRA Specialist Report that is incorporated by reference for the Regional Forester Briefing Paper).

Stands within as well as outside IRAs are far outside the natural range of variation (NRV) in terms of composition, and structure, for the cover types included. Currently, composition lacks species diversity as a result of closed forest canopies inhibiting development of a grass/forb/shrub understory. Forest structure is outside the NRV in terms of basal area and trees per acre. For example, in the ponderosa pine type average basal area is 113 square feet per acre while the desired condition is from 20 to 90 square feet per acre. Also, in the ponderosa pine type, the current number of trees per acre is 807, while the desired condition is less than 250 trees per acre.

Most of these areas have not experienced their normal fire regimes in over 100 years, missing many fire intervals. The proposed action has been designed to modify fire behavior and allow cover types within IRAs to return to their normal fire regimes. Without action within these areas, they would continue to

depart further from the desired condition and put at risk the values at risk within these IRAs as well as the areas around them.

Due to a history of fire suppression and a lack of active management, acres within IRAs are denser than their surrounding areas. Compared to the reference conditions and desired conditions for the project area (20 to 90 square feet of basal area), density in IRAs is extremely high (125 to 200 square feet of basal area), generally exceeding the areas outside for the IRAs. Stands at these densities, and their associated fuel loads, are at higher risk for uncharacteristic fire, increased susceptibility for insects and at a higher risk for drought-related mortality in the face of a changing climate.

Lack of fire and related effects has likely contributed to a compositional shift over time toward less fire resistant and more shade tolerant species like white fir. Increased density of forested cover types has reduced understory plant diversity, causing a dramatic change in understory composition from historically grass-forb-shrub communities to essentially unvegetated forest floor. Forests with altered composition are less resilient to disturbances like uncharacteristic fire, insects and drought. For additional information on vegetation characteristics in the Rim Country project area, consult the silviculture specialist report.

Table 46. Inventoried roadless areas and scenic integrity objectives

Forest	Inventoried Roadless Area	SIO Code	Within Project Area (Acres)
Apache-Sitgreaves	Chevelon Canyon	VH - Very High	3,736
		H - High	1,832
		M - Moderate	1
	Leonard Canyon	VH - Very High	399
		H - High	1,417
		M - Moderate	0
Coconino	Barbershop Canyon	VH - Very High	1,294
		H - High	17
		M - Moderate	0
	East Clear Creek	H - High	1,612
	Jacks Canyon	H - High	1,711
		M - Moderate	6
Tonto	Hellsgate	H - High	338
	Mazatzal	H - High	316
	Sierra Ancha Wilderness Contiguous	VH - Very High	3
		H - High	4,562
		M - Moderate	37
		VL - Very Low	10
Grand Total	-	-	17,290

Table 47. Acreage and percentage of land per inventoried roadless area per recreation opportunity spectrum class

Forest	Inventoried Roadless Area	ROS Code	Within Project Area (Acres)	Outside Project Area (Acres)
Apache-Sitgreaves	Chevelon Canyon	RN	0	
		SPM	1	
		SPNM	5,568	
	Leonard Canyon	RN		0
		SPM	0	0
		SPNM	1,816	1,253
Coconino	Barbershop Canyon	SPNM	1,310	
	East Clear Creek	RN	4	
		SPM	0	
		SPNM	1,608	
	Jacks Canyon	RN		0
		SPM	0	0
		SPNM	1,717	1,139
Tonto	Hellsgate	SPM	266	4,107
		SPNM	72	1,721
	Mazatzal	P		909
		RN		56
		SPM	257	5,233
		SPNM	59	10,416
	Sierra Ancha Wilderness Contiguous	RN	421	102
		SPM	1	1,228
		SPNM	4,192	1,838
Grand Total			**17,291**	**28,001**

Chevelon Canyon IRA

The Chevelon Canyon IRA consists of 5,569 acres on the Apache-Sitgreaves National Forests, the entire IRA is within the project area. The IRA is within the natural landscape management area.

Characteristic 1: Because of its unroaded status, soil and water within the IRA are not impacted by sediment or contaminants associated with road prisms or road use. The Long Tom Canyon–Chevelon Canyon subwatershed has been designated a priority watershed within the USDA's Watershed Condition Framework. Air quality within the project area as a whole is primarily affected by wildfire and prescribed fire occurring outside the project area.

Characteristic 2: This IRA does not supply any municipal drinking water.

Characteristic 3: The portion of Chevelon Creek in the IRA is upstream of Chevelon Lake. It is managed by the state primarily as a blue-ribbon trophy coldwater fishery for brown and rainbow trout. Native fish management is a secondary management objective for the state. The riparian community along the stream consists primarily of box elder, ash, narrowleaf cottonwood, willow, Gambel oak, rose, and wild grape. Small benches or sand and gravel bars are found near the mouths of side canyons and support a variety of grasses, herbaceous cover, and low shrubs. The aquatic community includes sensitive Little Colorado sucker and other native species such as bluehead sucker, desert sucker and speckled dace. The stream

provides habitat for threatened Chiricahua leopard frog and sensitive species such as roundtail chub, California floater and northern leopard frog, but these species are not currently present.

Woods Canyon Creek within the IRA is managed by the state primarily as a coldwater trout fishery for brown and brook trout. Speckled dace and sensitive Little Colorado sucker are present and habitat is available for bluehead sucker though the species is not present.

The IRA is adjacent to the general forest management area and Willow Springs/Horse Trap wildlife quiet area. Rare terrestrial wildlife species that are known to exist, or are likely to exist include Mexican spotted owl. One northern goshawk PFA (Post Fledgling Family Area) has portions of it within one-half mile of this IRA, with several nest stands also within one-half mile of the IRA portion in the Rim Country Project area. One Bald eagle nest is within one-half mile of the IRA, and two adjacent golden eagle active/historic nests are within this IRA. One Peregrine Falcon eyerie with several associated active/historic nests are within this IRA.

Characteristic 4: The threatened Mexican spotted owl and its critical habitat occur in the IRA. Habitat is available for threatened Chiricahua leopard frog, though the species is not known to occur in the IRA.

Characteristic 5: The IRA provides opportunities for activities of a semi-primitive non-motorized type. There are 0.8 miles of trails within the project area of the IRA.

Characteristic 6: The area does not serve any research function as a reference landscape, other than as a general example of an area lacking roads.

Characteristic 7: The primary scenic features are the primitive, steep-walled, and twisting canyons, with cliffs rising as high as 300 feet above deep pools in the stream channels. The vegetation diversity along the stream corridors adds to the scenic quality of the area. The entire IRA is in the project area with SIO classified as high to very high.

Characteristic 8: Many areas across the forest serve traditional cultural and/or sacred purposes. Specific locations associated with this are necessarily sensitive and are not disclosed in public documents. The project has been and would continue to be reviewed by governmental representatives of Native American groups with traditional ties to the project area.

Characteristic 9: Portions of the Chevelon Creek eligible wild and scenic river corridor are within the IRA.

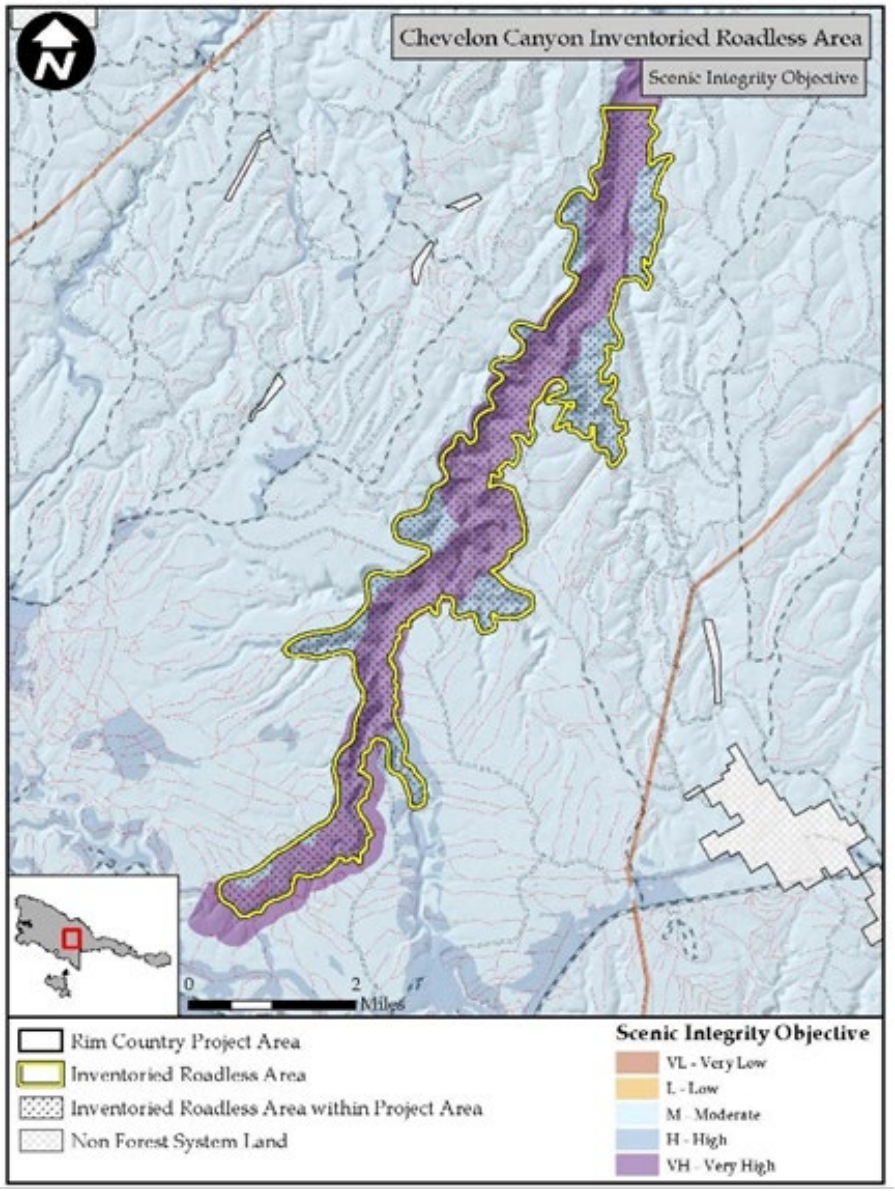


Figure 40. Chevelon Canyon IRA with SIO

Leonard Canyon IRA

The Leonard Canyon IRA consists of 3,069 acres on the Apache-Sitgreaves National Forests, 1,816 acres are within the project area. The IRA is within the natural landscape management area. It is adjacent to the Anderson Mesa and East Clear Creek management areas on the Coconino.

Characteristic 1: Because of its unroaded status, soil and water within the IRA are not impacted by sediment or contaminants associated with road prisms or road use. Air quality within the project area as a whole is primarily affected by wildfire and prescribed fire occurring outside the project area.

Characteristic 2: This IRA does not supply any municipal drinking water.

Characteristic 3: The steep-walled canyons in the IRA create complex environmental conditions with associated vegetation. The cottonwood-willow riparian forest along the stream channels consists primarily of box elder, ash, narrowleaf cottonwood, willow, Gambel oak, rose, and wild grape. Small benches or sand and gravel bars are found near the mouths of side canyons and support a variety of grasses, herbaceous ground cover, and low shrubs. Blumer's dock (*Rumex orthoneurus*) a sensitive plant species occurs in Leonard Canyon and in other canyons within the project area. The aquatic community within the creek and IRA includes threatened Little Colorado spinedace and sensitive Little Colorado sucker. Habitat is available for threatened Chiricahua leopard frog, bluehead sucker, and sensitive northern leopard frog. This area was the original source population for all of the stocking of Little Colorado spinedace in the Clear Creek drainage.

Rare terrestrial wildlife species that are known to exist or are likely to exist include Mexican spotted owl. One northern goshawk PFA is just over one-half mile away from this IRA in the Rim Country project area. No other federally listed or Forest Service sensitive terrestrial species occur in or near this IRA.

Characteristic 4: The threatened Mexican spotted owl and its critical habitat occur in the IRA. The threatened Little Colorado spinedace occurs within the IRA. Habitat is available for threatened Chiricahua leopard frog, though the species is not known to occur in the IRA.

Characteristic 5: The IRA provides opportunities for activities of a semi-primitive non-motorized type. There are 0.2 mile of trails within the project area of the IRA.

Characteristic 6: The area does not serve any research function as a reference landscape, other than as a general example of an area lacking roads.

Characteristic 7: The primary scenic features are primitive, steep-walled, and twisting canyons, with cliffs rising as high as 300 feet above deep pools in the stream channels. The vegetation diversity along the stream corridors adds to the scenic quality of the area. The natural beauty, wildlife, and remoteness of the area are the primary attractions. Scenery is a wild and scenic river ORV in East Clear Creek because of its beauty. A total of 59 percent of the IRA is in the project area with scenic integrity objective classified as high to very high.

Characteristic 8: Many areas across the Forest serve traditional cultural and/or sacred purposes. Specific locations associated with this are necessarily sensitive and are not disclosed in public documents. The Project has been and would continue to be reviewed by governmental representatives of Native American groups with traditional ties to the project area.

Characteristic 9: Portions of the Willow Creek, Leonard Canyon, and East Clear Creek eligible wild and scenic river corridors are within the IRA.

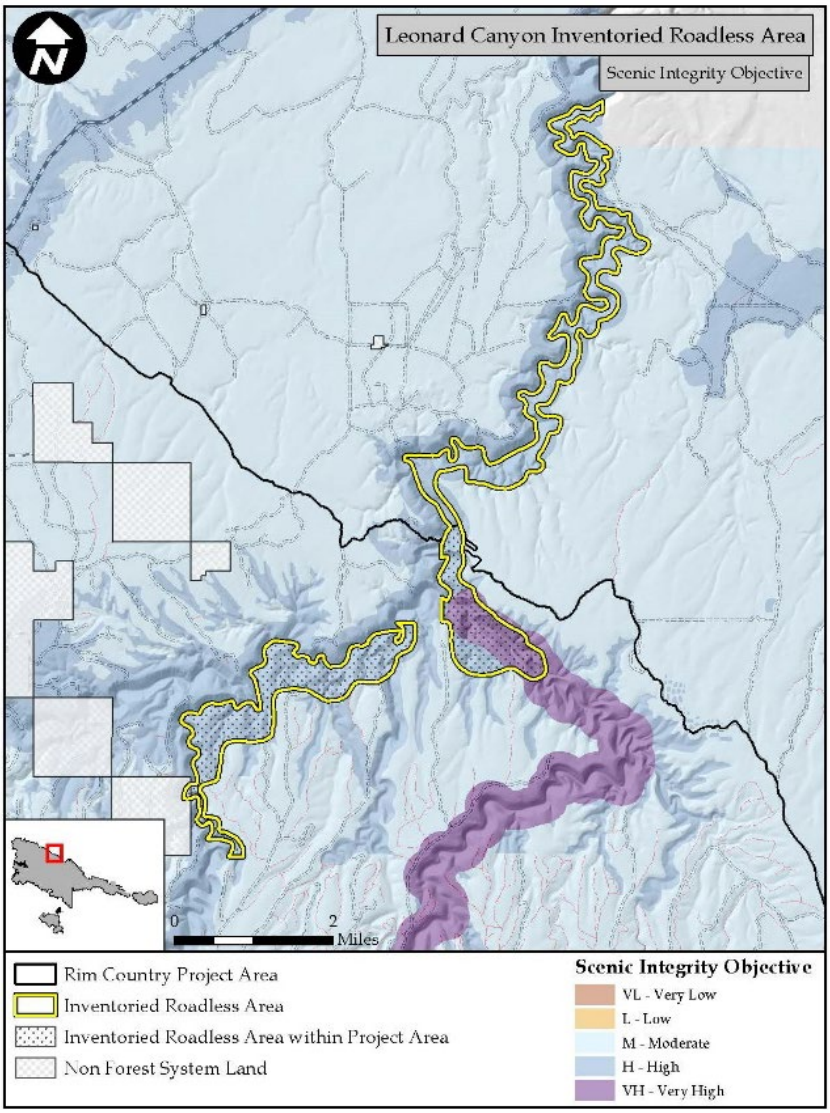


Figure 41. Leonard Canyon IRA with SIO

Barbershop Canyon IRA

The Barbershop Canyon IRA consists of 1,310 acres on the Coconino National Forest; the entire IRA is within the project area. The IRA is within the East Clear Creek management area.

Characteristic 1: Because of its unroaded status, soil and water within the IRA are not impacted by sediment or contaminants associated with road prisms or road use. Air quality within the project area as a whole is primarily affected by wildfire and prescribed fire occurring outside the project area.

Characteristic 2: This IRA does not supply any municipal drinking water.

Characteristic 3: Two southwestern region sensitive species: Bebb's willow (*Salix bebbiana*) and Arizona sneezeweed (*Helenium arizonica*) occur in Barbershop Canyon. Mexican spotted owl and its critical habitat occur in the IRA.

Threatened Little Colorado spinedace and sensitive Little Colorado sucker are present. Habitat is available for threatened Chiricahua leopard frog and sensitive northern leopard frog, but the species are not present.

Rare terrestrial wildlife species that are known to exist or are likely to exist include the threatened Endangered Species Act listed Mexican spotted owl and its critical habitat. Three northern goshawk PFA areas including one nest stand have portions within 0.5 mile of this IRA in the Rim Country project area. No other federally listed or Forest Service sensitive species occur in or near this IRA.

Characteristic 4: The threatened Mexican spotted owl and its critical habitat occur in the IRA. Threatened Little Colorado spinedace and sensitive Little Colorado sucker are present. Habitat is available for threatened Chiricahua leopard frog and sensitive northern leopard frog, but the species are not present.

Characteristic 5: The IRA provides opportunities for activities of a semi-primitive non-motorized type. There are 0.4 miles of trails within the project area of the IRA.

Characteristic 6: The area does not serve any research function as a reference landscape, other than as a general example of an area lacking roads.

Characteristic 7: The scenic integrity objective for the entire IRA is classified as high to very high.

Characteristic 8: Many areas across the Forest serve traditional cultural and/or sacred purposes. Specific locations associated with this are necessarily sensitive and are not disclosed in public documents. The project has been and would continue to be reviewed by governmental representatives of Native American groups with traditional ties to the project area.

Characteristic 9: Portions of the Barbershop Canyon eligible wild and scenic river corridor are within the IRA.

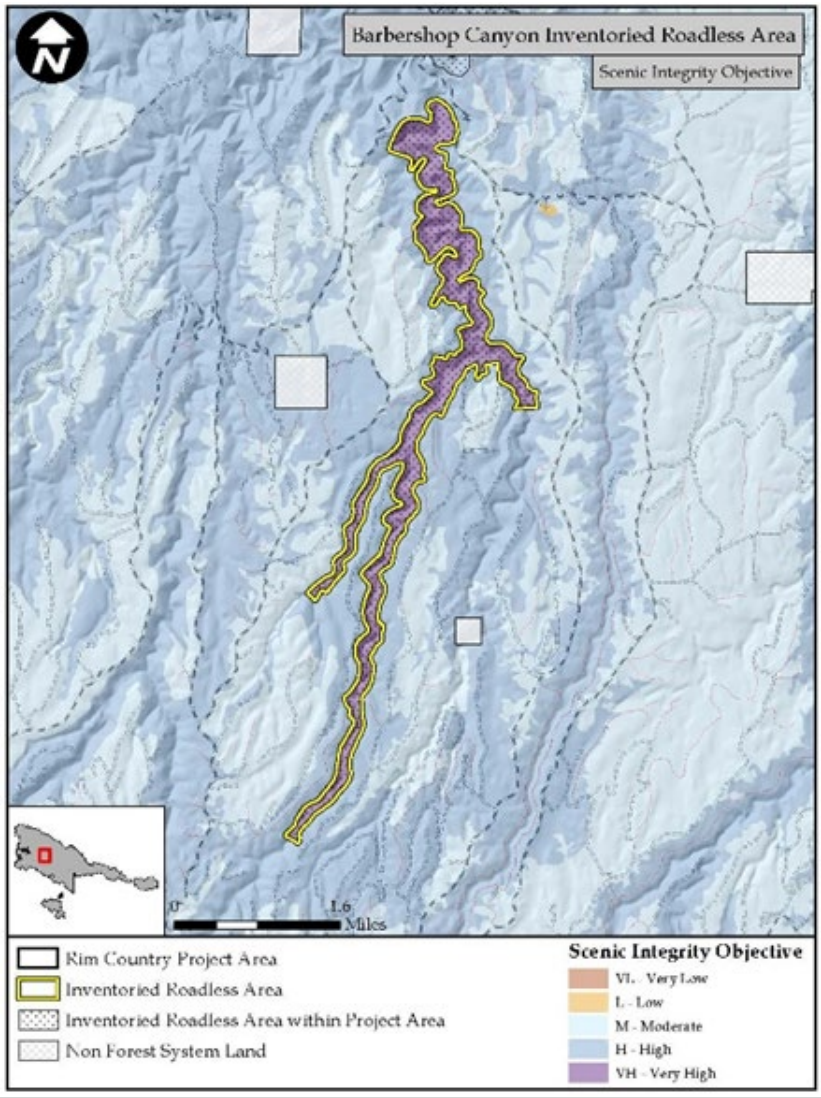


Figure 42. Barbershop Canyon IRA with SIO

East Clear Creek IRA

The East Clear Creek IRA consists of 1,612 acres in the Coconino National Forest. The entire IRA is within the project area. The IRA is within the East Clear Creek and pine belt management areas on the Coconino National Forest. It is adjacent to the Long Valley management area.

Characteristic 1: Because of its unroaded status, soil and water within the IRA are not impacted by sediment or contaminants associated with road prisms or road use. Air quality within the project area as a whole is primarily affected by wildfire and prescribed fire occurring outside the project area.

Characteristic 2: This IRA does not supply any municipal drinking water.

Characteristic 3: East Clear Creek Canyon passes through ponderosa pine forest, which grades into piñon-juniper woodland in the northern portions. The steep-walled canyons create complex environmental conditions with associated vegetation including dry mixed conifer forest. East Clear Creek below Blue Ridge Reservoir is within the IRA. It is managed by the state primarily as a native fishery and secondarily

as sport fishery for rainbow trout. The cottonwood-willow riparian forest along the stream channels consists primarily of box elder, ash, narrowleaf cottonwood, willow, Gambel oak, rose, and wild grape. Small benches or sand and gravel bars are found near the mouths of side canyons and support a variety of grasses, herbaceous ground cover, and low shrubs. One southwestern region sensitive species, cliff fleabane (*Erigeron saxatilis*) is present in East Clear Creek and within the project area.

The aquatic community within the creek and IRA includes threatened Little Colorado spinedace and two sensitive species: Little Colorado sucker and roundtail chub. Other native fish include bluehead sucker and speckled dace. Habitat is available for threatened Chiricahua leopard frog and sensitive northern leopard frog.

Rare terrestrial wildlife species that are known to exist or are likely to exist include the threatened Endangered Species Act listed Mexican spotted owl and its critical habitat and one northern goshawk PFA is just over one-half mile away from this IRA in the Rim Country project area. Two Peregrine Falcon nests are within one-half mile of this IRA in the Rim Country project area.

Characteristic 4: The threatened Mexican spotted owl and its critical habitat occur in the IRA. The threatened Little Colorado spinedace and designated critical habitat are present in the IRA. Habitat is available for threatened Chiricahua leopard frog, though the species is not known to occur in the IRA.

Characteristic 5: The IRA provides opportunities for activities of a semi-primitive non-motorized type (a small portion of the IRA is classified as Roaded Natural (RN)). There are 2.2 miles of trails within the project area of the IRA.

Characteristic 6: The area does not serve any research function as a reference landscape, other than as a general example of an area lacking roads.

Characteristic 7: Scenery is a WSR ORV in East Clear Creek because of its beauty. The entire IRA is in the project area with scenic integrity objective classified as high.

Characteristic 8: Many areas across the Forest serve traditional cultural and/or sacred purposes. Specific locations associated with this are necessarily sensitive and are not disclosed in public documents. The project has been and would continue to be reviewed by governmental representatives of Native American groups with traditional ties to the project area.

Characteristic 9: Portions of the East Clear Creek and Barbershop Canyon eligible wild and scenic river corridors are within the IRA. The area has unique geology.

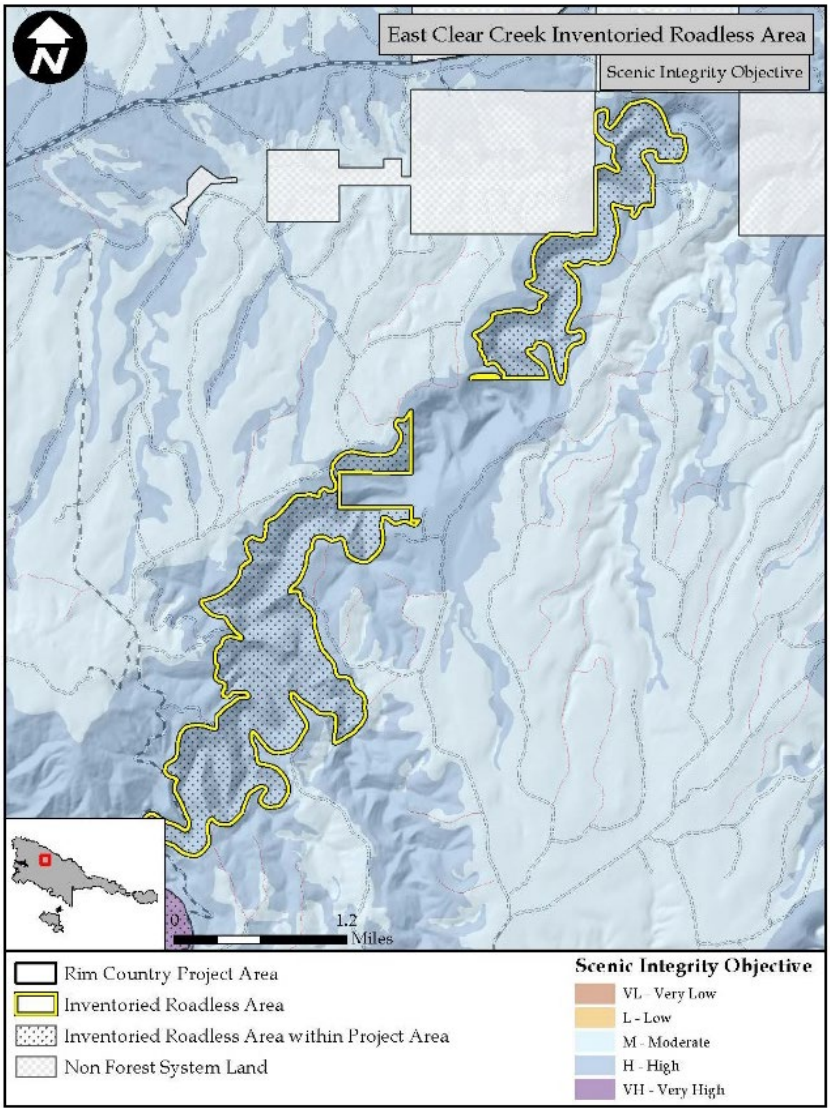


Figure 43. East Clear Creek IRA with SIO

Jacks Canyon IRA

The Jacks Canyon IRA consists of 2,855 acres in the Coconino National Forest; 1,717 acres are within the project area. The majority of the IRA is within the Anderson Mesa management area with a small sliver within the pine belt management area on the Coconino National Forest.

Characteristic 1: Because of its unroaded status, soil and water within the IRA are not impacted by sediment or contaminants associated with road prisms or road use. Air quality within the project area as a whole is primarily affected by wildfire and prescribed fire occurring outside the project area.

Characteristic 2: This IRA does not supply any municipal drinking water.

Characteristic 3: Habitat is available for threatened Chiricahua leopard frog, though the species is not known to occur in the IRA. The IRA is dominated by pinyon juniper, grassland, and ponderosa pine vegetation. A portion of the IRA is within the Anderson Mesa important bird area. Rare terrestrial wildlife species that are known to exist or are likely to exist include the threatened Endangered Species Act listed

Mexican spotted owl and its critical habitat. No other federally listed or Forest Service sensitive species occur in or near this IRA.

Characteristic 4: The threatened Mexican spotted owl and its critical habitat occur in the IRA. The threatened Little Colorado spinedace and designated critical habitat are present in the IRA. Habitat is available for threatened Chiricahua leopard frog, though the species is not known to occur in the IRA.

Characteristic 5: The IRA provides opportunities for activities of a semi-primitive non-motorized type. No trails are within the project area of the IRA.

Characteristic 6: The area does not serve any research function as a reference landscape, other than as a general example of an area lacking roads.

Characteristic 7: A total of 60 percent of the IRA is in the project area with scenic integrity objective classified as high. Mexican spotted owl and its critical habitat occur in the IRA.

Characteristic 8: Many areas across the Forest serve traditional cultural and/or sacred purposes. Specific locations associated with this are necessarily sensitive and are not disclosed in public documents. The project has been and would continue to be reviewed by governmental representatives of Native American groups with traditional ties to the project area.

Characteristic 9: None are applicable within the IRA.

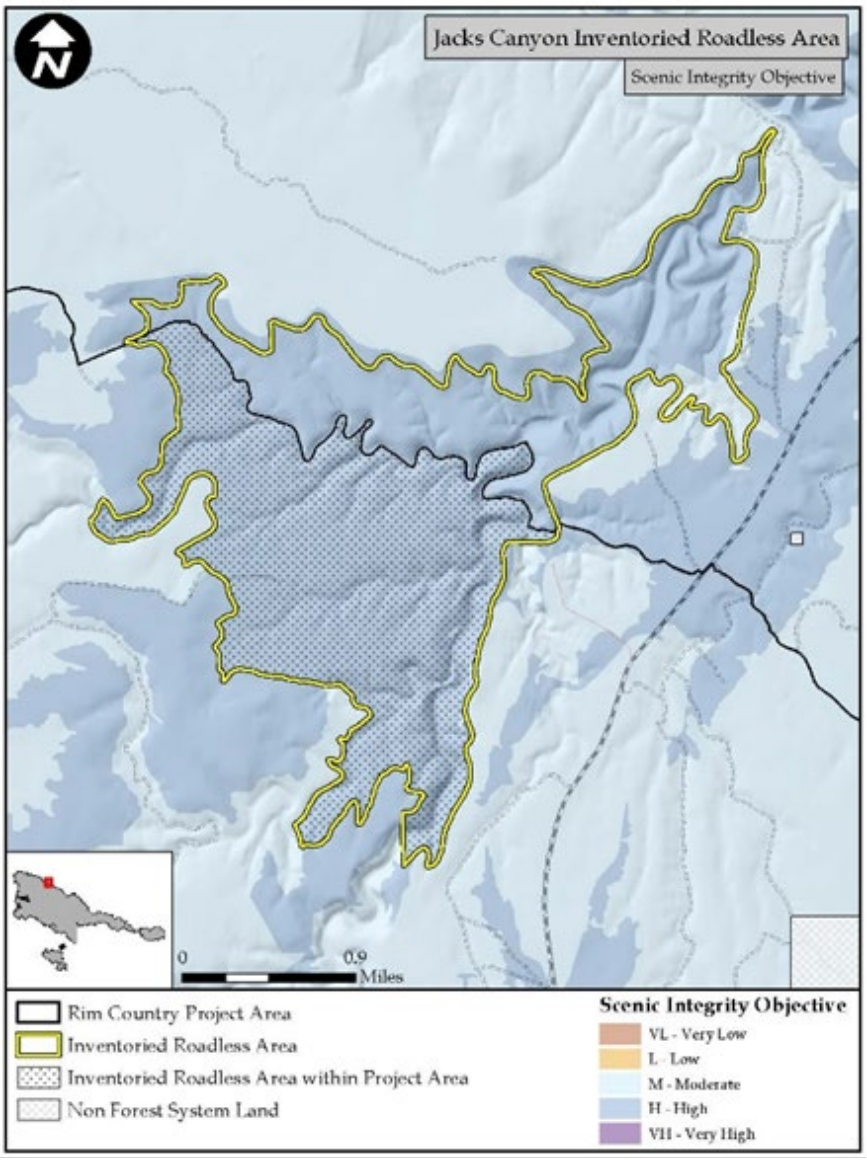


Figure 44. Jacks Canyon IRA with SIO

Hellsgate IRA

The Hellsgate IRA consists of 6,166 acres within the Tonto National Forest; 338 acres are within the project area. The IRA is within the 4FRI management area in the Tonto National Forest Land Management Plan.

Characteristic 1: Because of its unroaded status, soil and water within the IRA are not impacted by sediment or contaminants associated with road prisms or road use. A small section (0.13 mile) of Tonto Creek within the Hellsgate IRA has been identified as impaired for mercury and E. coli by the Arizona Department of Environmental Quality. A Total Daily Maximum Load (TMDL) has been developed for this reach for the E. coli impairment. Air quality within the project area as a whole is primarily affected by wildfire and prescribed fire occurring outside the project area.

Characteristic 2: This IRA does not supply any municipal drinking water.

Characteristic 3: Dominant vegetation communities include ponderosa pine, green oak (in drainages), and juniper woodland and chaparral as you move up slope. To the average forest visitor, the vegetation appears natural, reflects healthy ecosystem function, and shows little to no influence of previous human intervention. Very little fuels or timber management has occurred due to lack of road access. A small portion of Tonto Creek in the Hellsgate IRA is within the project area. Tonto Creek is a perennial creek that cuts a canyon through the wilderness making the terrain subject to steep elevation changes. This aquatic community includes sensitive desert sucker, Sonoran sucker, and headwater chub.

Rare terrestrial wildlife species that are known to exist or are likely to exist include the threatened Endangered Species Act listed Mexican spotted owl and its critical habitat. No other federally listed or Forest Service sensitive species occur in or near this IRA. Most of the Management Indicator Species (MIS) included in the Terrestrial Wildlife Specialist Report could occur in this IRA.

Characteristic 4: The threatened Mexican spotted owl and its critical habitat occur in the IRA.

Characteristic 5: The IRA provides opportunities for activities of a semi-primitive non-motorized and semi-primitive motorized type. No trails within the project area of the IRA.

Characteristic 6: The area does not serve any research function as a reference landscape, other than as a general example of an area lacking roads.

Characteristic 7: Only 5 percent of the IRA is in the project area with SIO classified as high.

Characteristic 8: Many areas across the Forest serve traditional cultural and/or sacred purposes. Specific locations associated with this are necessarily sensitive and are not disclosed in public documents. The Project has been and would continue to be reviewed by governmental representatives of Native American groups with traditional ties to the project area.

Characteristic 9: The IRA is adjacent to the Hellsgate Wilderness. Portions of the Tonto Creek (Upper) eligible wild and scenic river corridor are within the IRA.

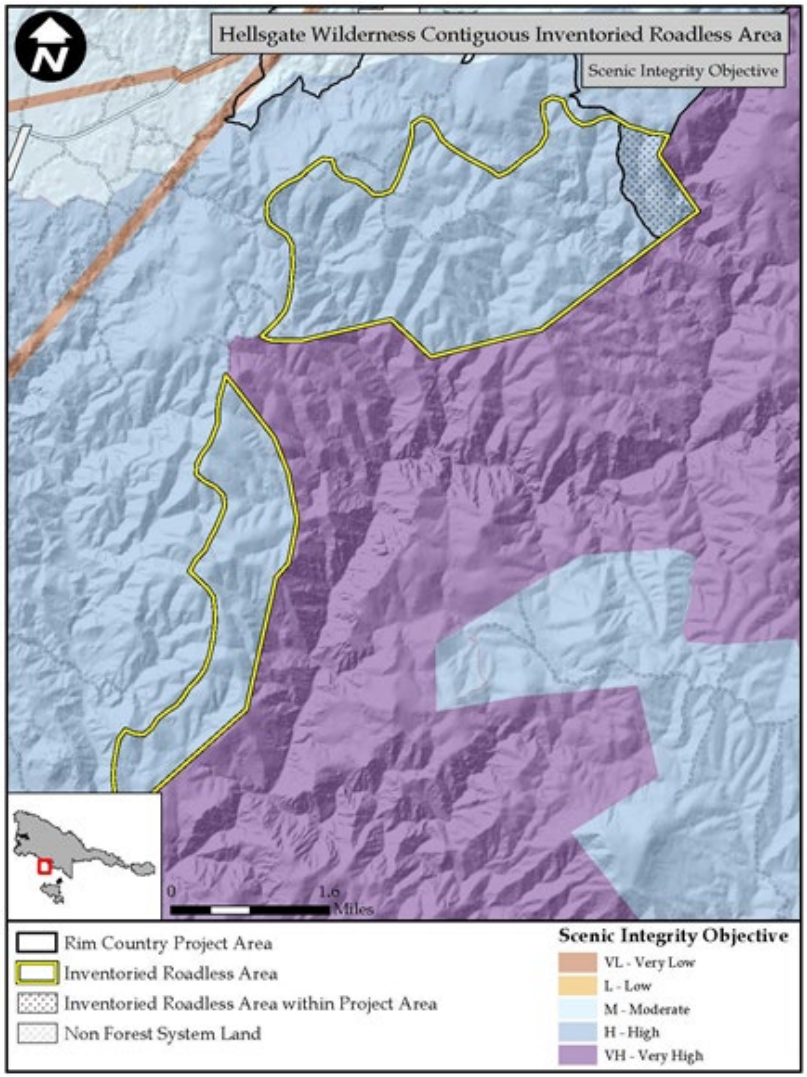


Figure 45. Hellsgate IRA with SIO

Mazatzal IRA

The Mazatzal IRA consists of 16,930 acres in the Tonto National Forest, 316 acres are within the project area. The IRA is within the 4D, 4F, 1E, and 1F management areas in the Tonto National Forest Land Management Plan. Portions of the Arizona National Scenic Trail pass through the IRA. The IRA is adjacent to the Mazatzal Wilderness.

Characteristic 1: Because of its unroaded status, soil and water within the IRA are not impacted by sediment or contaminants associated with road prisms or road use. Air quality within the project area as a whole is primarily affected by wildfire and prescribed fire occurring outside the project area. This IRA overlaps with the Class I airshed of the Mazatzal Wilderness Area.

Characteristic 2: This IRA does not supply any municipal drinking water.

Characteristic 3: Dominant plant communities include pinyon juniper woodlands with some ponderosa pine in the stream bottoms and some ash, cottonwood, and sycamore in the riparian areas. Arizona cypress is also in the area. Pine and Rock Creeks within the IRA have sensitive headwater chub and

desert sucker which are not unique to the area. The portion of the IRA within the project boundary does not contain any aquatic species. Rare terrestrial wildlife species that are known to exist or are likely to exist include the threatened Endangered Species Act listed Mexican spotted owl and its critical habitat. No known northern goshawk, peregrine, bald or golden eagles within a half mile of potions of the IRA within the Rim Country project area. Most of the Management Indicator Species (MIS) included in the Terrestrial Wildlife Specialist Report could occur in this IRA.

Characteristic 4: The threatened Mexican spotted owl and its critical habitat occur in the IRA.

Characteristic 5: The IRA provides opportunities for activities of a primitive, semi-primitive motorized, semi-primitive non-motorized type (a small portion of the IRA is classified as roaded natural). There are 0.7 miles of trails within the project area of the IRA. Portions of the Arizona National Scenic Trail pass through the IRA.

Characteristic 6: The area does not serve any research function as a reference landscape, other than as a general example of an area lacking roads.

Characteristic 7: Only 2 percent of the IRA is in the project area with SIO classified as high.

Characteristic 8: Many areas across the forest serve traditional cultural and/or sacred purposes. Specific locations associated with this are necessarily sensitive and are not disclosed in public documents. The project has been and would continue to be reviewed by governmental representatives of Native American groups with traditional ties to the project area.

Characteristic 9: The IRA is adjacent to the Mazatzal Wilderness.

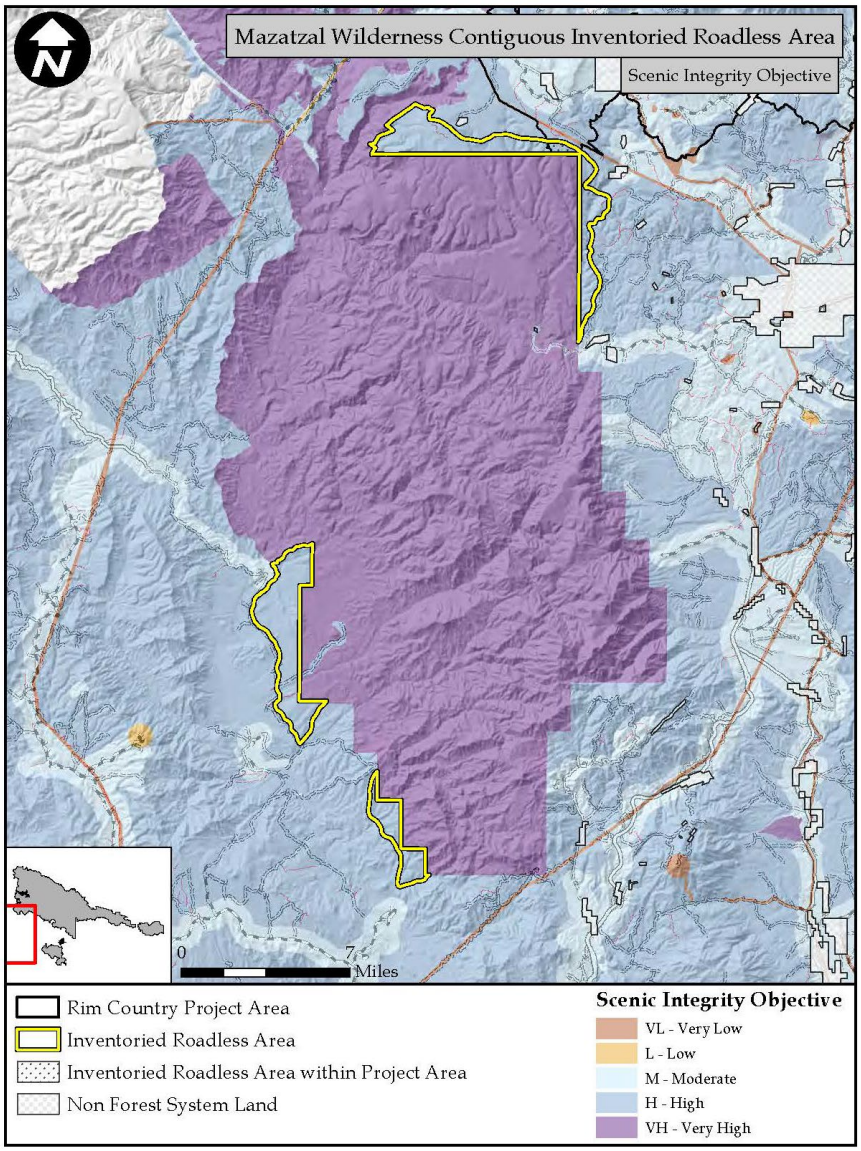


Figure 46. Mazatzal Wilderness Contiguous IRA with SIO

Sierra Ancha Wilderness Contiguous IRA

The Sierra Ancha Wilderness Contiguous IRA consists of 7,781 acres within the Tonto National Forest; 4,613 acres are within the project area. The IRA is within the 5D, 5E, 5F, and 5G management areas in the Tonto National Forest Land Management Plan. Little or no evidence of human influence is present on the landscape. Prevalence of improvements is rare or scattered.

Characteristic 1: Because of its unroaded status, soil and water within the IRA are not impacted by sediment or contaminants associated with road prisms or road use. Air quality within the project area as a whole is primarily affected by wildfire and prescribed fire occurring outside the project area. This IRA overlaps with the Class I airshed of the Sierra Ancha Wilderness Area.

Characteristic 2: This IRA does not supply any municipal drinking water.

Characteristic 3: The vegetation type is a dry mix conifer, wet mix conifer with aspen, ponderosa pine, and evergreen oak. Plant communities consist of juniper grass, pinyon grass, pinyon juniper woodland, chaparral and brush, as well as some riparian communities including cottonwood, sycamore, alder, and ash. There are known occurrences of bloomers dock (sensitive species). Rare terrestrial wildlife species that are known to exist or are likely to exist include the threatened Endangered Species Act listed Mexican spotted owl and its critical habitat. Two Peregrine falcon territories occur within one-half mile of the portions of the IRA that are within the Rim Country project area. No known northern goshawk, bald or golden eagles occur within a half mile of potions of the IRA within the Rim Country project area. Most of the management indicator species (MIS) included in the Terrestrial Wildlife Specialist Report could occur in this IRA.

Characteristic 4: The threatened Mexican spotted owl and its critical habitat occur in the IRA.

Characteristic 5: The IRA provides opportunities for activities of a semi-primitive motorized, semi-primitive non-motorized type, and roaded natural. There are 7.6 miles of trails within the project area of the IRA.

Characteristic 6: The area does not serve any research function as a reference landscape, other than as a general example of an area lacking roads.

Characteristic 7: This area is characterized by high cliffs and abrupt changes in elevation, which ranges from 3,500 to 4,000 feet. There are unique or outstanding landscape features in this area, including scenery which includes cliffs and cliff dwellings. A total of 59 percent of the IRA is in the project area with 4,562 acres in high SIO.

Characteristic 8: Many areas across the Forest serve traditional cultural and/or sacred purposes. Specific locations associated with this are necessarily sensitive and are not disclosed in public documents. The project has been and would continue to be reviewed by governmental representatives of Native American groups with traditional ties to the project area.

Characteristic 9: A small sliver of the Pueblo Canyon eligible wild and scenic river corridor is within the IRA. Portions of the Sierra Ancha Experimental Forest and the proposed Upper Forks Parker Creek RNA are within the IRA. The IRA is adjacent to the Sierra Ancha Wilderness.

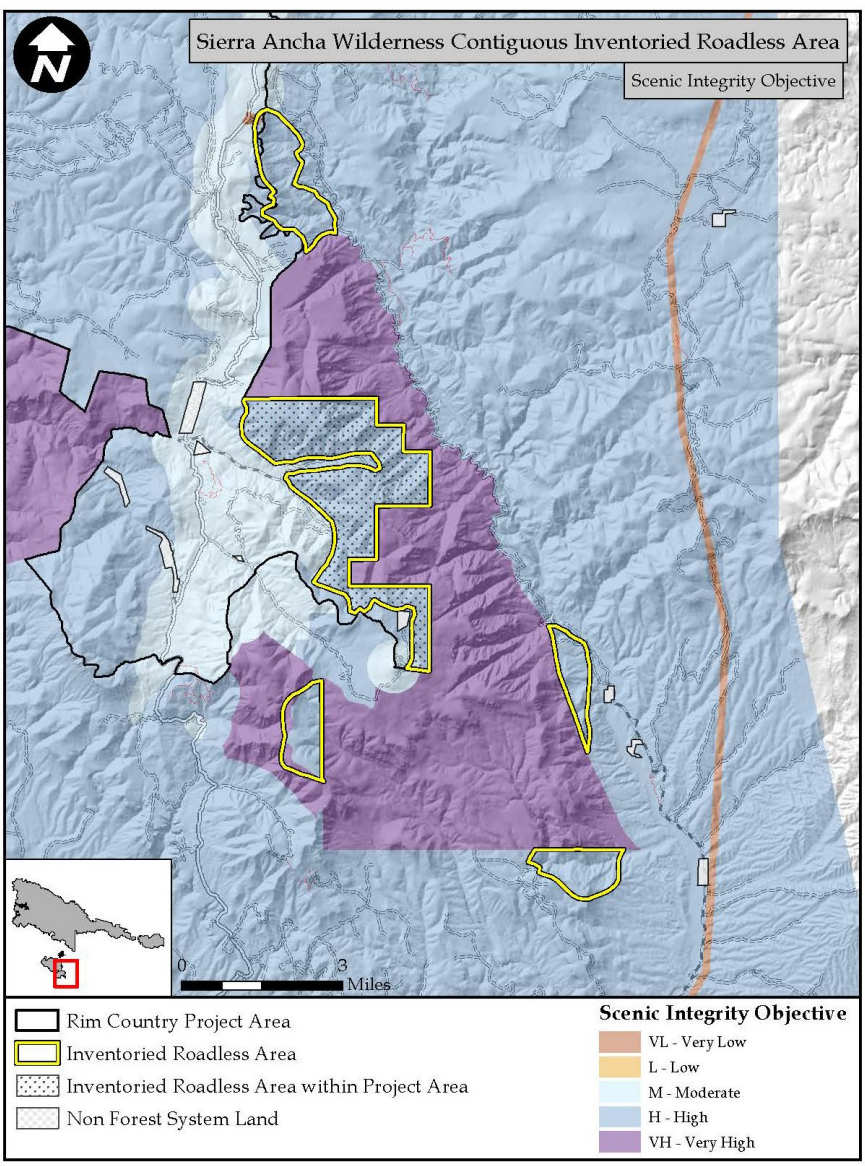


Figure 47. Sierra Ancha Wilderness Contiguous IRA with SIO

Assumptions

- No temporary roads or road rebuilding/reconstruction would occur per design feature RS013.
- No in-woods processing sites or rock pit expansion are proposed in IRAs.
- No cable operations are proposed in IRAs per design feature RS013.
- The cutting of timber for removal is expected to be infrequent because operations in the IRAs would be of limited scope and duration intermittently over a 20-year or more time span. It is expected that re-entry into the IRAs for product removal would not be necessary because first entry would put forested stands on a trajectory toward the natural range of variation.
- Restoration activities would focus on cutting smaller diameter live, standing trees (5-16 inches).

- The Rim Country Project would use a condition-based management approach for mechanical and aquatic treatments within IRAs. Condition-based management ensures that the right treatment is applied to the right location to meet desired conditions most effectively. The approach does not assign specific treatments to specific areas, but rather assigns treatments to a set of conditions that occur on the landscape. Appendix D of the FEIS contains the Rim Country Implementation Plan. The plan outlines procedures for condition-based management and the old and large tree implementation plans. IRAs would be evaluated for resource protection considerations when activities are within IRAs be consistent with the 2001 Roadless Area Conservation Rule Exception Criteria (Appendix D, Implementation Plan Checklist and Section D, Decision Tree Modifiers), requirement of additional notification and approvals including line officer approval and coordination with the Regional Inventoried Roadless Area Lead (Appendix D, Implementation Plan Checklist), and incorporation design features (Appendix C). Treatments in Inventoried Roadless Areas shall be designed to maintain the overall roadless character of inventoried roadless areas. Additionally, in accordance with the Old and Large Tree Implementation Plans (Appendix D), removal of old and large trees would be rare. Exceptions for removal of old and large trees are outlined in the plans, however exceptions for removal of old trees would be rare.
- For mechanical treatments, a single entry with chainsaw falling crews, feller bunchers, log skidders, trucks and/or similar equipment would be necessary and could last multiple seasons depending on the size of the mechanical operation. Another entry would be necessary for each prescribed fire activity and would require the use of hand crews, ATVs, engines, trucks, and/or similar equipment. Entry for prescribed fire operations would occur separately from mechanical operations. Any subsequent prescribed fire operations would occur seasons after initial entry, depending on fuel accumulation and predicted fire behavior. Re-entry into the IRAs for product removal would not be necessary.
- The amendment exception for treatment of slopes over 40 percent is incorporated into the analysis.

Methodology and Indicators

The analysis focuses on effects with regards to the nine Roadless Characteristics listed in 36 CFR § 294.22. These characteristics are also the analysis indicators as well as acres of treatments in IRAS.

Roadless Characteristics

(1) High quality or undisturbed soil, water, and air;
(2) Sources of public drinking water;
(3) Diversity of plant and animal communities;
(4) Habitat for threatened, endangered, proposed, candidate, and sensitive species, and for those species dependent on large, undisturbed areas of land;
(5) Primitive, semi-primitive non-motorized, and semi-primitive motorized classes of dispersed recreation;
(6) Reference landscapes;
(7) Natural appearing landscapes with high scenic quality;
(8) Traditional cultural properties and sacred sites; and
(9) Other locally identified unique characteristics.

Environmental Consequences

Fire Hazard Index and Potential Fire Type within IRAs

The following figures will be referred to throughout the analysis. They portray the fire hazard index and potential fire type by alternative for each of the IRAs.

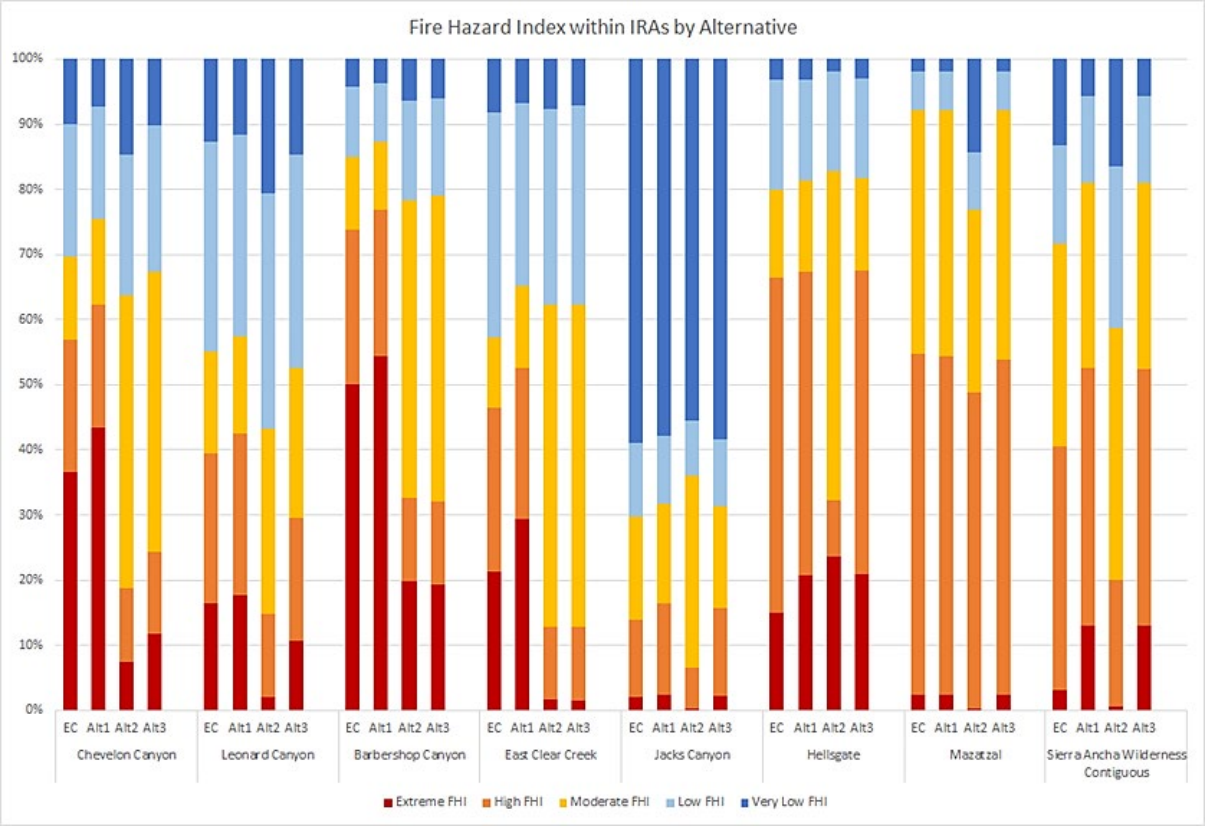


Figure 48. Fire hazard index by IRA for Alternatives 1, 2 and 3

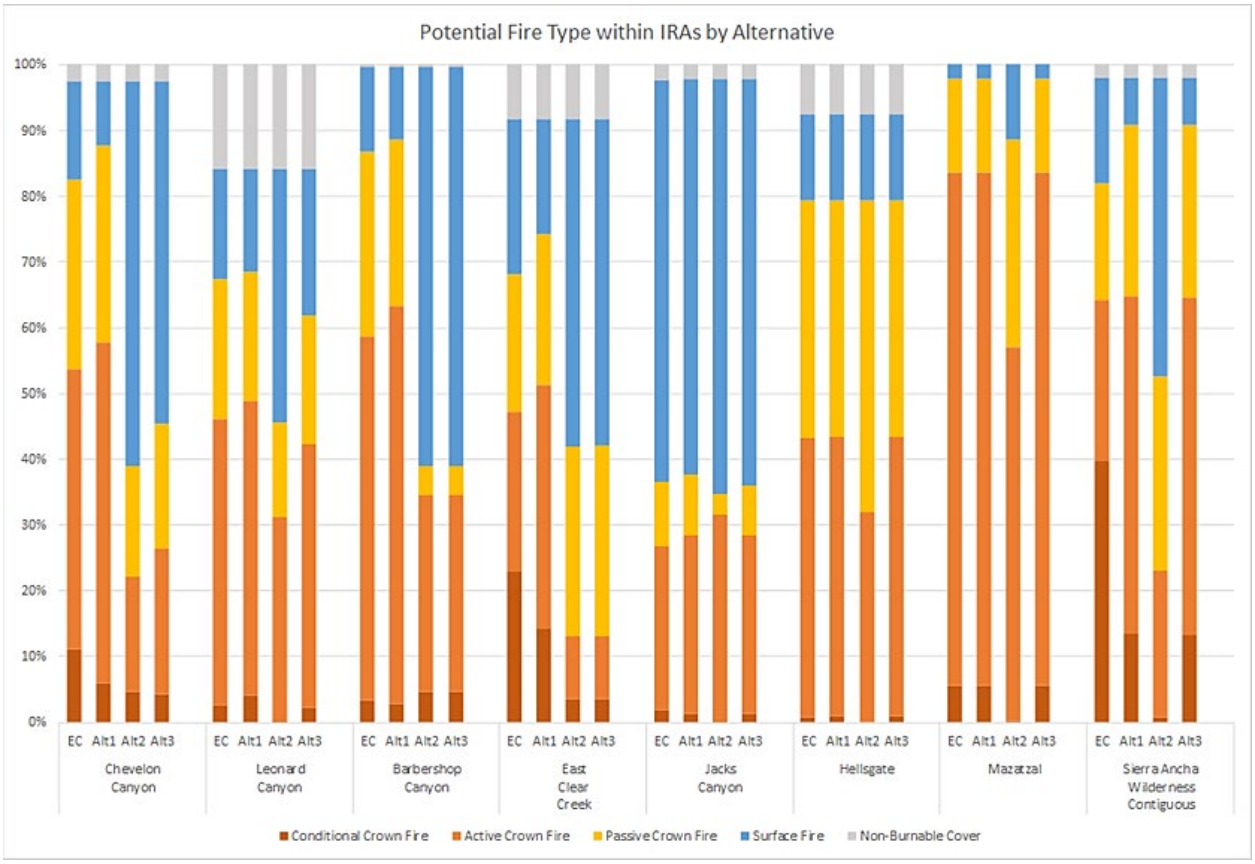


Figure 49. Potential fire behavior by IRA for Alternatives 1, 2, and 3

Alternative 1 – No Action

Under Alternative 1, the Rim Country Project would not be implemented; therefore, no new impacts to the IRAs from project implementation would occur. Potential negative impacts to the characteristics 1, 3, 4, 5, and 7 could result from not addressing the existing stand conditions within the IRA, specifically the increased risk of uncharacteristic wildfire. As shown in Figure 48, fire hazard index is especially high in Barbershop Canyon (over 50 percent), Chevelon Canyon (over 40 percent) with no treatment over 20 years. Shown in Figure 49, potential for fire behavior in Barbershop Canyon (over 60 percent), Chevelon Canyon (over 50 percent), Mazatzal (over 80 percent), and Sierra Ancha Wilderness Contiguous (over 60 percent) is highest for active crown fire. Potential impacts of large, severe wildfires to IRA characteristics could include loss of riparian vegetation thereby decreasing bank stability and resulting in excessive erosion and sediment production, loss of habitat for terrestrial and aquatic species health, impacts to the scenic integrity of the IRAs, and safety risks to public recreational uses. Overall, there could be potential negative impacts to the characteristics 1, 3, 4, 5, and 7 from not addressing the existing stand conditions within the IRAs, specifically the increased risk of uncharacteristic wildfire.

Effects Common to Both Action Alternatives

Restoration activities would focus on cutting smaller diameter live, standing trees (5 to 16 inches). As stated in the Rim Country Old Tree Implementation Plan (Appendix D of the FEIS), old trees would be retained, with few exceptions, regardless of their diameter, within the Rim Country analysis area. Removal of old trees would be rare. Exceptions would be made for threats to human health and safety,

and those rare circumstances where the removal of an old tree is necessary in order to prevent additional habitat degradation that would be caused by forest thinning and burning operations. Old trees would not be cut for forest health reasons or to balance age or size class distributions. Large post-settlement trees, would be retained with the exceptions outlined in the Rim Country Large Tree Implementation Plan (Appendix D of the FEIS) such as encroachment within seeps and springs, wet meadows, grasslands, aspen stands, conifers encroaching into riparian areas, etc.

The project would maintain characteristics 5, 7, 8, and 9. Characteristics 1, 2, 3, and 4 would be improved as described in the analysis below. Particularly, characteristics 3 and 4 for terrestrial and aquatics species would be improved. Mechanical thinning would improve habitat characteristics beneficial for the Mexican spotted owl (from the Mexican spotted owl Recovery Plan) while also protecting Mexican spotted owl habitat from high-severity wildfire. Treatment in IRAs is especially important to ensure continuity of restoration treatments, especially because IRAs represent areas that have high departure from desired conditions and pose a risk to values around them.

Treatments would promote resiliency in forested areas during wildfires by reducing the potential for high-severity fire behavior within IRAs. Post adverse wildfire watershed effects increase with the percentage of the watershed that burns at moderate to high severity (Cannon 2010; Neary 2011). The potential of damage from wildfires would be reduced in IRAs, especially within East Clear Creek, Barbershop, Sierra Ancha Wilderness Contiguous, Jacks Canyon, and Chevelon Canyon.

General and heavy stream restoration and road decommissioning would be the same under both action alternatives. Benefits to IRA character would be felt in Chevelon Canyon, Leonard Canyon, Barbershop Canyon, East Clear Creek, Hellsgate, Mazatzal, and Sierra Ancha Wilderness Contiguous IRAs (See Table 48). Decommissioning of roads within the IRA would prove beneficial to all applicable roadless characteristics (1, 3, 4, 5, and 7) by mitigating all impacts associated with the existing unauthorized road segment. Stream restoration impacts are described in Characteristic 1, 3, and 4 below.

In most cases, the project's anticipated effects for each resource area are not expected to be different when crossing the boundary into the IRAs, therefore the analysis in other resource sections for specific actions would be similar.

Characteristic 1

Soils: Effects to soils are described within the soils and watershed section of the FEIS. Mechanical thinning with IRAs would cause soil compaction, puddling, displacement, erosion, loss of soil organic matter, short-term changes in soil moisture content or retention, changes in nutrient cycles, changes in soil fauna, and introduction of invasive and noxious weeds. Thinning of forest cover on soils currently characterized as unsatisfactory would improve soil conditions over the long-term by improving soil moisture and allowing greater sunlight penetration to the forest floor (for example sunflecks) resulting in an increase in grasses, forbs and shrubs in the forest understory where litter is currently the dominant soil cover (Griffis et al. 2000). The increased herbaceous vegetation would reduce soil erosion rates by providing vegetative ground cover that would intercept rain before it can reach soil surfaces and detach and entrain soil particles in runoff. Woody debris from forest thinning (slash) would be lopped and scattered where doing so would not result in excessive fuel loads, further mitigating potential adverse effects to soils and watershed resources. Finer litter and woody debris that is incidental to forest vegetation treatments (such as needles, leaves, twigs, cones, bark, etc.) would also remain on the ground following mechanical treatments to protect soil surfaces from wind and water erosion.

Water: Effects to water and riparian resources are described within the Water and Riparian section in Volume 1 of the FEIS. As described in Chapter 3 of the Rim Country FEIS, moving existing conditions

toward desired conditions through implementation of the action alternatives would improve the state of the physical and biological processes both in the areas affected and within a watershed that effect soil and hydrologic functions supportive of ecosystems.

Mechanical thinning treatments would promote resiliency during uncharacteristic wildfires by reducing the potential for high-severity burning of upland and riparian vegetation. Loss of vegetation from high-severity fires can decrease soil stability resulting in excessive erosion and sediment production affecting water quality of downgradient and downstream waterbodies. Resource protection measures for mechanical treatments would be implemented to minimize nonpoint source pollution as outlined in the 2019 Intergovernmental Agreement (memorandum of understanding) between the Arizona Department of Environmental Quality and the Southwestern Region of the Forest Service. Design features related to mechanical vegetation treatments are expected to minimize effects to resources and nonpoint source pollution. The project includes establishment and limitations within Aquatic Management Zones (SW001-SW-006), erosion control (SW022-SW023, SW025, SW40), spreading treatments in time and space within a watershed (SW054) as well as for skid trails (SW020-21, SW28-SW030, SW032-33, SW041, SW046), yarding (SW036), stream crossings (SW031), ground-disturbance limitations (SW039, SW045-SW049), protected areas (SW044) and landings (SW038, SW047) are expected to reduce effects. The project also includes a design feature to protect herbaceous regrowth post-treatment from livestock grazing if necessary (RM004, SW012).

Prescribed fire treatments would reduce fuel loading that continues to increase in both living biomass and woody detritus through natural forest ingrowth and tree encroachment into existing openings, resulting in increased risk of high-severity wildfire. A dense forest litter layer (duff) has displaced much of the herbaceous vegetation which provides even greater benefits to soil hydrologic function due to fine root turnover, increased fine litter, improved soil porosity and aggregate stability, and increased water holding capacity. Increased water turbidity, and downstream flooding would be more widespread in an uncontrolled wildfire situation than under prescribed fire conditions where the size and intensity of the fire can be controlled. Design features (Appendix C of the FEIS) related to prescribed fire are expected to minimize the potential effects described above. The project includes limitations within Aquatic Management Zones (SW007 and SW-008), spreading treatments in time and space within a watershed (SW054), fireline criteria (FE008, SW050-51, TR002), riparian criteria (SW053), general fire (FE003, FE007) and cumulative impacts (FE011) which are expected to reduce potential impacts. The project also includes design features to protect herbaceous regrowth post-treatment from livestock grazing if necessary (RM004, SW012).

Water quality would likely benefit from road decommissioning of Forest Service system roads and unauthorized routes being used for motorized travel that continue to discharge runoff and sediment to project area streams, especially where the roads are poorly located in stream bottoms, have inadequate drainage structure, and are hydrologically connected to the stream network. Appendix C of the FEIS has specific soil and water design features to minimize nonpoint source pollution from road decommissioning and other road activities (SW056-SW058).

Implementation of restoration activities described in the Aquatic and Watershed Condition- Based Management Approach could promote conditions for desirable water quality and quantity characteristics across the project area. Restoration activities include a range of treatment types from heavy mechanical stream reconstruction to building of small wood and rock stabilization structures. Also included are riparian planting and protection, spring restoration, and vegetation treatments including thinning and prescribed fire just to name a few others. Long-term water quality would benefit from promotion of soil and channel stability with improved dissipation of stream energy, water storage, and more stable flow regimes through maintenance or improved riparian vegetation conditions. Reduction of canopy cover near riparian areas would stimulate the development of understory vegetation including deciduous woody

riparian vegetation (for example aspens, willows and cottonwoods). Increased infiltration resulting from the vegetative treatments promotes infiltration of excess moisture into sub-surface storage increasing groundwater levels supporting riparian vegetation and spring flow. Short-term inputs of sediment are expected from these ground-disturbing activities, however Appendix C of the FEIS has design features to minimize point and nonpoint source pollution and protect riparian resources. Reducing heavy equipment impacts are addressed in AQ008, AQ011, AQ030, SW063, SW065-68, SW070, to reduce direct impacts and sedimentation. Reducing impacts to riparian vegetation is covered by AQ014, AQ035, AQ037, SI001, SI003, SI023, and SW008-9, while protecting stream shade is included in AQ032-34. There are also design features for mimicking stream reference conditions (SW055), site rehabilitation (SW059-63) and stockpiling materials from uplands for use in streams (SI007).

There are four design features to prevent pollutants from entering riparian areas, waterbodies and aquatic habitats which minimizes the potential effects. These measures range from checking for leaks daily to refueling and staging areas being outside aquatic management zones (AQ003, SW015-16, and SW074).

As described in Water and Riparian Resources Section in Chapter 3 of the Rim Country FEIS, the action alternatives would move areas currently not meeting desired conditions with respect to stable soil and hydrologic regimes to those supporting improved water quality and quantity and riparian systems. Moving toward these desired conditions contributes to healthy watersheds and clean downstream drinking water which is consistent the social and ecological values and characteristics of inventoried roadless areas.

Air: Effects to air are described fully within the air quality section of the FEIS (volume 2). Air quality impacts would come primarily from prescribed fire. Areas treated with prescribed fire would produce lower emissions per acre than untreated acres burned by wildfire. All prescribed fire treatments would comply with National Ambient Air Quality Standards. Implementation of the project would comply with the federal Clean Air Act and at the state level with the Arizona Department of Environmental Quality's regulations that require the project to not cause exceedances of the National and State Ambient Air Quality Standards in populated areas.

Characteristic 2

None of the IRAs supply any municipal drinking water, therefore this characteristic is not analyzed.

Characteristic 3

Terrestrial Species: Effects to terrestrial wildlife species are described fully within the terrestrial wildlife section of the FEIS. Mechanical thinning in IRAs has the potential to effect terrestrial wildlife species in the short-term, with long-term benefits that outweigh brief disturbance. Short-term effects include noise disturbance, alteration of understory and habitat that cause animals to leave the area. Design features related to mechanical vegetation treatments are expected to minimize the potential effects described above.

Prescribed burning has the potential for negative short-term effects to upland vegetation and harm to individual terrestrial species if present. Short-term effects would result if these activities occur within species habitat from firelines (ground disturbance), removal or reduction of vegetation, and altered water quality downstream from ash. Generally herbaceous vegetation recovers quickly after low and moderate intensity prescribed fire. Long-term effects of prescribed burning are expected to be positive for terrestrial wildlife species and habitats. Reduced fuel loading would protect these areas from the effects of uncharacteristic wildfire in the future and returning frequent fire to the ecosystem is a restoration activity that this project hopes to achieve to preserve these areas for the future.

Numerous wildlife design features (Appendix C) have been added to the project to protect the Mexican spotted owl, northern goshawk, and bald and golden eagles that would minimize effects to these species in IRAs as well as the entire project area. These include buffers from noise from mechanical equipment as well as seasonal restrictions. Other raptorial bird species, wolves and bats have design features that would minimize disturbance to these species of terrestrial wildlife.

For Forest Service Sensitive Species, the terrestrial wildlife section determined that individuals of some species could be affected by proposed activities but that no species would trend toward Federal listing as a result of the proposed alternatives. On the Tonto, management indicator species were analyzed in the terrestrial wildlife section with no species trends affected by the proposal. The same determinations are true for implementation in the IRAs within Rim Country project.

Plant Species: Impacts to Bebb's willow and Arizona sneezeweed, and Blumer's dock are present within the botany section of the FEIS. Overall, impacts to these species would not effect this IRA character due to inclusion of design features (Appendix C).

Aquatic Species: Effects to aquatic species are described within the aquatics species section of the FEIS. Mechanical thinning within aquatic management zones could have negative effects to species and their habitats from reduced riparian vegetation cover and ground disturbance leading to increased sedimentation to streams in the short term (less than 5 years). Elevated sedimentation above current levels could negatively impact aquatic habitat, species, and water quality; particularly fish eggs and early life history stages that occur on or within substrate as well as the aquatic macroinvertebrate community structure. Habitat is impacted by increased fines and embeddedness to spawning substrates which can lead to loss of habitat quality and reduced reproductive success. However, herbaceous ground cover would reestablish and should increase given reduced conifer canopy cover and increased sunlight reaching the ground. There is the potential of impacts to individual frogs in the form of harm or modification of behavior during implementation. Indirectly, frogs may avoid or move out of these areas while work is occurring causing displacement or disruption of social and feeding behavior. These effects have the potential to reduce the health or reproductive capability of individuals.

Design features related to mechanical vegetation treatments are expected to minimize the potential effects described above. The project includes spreading treatments in time and space within a watershed (SW054) as well as for skid trails (SW020-21, SW28, SW030, SW032-33, SW041, and SW046), yarding (SW036), and landings (SW038, SW047) are expected to reduce effects. The project also includes a design feature to protect herbaceous regrowth post-treatment from livestock grazing if necessary (RM004, SW012).

Prescribed burning has the potential for negative short-term effects to riparian vegetation and harm to individual frogs if present. Short-term effects would result if these activities occur within species habitat from firelines (ground disturbance), removal or reduction of vegetation, and altered water quality from ash. Generally herbaceous vegetation recovers quickly after low and moderate intensity prescribed fire. However, prior to this, there may be increased sedimentation into streams short term which may negatively affect habitat by increasing substrate embeddedness or potentially effecting eggs, larval fishes and tadpoles and aquatic insect prey base.

Long term effects of prescribed burning are expected to be positive for aquatic species and habitats. Reduced fuel loading would protect these areas from the effects of uncharacteristic wildfire in the future. Large woody debris recruitment and streamside cover or structure can also improve with prescribed fire. Fire plays an important role in maintaining heterogeneity in riparian and aquatic systems that has been excluded similar to surrounding uplands (Gresswell 1999); therefore, restoring the fire regime would have some benefits to riparian condition.

Design features related to prescribed fire are expected to minimize the potential effects described above. The project includes spreading treatments in time and space within a watershed (SW054), fireline criteria (FE008, SW050-51, and TR002), riparian criteria (SW053), general fire (FE003, FE007) and cumulative impacts (FE011) which are expected to reduce potential impacts. The project also includes a design feature to protect herbaceous regrowth post-treatment from livestock grazing if necessary (RM004, SW012).

Though the long-term effects of stream restoration projects are anticipated to be positive for species, some actions may result in a degree of short-term negative effects to aquatic species and their habitats. General stream restoration activities have little ground disturbance and no negative impacts to fish would occur as these activities occur in the riparian area and not the stream. Benefits of improved riparian vegetation include increased stream shading, bank stability, hiding cover for amphibians and reptiles, and improved riparian condition. Short term effects of heavy mechanical restoration generally include disturbance within the streams and nearby floodplains which may result in sediment plumes while work is occurring, temporary disturbance of occupied habitats and displacement of individuals, temporary reduction of riparian vegetation cover in the project area and change of channel structure. These impacts are considered short-term (a few weeks) and sediment should be moved downstream during the first high stream flow. Beneficial impacts of stream restoration of improved habitat, connectivity and stream function are immediate and long-term.

Multiple project design features are included in the project to reduce adverse impacts where feasible given the nature of these methods. Reducing heavy equipment impacts are addressed in AQ008, AQ011, AQ030, SW063, SW065-68, SW070, to reduce direct impacts and sedimentation. Reducing impacts to riparian vegetation is covered by AQ014, AQ035, AQ037, SI001, SI003, SI023, and SW008-9 while protecting stream shade is included in AQ032-34. There also design features for site rehabilitation (SW059-63) and stockpiling materials from uplands for use in streams (SI007).

There are four design features to prevent pollutants from entering riparian areas, waterbodies and aquatic habitats which minimizes the potential effects. These measures range from checking for leaks daily to refueling and staging areas being outside aquatic management zones (AQ003, SW015-16, and SW074). There is one design feature to prevent introduction of disease or aquatic invasive species to any stream or water body (AQ001).

Characteristic 4

Eight of the IRAs contain Mexican spotted owl habitat (either protected activity centers or recovery habitat). A total of 10,740 acres of treatment are proposed in IRAs in Mexican spotted owl habitat. Thinning and prescribed fire is proposed for 2,473 of those acres with the remainder proposed for prescribed fire only. Specific acreages by IRA are included in Table 48 below. General stream restoration is proposed on 23.3 miles of IRAs, in protected activity centers, in the project area. Of these miles, only 0.03 are proposed for heavy mechanical restoration. Short-term disturbance to Mexican spotted owls are expected, however, overall, the effects of treatments would benefit the Mexican spotted owl and its habitat. Treatments in IRAs would put forested stands on a trajectory toward the natural range of variation and making them more diverse, and resilient to disturbances such as fire, disease, insects and climate change. An increase in resiliency would improve IRA characteristic 4 as it pertains to the forest structure, composition, pattern and process thereby benefiting Mexican spotted owl habitat. Additional analysis for this species is located in the terrestrial wildlife section of the FEIS.

The threatened Colorado spinedace and its critical habitat are present in four IRAs. Habitat for the threatened Chiricahua leopard frog is available, but the species is not present. Long term benefits from mechanical treatments include reduced uncharacteristic fire risk and road density. General stream

restoration would have a long-term benefit of improves riparian vegetation structure and function, bank stability, and stream shade. Heavy mechanical stream restoration has negative impacts to individuals and increased sedimentation during implementation, but immediate and long-term benefits of improved stream habitat and stream function. These activities provide for long term habitat, population viability and species recovery, therefore improving IRA characteristic 4. Addition analysis for these species is present in the aquatics section of the FEIS (volume 1).

Characteristic 5

The long-term inventoried roadless area characteristics are not expected to change as a result of vegetation management activities, or other proposed actions. Overall, proposed activities would have only limited, short-term impacts on the visitor experience. None of the proposed activities would result in a permanent change in the condition of the area or its potential to be included in future inventories. Long-term benefits to recreation setting due to forest restoration, more resilient forest conditions, and a reduced risk of severe wildfire in the future.

Proposed treatments would diminish the risk of large, highseverity, catastrophic fires that could result in forest closures. This could impact visitor's trip itineraries but would not change the recreation opportunity spectrum. No roads would be built as indicated in design features (Appendix C). The proposed activities would help preserve the natural appearing character of the landscape and lessen the risk of loss in the event of a wildfire. The inventoried roadless character would be protected and possibly enhanced.

Portions of the Arizona Trail occur in the Mazatzal IRA. Design features (Appendix C) specifically for the minimization of impacts to the Arizona Trail and recreationalists would reduce impacts. Specially, these design features include: coordination with recreation staff to provide additional scenic integrity guidelines (RS001), protection of the trail during prescribed burning control line establishment and mitigation of adverse effects (RS004), minimal marking of trees in the Arizona Trail corridor and avoiding using the Arizona trail as a boundary (RS006), meetings with the Arizona Trail Association in the planning stages (RS006), treatment of the edges of thinning areas to maintain scenic integrity (RS006), emphasis for slash treatment and road decommissioning (RS010), not allowing skid trails to be established (RS010), eliminating jackstraw treatments within the line of sight or 300 feet from the trail (RS012), notification of trail detour routes during operational closures (RS015), and slash treatment pull-back near national trails (RS016).

Characteristic 6

No treatments would occur within the Sierra Ancha Experimental Forest in the Sierra Ancha Wilderness Contiguous IRA. No treatments that would occur within the Upper Forks Parker Creek Research Natural Area in the Sierra Ancha Wilderness Contiguous IRA. Therefore, there would be no impacts to Characteristic 6.

Characteristic 7

IRA treatment alternatives would have short term direct impacts to roadless resources during project implementation such as increased presence of people and smoke, charred bark of standing trees and down logs, and a blackened appearance to the ground plane and burned understory plants with prescribed fire treatment. Burn piles would also be evident on the landscape in the short term until they are burned for all action alternatives. The visual effects would be reduced within two years, with the regeneration of ground cover plants and the deposition of forest litter over the burned sites.

The conventional mechanical treatments typically have moderate short-term effects on scenery. There would be a low to moderate effect on scenic quality during and immediately following mechanical

treatment methods. The presence of skid trails, landings, or scattered slash would result in a moderate reduction of the scenic quality until harvesting activities are completed, and design features are implemented. The effects in these areas would be short-term (lasting 1 to 5 years after treatment) because skid trails would be rehabilitated and activity-generated slash would be treated or removed to be utilized. The ground disturbance resulting from using machines to pile slash would be noticeable for one to three years after project completion, depending on how quickly the areas revegetate. Scraped trees would heal or scars would become less noticeable over time. Within inventoried roadless areas, mitigation would help maintain the roadless area characteristics of primitive, semi-primitive nonmotorized and semi-primitive motorized classes of dispersed recreation. Design features and the land management plans have criteria specific to IRA's and High Scenic Quality areas to help preserve the scenic integrity of the IRA's. Stumps are typically flush cut or left no more than eight inches high, slash would be treated, removed, and existing and natural barriers would be used as control lines to mitigate the effects on scenery. The effects for each treatment type are described in detail in the Chapter 3 Scenery section of the FEIS under Alternative 2 Mechanical Treatment and Burning. The effects would occur within each IRA and would vary in degree depending on the number of acres treated per treatment type highlighted in the tables below (Table 48 and Table 49). An indirect effect of proposed activities could be displacement of visitors to untreated areas for recreation, mostly because of visuals. However, this effect would last for about 1 to 2 years after treatment activities when green-up would occur.

Visitors adjacent to the IRA treatment areas, including those on the boundary of wilderness and IRA treatment areas would expect to observe the presence of workers and the sights and sounds of project work occurring within the IRAs. The sounds of equipment may be audible until visitors travel further into the interior of adjacent wilderness or away from the IRA treatment areas. These effects are expected to be short term and only persist near the IRA treatment areas. Smoke from prescribed fire would likely be a short-term effect in these locations as well.

Management activities focus on restoring the characteristics of ecosystem composition and structure, such as to reduce the risk of uncharacteristic wildfire effects, within the range of variability that would be expected to occur under natural disturbance regimes of the current climatic period.

The proposed treatments would address the purpose and need of the project, resulting in a more diverse, and resilient and sustainable forest ecosystem with a reduction in risk of negative impacts from wildfire. The long-term forest health and resiliency would be most improved under Alternative 2 and Alternative 3 than Alternative 1 due to the development of a less homogenous forest, more diversity of species, and a mosaic of age classes. Short-term effects from prescribed fire and mechanical treatment to scenic quality would be apparent in the landscape as described above and below under Alternative 2. In the long term, treated areas would be more resilient to wildfire, and other natural disturbances, which would more likely maintain the quality of soil, water, and air in the future.

Characteristic 8

The effects to traditional cultural properties and sacred sites with the affected IRAs have not been identified yet. General effects to cultural resources are described in the Cultural Resources Specialist Report and the FEIS. The Tribal Relations section of the FEIS details the extensive tribal consultation that has occurred for this project and a list of the tribes consulted can also be found in this section.

Prior to project implementation, cultural resources inventories would be conducted. Tribal consultation would be conducted after the cultural resources inventories are complete and a determination has been made if there are cultural resources, or properties eligible as traditional cultural places, sacred sites or other sites or resources of tribal concern that would require mitigation. The Design Features (Appendix C

– CT001-CT019) and Implementation Plan (Appendix D) would be followed to limit potential effects to properties and resources of Tribal concern. Typical mitigation may include flag and avoid, hand treatments like lop and scatter and light burning.

Characteristic 9

Other than those described above for other unique characteristics, treatments within eligible wild and scenic rivers (see Characteristic 1: Water and 3: Aquatics) would be conducted to maintain the outstandingly remarkable values of the segments. Design features criteria specific to eligible wild and scenic rivers to help preserve the outstandingly remarkable values include locating landings, in-woods processing sites, and skid trails outside of eligible Wild and Scenic Rivers (RS010), placing emphasis on slash treatment in the eligible Wild and Scenic River corridors (RS010), removing, burning, or chipping debris and root wads (RS011), restrictions on stump heights (RS013), use of existing barriers or natural barriers for control lines (RS013), and limitation of tree cutting within eligible or suitable wild river segments on the Apache-Sitgreaves National Forests (RS022). Specifically, design feature RS021 states "All restoration activities within eligible or suitable wild and scenic river corridors would be designed to protect or enhance the free-flowing character and outstandingly remarkable values (ORVs) of rivers, and to maintain the rivers' current inventoried classifications (wild, scenic, or recreational), unless a suitability study is completed that recommends management for a less restrictive classification (See RS022)." No treatments would occur with wilderness areas. Important bird areas and wildlife quiet areas would be preserved by silvicultural and prescribed burn prescriptions that are designed to restore the habitat and preserve characteristics that are important to wildlife species that evolved there such as large trees and snags, canopy cover, course woody debris, with abundant shrub and herbaceous cover. Comprehensive restoration would further benefit these areas to restore riparian, stream channel, wet meadow, and other important features for wildlife species.

Alternative 2 – Modified Proposed Action

Table 48. Proposed treatments within IRAs for Alternative 2

Inventoried Roadless Area	Mechanical Thinning and Prescribed Fire (acres)	Prescribed Fire Only (acres)	General Stream Restoration (miles)	Heavy Mechanical Stream Restoration (miles)	Road Decommissioning (miles)
Chevelon Canyon	372	4,816	1.35	0.01	-
Leonard Canyon	725	1,083	10.14	-	-
Barbershop Canyon	460	850	12.13	-	-
East Clear Creek	552	1,058	9.79	0.06	-
Jacks Canyon	1,169	548	-	-	-
Hellsgate	338		0.11	-	-
Mazatzal	316		-	-	0.5
Sierra Ancha Wilderness Contiguous	3,366	1,247	-	-	0.08
Grand Total	**7,298**	**9,602**	**33.52**	**0.07**	**0.58**

See the IRA Specialist Report for treatment maps for Alternative 2.

After treatment, the fire hazard index would be reduced in IRAs, especially within Barbershop Canyon, East Clear Creek, and Chevelon Canyon IRAs (Figure 48). Large wildfires in areas with high fire hazard indexes have a high potential to be difficult and dangerous to suppress and have a high potential for adverse post fire effects. As shown in Figure 49, once fully implemented, treatments are expected to reduce the potential for active and conditional crown fire and move the treated areas toward meeting desired conditions in all IRAs.

Alternative 3 – Focused Alternative

Table 49. Proposed Treatments within IRAs for Alternative 3

IRA Name	Mechanical & Prescribed Fire (Acres)	Prescribed Fire Only (acres)	General Stream Restoration (miles)	Heavy Mechanical Stream Restoration (miles)	Road Decommissioning (miles)
Chevelon Canyon	305	3,961	1.35	0.01	-
Leonard Canyon	339	428	10.14	-	-
Barbershop Canyon	460	850	12.13	-	-
East Clear Creek	552	1,058	9.79	0.06	-
Jacks Canyon	79	20	-	-	-
Hellsgate Wilderness Contiguous	2	-	0.11	-	-
Mazatzal Wilderness Contiguous	-	-	-	-	0.5
Sierra Ancha Wilderness Contiguous	20	5	-	-	0.08
Grand Total	**1,757**	**6,321**	**33.52**	**0.07**	**0.58**

See the Inventoried Roadless Areas Specialist Report for treatment maps for Alternative 3.

The main difference between Alternative 2 and Alternative 3 is the increased acreage in mechanical treatment. Alternative 2 has 7,298 acres of mechanical treatment and Alternative 3 has 1,757 acres. The inventoried roadless character would be protected and possibly enhanced, in IRAs that are treated (see Table 49). The proposed activities would help preserve the natural appearing character of the landscape and lessen the risk of loss in the event of a wildfire, in IRAs that are treated (Table 49). As shown in Figure 48, fire hazard index is reduced in IRAs where treatment would occur. Jacks Canyon, Hellsgate, Mazatzal, and Sierra Ancha Wilderness Contiguous IRAs would receive few to no mechanical and prescribed fire treatments, fire index as compared to Alternative 1 represents no change, to a very minimal change. The same is true for these IRAs for potential fire behavior as shown in Figure 49.

Land Management Plan Amendment Substantive Requirements

One project-specific plan amendment is proposed for the Rim Country Project. This plan amendment includes three exceptions to the 1985 Tonto National Land Management Plan standards and guidelines so new controls and technologies can be utilized where appropriate (see Appendix B for the full amendment text). Exception 1 clarifies existing direction related to managing canopy cover and interspace in the Land Management Plan. The purpose of exception 1 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 and other cover types in the Southwest. Exception 2 brings alternatives 2 and 3 into alignment with the revised Mexican Spotted Owl Recovery Plan and defers monitoring to the USFWS biological opinion that is specific to this project. Exception 3 removes the language related to 40 percent slopes and the language identifying slopes above 40 percent as inoperable, to allow mechanical treatments with new methods and equipment to treat in those areas.

The 2012 Planning Rule requires consideration of the applicable substantive requirements as described in 36 CFR 219.8 through 219.11 that are directly related to the plan direction being added, modified, or removed by the amendment (36 CFR 219.13). The responsible officials have determined the one proposed amendment, with three exceptions, is directly related to the following substantive requirements:

§219.8 Sustainability

(a)(1)(vi) Ecological Sustainability, Ecosystem Integrity, Opportunities for Landscape-Scale Restoration;

(a)(2)(i) Air, Soil, and Water, Air Quality;

(a)(2)(iii) Air, Soil, and Water, Water Quality;

(b)(2) Social and Economic Sustainability, Sustainable recreation; including…scenic character; and

(b)(3) Social and Economic Sustainability, Multiple uses that contribute to local, regional, and national economies in a sustainable manner.

§219.9 Diversity of Plant and Animal Communities

(a)(1) Ecosystem Plan Components, Ecosystem Integrity; and

(b)(1) Additional Species-Specific Plan Components, Provide the ecological conditions to contribute to the recovery of federally listed threatened and endangered species.

Evaluation of Substantive Requirements

The effects of the proposed amendment disclosed in this chapter, reflect the effects analysis for the respective resources and substantive requirements related to the amendment, and were informed using the best available scientific information, scoping, effects analysis, monitoring data, or other rationale.

36 CFR 219.8 Sustainability

Per 36 CFR 219.8, "a plan developed or revised under this part must provide for social, economic, and ecological sustainability within Forest Service authority and consistent with the inherent capability of the plan area…" Specifically, the activities that would be authorized by the amendment could potentially influence protections for:

a. Ecological sustainability including ecosystem integrity to include structure, function, composition, and connectivity of terrestrial and aquatic ecosystems and watersheds; air quality; and water quality and resources.

The proposed amendment would not result in substantial adverse effects associated with the sustainability requirement nor would the proposed amendment substantially lessen protection for a specific resource or use associated with social, economic, or ecological sustainability. As a result, the proposed plan amendment is consistent with the sustainability requirements at 36 CFR 219.8.

The project activities would positively impact ecosystem integrity, terrestrial and aquatic ecosystems, watersheds, and air quality and result in beneficial impacts to air quality, soils, watersheds, and native vegetation. Overall forest health and resilience in the project area would improve over the long term reducing the hazards associated with undesirable fire effects and increasing forest and grassland resilience and sustainability. Project activities would improve terrestrial and aquatic species habitat and improve the condition and function of streams and springs. They would also preserve cultural resources, support sustainable forest products industries, improve the motorized transportation system, and provide for a more sustainable road system where poorly located roads are relocated or decommissioned.

The proposed amendment (which includes three exceptions) would allow the project to be implemented in a manner to support landscape-scale restoration within the 1,240,000-acre project area. The methods for implementing the project would consider the ecological integrity for terrestrial and aquatic ecosystems and watersheds during design, layout and implementation. This benefits not only ecological sustainability but provides long term benefits for social and economic sustainability for the project area's future

Exception 1 would update guidance and direction to ensure consistent management across the three forests within the rim country project area. This would focus on providing habitat conditions that benefit the species based on post-fledging family areas and specific management design features to leave nest areas denser and with larger trees than the surrounding areas. The Rim Country project incorporates desired conditions for restoring fire-adapted ponderosa pine and other cover types in the Southwest.

Exception 2 would create consistency with the 2012 Mexican spotted owl recovery plan and defer monitoring to the USFWS biological opinion specific to this project. Benefits include updating language to be consistent with the revised recovery plan and the other forests; greater flexibility for treatments in Mexican spotted owl habitat; and treatments in Mexican spotted owl habitat are consulted upon with USFWS and have been analyzed across the landscape on all three forests. Restoration activities such as wet meadow and riparian treatments, thinning, and the use of prescribed fire throughout the project and specifically in within Mexican spotted owl habitat would result in beneficial impacts to air quality, soils, watersheds, and native vegetative communities. Overall, restoration activities within Mexican spotted owl protected activity centers would improve forest health and resilience in a larger portion of the project area over the long term, thereby reducing hazards associated with undesirable fire effects.

Exception 3 would remove the limitation on the use of mechanical equipment for slopes greater than 40 percent. Benefits of using specialized mechanical equipment to restore steep slopes include more flexible management by including new methods to restore the forested cover types. The 40 percent slope restriction was based on the previous Mexican spotted owl recovery plan which is no longer in use and this exception allows the forests to incorporate best available scientific information.

By allowing treatments on steeper slopes the project also has long term beneficial impacts to vegetation, air quality, soils, and watersheds due to reducing stand density and crown fire potential thus reducing higher severity wildfire. Improved watershed functions would be expected to also improve water quality

and riparian areas within project area. Long-term beneficial impacts to vegetation communities, air quality, soils, and watersheds would result because uncharacteristic wildfires in the ecological response units in the project area would be mitigated. Furthermore, restoration activities on steep slopes would improve the vigor of residual trees by reducing competition for scarce resources, increasing the resilience of stands to insect and disease risk in a larger portion of the project area, and thereby resulting in improved forest health and watershed functioning.

Furthermore, by allowing mechanized equipment to be used on slopes greater than 40 percent, a larger portion of the project area would be open to the removal of forest products. Increased revenue to the Federal Government and increased income to contractors would be expected as a result of this proposed land management plan amendment, thereby supporting the plan area's contribution to social and economic sustainability.

The proposed amendment exceptions could alter recreation experience, particularly scenery as a result of surface disturbance, smoke and charred vegetation from unplanned and prescribed fires, and long-term changes in vegetation structure and composition. The impacts to scenery and recreational settings would be localized and visible in both the short and long term. Impacts from smoke would be short term; these impacts would dissipate when prescribed fire activities cease. Resulting charred vegetation from fires would be visible in the long term. Scenic quality would be further impacted by the presence of activity slash and temporary roads and skid trails in the short term. These impacts would be reduced by natural vegetation regeneration and site rehabilitation in the long term. Changes to vegetation structure would have long-term, positive effects on scenic quality because improving forest health and resiliency also improves the recreation setting.

By ensuring resilient ecosystems, the project can help to sustain local economic and social wellbeing, promote a sustainable flow of societal benefits, and manage these National Forest System lands to provide enduring ecosystem services and contribute to social and economic stability as well. The proposed action would allow for beneficial economic impacts such as jobs, Federal spending, timber revenues, and income to be recognized by the local communities.

In conclusion, the proposed amendment would not result in substantial adverse effects associated with the sustainability requirement nor would the proposed amendment substantially lessen protection for a specific resource or use associated with social, economic, or ecological sustainability. As a result, this plan amendment is consistent with the sustainability requirements at 36 CFR 219.8.

36 CFR 219.9 Diversity of Plant and Animal Communities

Per 36 CFR 219.9, "a plan developed or revised under this part must provide for the diversity of plant and animal communities, within Forest Service authority and consistent with the inherent capability of the plan area…" Additionally, the plan must support the persistence of most native species in the plan area. Specifically, the activities that would be authorized by the amendment could potentially influence protections for:

b. ecosystem plan components including ecosystem integrity of terrestrial and aquatic ecosystems and watersheds; and

c. species-specific plan components including providing for ecological conditions that contribute to the recovery of federally listed, proposed, and candidate species, and that contribute to the viability of species of conservation concern.

The project analysis includes consideration of substantial adverse impacts to, or substantially lessened protections for, federally listed, sensitive, management indicator, and other plant and animal species that may occur as a result of the amendment in accordance with 36 CFR 219.13(b)(6).

The proposed amendment would not result in substantial adverse impacts to plant and animal communities within the project area, including to those species of conservation concern. Nor would the proposed amendment substantially lessen protection for any plant and animal species. All amendment exceptions support the persistence of native species in the Rim Country project area. As a result, this plan amendment is consistent with the diversity of plant and animal communities as required by 36 CFR 219.9.

Watershed conditions, wildlife habitat, and timber are all resources that would be improved by the proposed amendment. Beneficial impacts to these resources would also improve the associated multiple uses. For example, by improving the watershed conditions and wildlife habitat, there would be increased opportunities for wildlife viewing, improved recreational uses, and sustainable ecosystems. Thinning treatments allowed as part of the proposed amendment could also contribute to traditional cultural uses, forest product industries, rangeland uses because access to such forest products or opening up stands would be desirable.

The proposed amendment would support greater diversity of plants and animal communities through restoration efforts by allowing implementation of needed vegetation treatments across the project area, as opposed to treating smaller portions of the project area. While there would be short-term adverse impacts from the project, the resulting long-term benefits would be a sustainable, resilient forest ecosystem capable of supporting diverse plant and animal communities and multiple uses valued by local communities and visitors.

The project analysis includes consideration of substantial adverse impacts to, or substantially lessens protections for, federally listed, sensitive, management indicator, and other plant and animal species that may occur as a result of the amendment. The interdisciplinary team analyzed impacts to plant and animal communities through specialist reports including the terrestrial and aquatic wildlife biological evaluation. In addition to these reports, a biological assessment was completed to support Endangered Species Act Section 7 consultation with the U.S. Fish and Wildlife Service regarding potential effects on the federally listed species: the Mexican spotted owl (*Strix occidentalis lucida*).

Stand-replacing fire has been defined as a major threat to the Mexican spotted owl and its critical habitat. The proposed amendment to allow restoration activities, including vegetation thinning and the use of prescribed fire to improve ecological conditions for the species. The proposed amendment would help the project area trend toward having a more diverse stand structure to meet the desired conditions for Mexican spotted owl, as defined in the 2012 recovery plan; thereby making the species' habitat more resilient to future wildfires as well as insect and disease infestations.

The proposed restoration treatments are intended to shift the mixed conifer ecological response units toward trending to meet conditions more desirable for the persistence of Mexican spotted owl habitat as well as more resilient toward wildfire. The project includes restoration activities in upland areas while resource protection measures were designed to minimize or avoid activities that would result in negative impacts to the Mexican spotted owl individuals and habitat.

For migratory birds, the activities associated with the proposed amendment such as allowing for mechanized treatment on slopes greater than 40 percent, treatment within protected activity centers and

northern goshawk habitat, and treatments within other essential habitat for federally listed species, would result in short-term negative impacts as well as long-term beneficial impacts to migratory birds. In the short-term the proposed amendment would allow for restoration treatment that may disturb nests and disrupt courtship of nesting pairs. However, the proposed amendment is expected to provide better habitat for migratory birds by creating openings and enhancing the development of large trees.

The analysis in chapter 3 addresses how the proposed amendment contributes to ecosystem integrity of terrestrial ecosystems and watersheds within the project area. The proposed amendment would result in long-term beneficial conditions for animal communities. Similarly, for plant communities, the proposed amendment would allow for restoration treatment that would result in long-term beneficial conditions for plant species because restoration activities would improve watershed health, the hydrologic function of springs and wetlands would be enhanced, and plant species habitat within and adjacent to treatment areas.

In conclusion, the proposed amendment would not result in substantial adverse impacts to plant and animal communities. Nor would the proposed amendment substantially lessen protections for any plant and animal species as it supports species persistence in project area. As a result, this plan amendment is consistent with the diversity of plant and animal communities as required by 36 CFR 219.9.

Unavoidable Adverse Effects

Though both action alternatives (Alternatives 2 and 3) were designed to move resources toward desired conditions, implementation of either one would result in some unavoidable, short-term, adverse effects. At the same time, implementation of Alternative 1, the no action alternative, would also result in some unavoidable, short-term, adverse effects from forest management activities that are part of other projects and from wildfires that may occur within or near the Rim Country project area.

Adverse effects from implementation of either of the action alternatives would be limited in extent and duration by ensuring that management activities are consistent with standards and guidelines from the land management plans and proposed amendment. Project design features, found in Appendix C, along with mitigations and protocols in Appendix J of the Programmatic Agreement between the Southwestern Region of the Forest Service, the Arizona, New Mexico, Texas and Oklahoma State Historic Preservation Offices and the Advisory Council on Historic Preservation, would apply to both action alternatives and would provide additional means and mitigations to avoid or minimize adverse effects while still meeting the purpose and need of the project.

Implementation of activities in both action alternatives could result in some of the following unavoidable, short-term, adverse effects (further details can be found in the respective resource sections of this chapter):

1. Individuals of some threatened and endangered species, as well as some sensitive species, may be harmed. Habitat for certain species may be temporarily adversely affected.
2. Short-term disturbances to grasses, forbs, shrubs, and small trees may occur.
3. Air quality may temporarily decrease.
4. Erosion and soil compaction may temporarily increase.
5. Water quality may be temporarily affected.
6. Cultural artifacts, features, and sites may be disturbed or damaged.
7. Tribal access to Traditional Cultural Properties and forest products may be temporarily hindered during implementation of treatments.

8. Temporary decreases in access to recreation opportunities and deviations from scenic integrity objectives may occur.
9. Forage availability may decrease temporarily.
10. Noxious weed infestation may increase.

None of the alternatives has expected energy requirements or conservation potential (40 CFR 1502.16(e)).

Natural or depletable resource requirements and conservation potential of various alternatives and mitigation measures, as well as means to mitigate adverse environmental effects are discussed in the resource sections of this chapter and in Appendix C (40 CFR 1502.16(f)).

None of the alternatives would affect the design of the built environment. The effects of implementing the alternatives on urban quality and historic and cultural resources (40 CFR 1502.16(g)) are displayed in the Fire Ecology and Air Quality, Tribal Relations, and Cultural Resources Reports and the corresponding sections of this chapter.

There could be short-term, temporary effects on land special uses and mineral projects as site-specific restoration activities were implemented. For example, access to sites may be temporarily restricted while thinning or burning was occurring. The duration of these effects would be only as long as the site-specific activities were occurring – for example, the amount of time that thinning was occurring in the vicinity of a particular permit area or mineral site. Prior to any site-specific implementation, the Forest Service would work with affected permit or claim holders to determine site-specific concerns, such as timing restoration activities to avoid periods of high use or access need by the permit holders. Such mitigation would minimize potential adverse effects on these resources.

Short-term Uses and Long-term Productivity

The National Environmental Policy Act (NEPA) requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101). Consistent with the Multiple-Use Sustained-Yield Act of 1960 (16 U.S.C. 528-531), the Forest Service manages each national forest to sustain the multiple use of its renewable resources in perpetuity while maintaining the long-term health and productivity of the land. Land management plans guide sustainable, integrated management of the resources within the plan area in the context of the broader landscape, giving due consideration to the relative values of the various resources in particular areas (36 CFR 219.1(b)).

By ensuring that proposed treatment activities and design features in both action alternatives move resources toward desired conditions in a manner consistent with land management plan direction, the long-term productivity of the land would not be impaired by short-term uses associated with implementation of either action alternative. All potential short-term disturbances would be evaluated and mitigated at a site-specific level prior to implementation. This disclosure focuses on soils, water, and vegetation resources. More detailed discussions related to short-term uses and long-term productivity can be found in the effects analysis sections for the individual resources earlier in this chapter and in individual resource specialist reports.

Soils and Water

Implementation of Alternative 1, the no action alternative, would not directly affect soil and water productivity and quality, though it would result in continued loss of soil productivity on, and erosion from, roads that would be decommissioned by implementation of either of the action alternatives. It would do nothing to avoid or decrease undesirable effects on soils and water quality from future wildfires.

Restoration treatments and associated activities, including prescribed fire, in Alternatives 2 and 3 would result in some ground disturbance and would produce short-term, localized effects to soil productivity and water quality. Long-term benefits of treatments in both alternatives would include avoiding or decreasing undesirable effects on soils and water quality from future wildfires and improving overall soil retention and water quality in degraded watersheds. Because of the larger area over which mechanical thinning and prescribed fire treatments would be implemented in Alternative 2, both the short-term effects and long-term benefits to productivity would be greater than those from activities in Alternative 3. Both action alternatives would decommission equal mileages of forest system and unauthorized roads, leading to positive long-term benefits on soil productivity and water quality in the areas around those roads under either alternative.

Vegetation

Alternative 1 would not directly result in short-term effects on the productivity of vegetation. At the same time, it would not address the problems of stagnant tree growth and mortality, or susceptibility to fire and insect or disease outbreaks. Thus, it would be expected to lead to declining productivity, if not outright losses of over- and understory species from stand-replacing wildfires and insect or disease outbreaks over the long term.

Implementation of either action alternative would lead to short-term effects on and mortality of vegetation from disturbances associated with implementing restoration treatments. However, restoration treatments would reduce inter-tree competition, improve growth and vigor of residual trees, and increase understory productivity and diversity, including of shade-intolerant species. These treatments would also improve resistance and resilience to wildfires, climate change, and insect and disease outbreaks, thus maintaining or enhancing the long-term productivity of restored ecosystems.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be undone, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time, but are reversible, such as the temporary loss of canopy cover in forested areas that are kept clear for use as a power line right-of-way or road. See discussions of environmental consequences for individual resources earlier in this chapter for more detail.

A likely outcome of Alternative 1 would be one or more high-severity stand-replacing wildfires in the project area. Post-fire effects on resources that require decades or longer to recover would constitute irretrievable commitments of those resources in the short term and potentially the long term. For example, topsoil, which is critical to healthy surface vegetation, would take centuries to fully recover. Likewise, the loss of old and large trees would be irretrievable and would require many decades, if not centuries, to recover. Given uncertainties of the effects of climate change and the possibility of post-fire vegetation type conversions from forest to non-forest, the loss of entire stands to wildfires could represent an irreversible commitment of those resources. Cultural resources are non-renewable, and direct damage from high-severity wildfires, such as spalling of rock art or cracking of artifacts, would represent an irreversible commitment of those resources. In addition, indirect effects of high-severity wildfires on

cultural resources, such as damage from bulldozers used during suppression operations, or exposure following post-fire erosion, can lead to irreversible degradation or losses of cultural resources.

Alternative 1 would not result in additional road decommissioning within the project area beyond what may occur as part of other projects or management activities. Relative to the action alternatives, both of which would include decommissioning of up to 490 miles of existing system roads and 800 miles of unauthorized roads, the lost soil and vegetation productivity associated with continued use of these roads in Alternative 1 would represent an irretrievable commitment of these resources.

Alternatives 2 and 3 include mechanical thinning and prescribed burning on approximately 953,130 and 529,060 acres, respectively. Potential cultural resource damage from thinning, burning, and related activities would represent an irreversible commitment of these resources. Design features and established mitigation measures and protocols would help avoid and minimize potential negative effects on cultural resources.

Alternatives 2 and 3 include the construction of up to 330 and 170 miles of temporary roads, respectively. Decreases in soil and vegetation productivity while these roads are used would represent irretrievable commitments of resources. Inadvertent damage to cultural resources from construction and use of temporary roads would be an irreversible commitment of these resources. Design features, along with established mitigation measures and protocols to protect cultural resources, would help avoid and minimize potential negative effects of construction and use of temporary roads. Temporary roads would be decommissioned when restoration work is completed in the areas to which they provide access.

Alternatives 2 and 3 include the proposed expansion of 11 existing rock pits to provide adequate sources of road surfacing material for project-related activities. The expansion of these pits would represent an irretrievable commitment of resources due to the removal of developed soils needed for vegetative growth on approximately 29 acres. The differences in soil productivity within the pit and in the surrounding area would be distinct and unavoidable, though effects on other resources would be mitigated by using design features. The loss of productive topsoil from rock pit expansion would be offset by decreases in soil erosion on and along roads from the proper maintenance of road surfaces to manage runoff.

Alternatives 2 and 3 include the potential for creation of up to 12 in-woods processing and storage sites to facilitate more utilization of forest resources, increase transportation efficiencies, and reduce implementation costs. The surface area for all 12 processing sites would be 127 acres, with individual sites ranging in size from four to 21 acres. Sites were chosen to minimize potential effects on soils and water quality, and design features were developed to further mitigate potential effects on these and other resources. Nonetheless, the clearing and preparation for use of any of these sites would result in irretrievable commitments of vegetation and soil productivity resources, because vegetation would be cleared and topsoil displaced and compacted if any of these sites are used.

The effects on lands and lands special uses would occur only during the implementation of this project. Once the project was complete, effects would cease. The long-term benefit to structures located on non-National Forest Service lands and those authorized by special use permits would be a reduced risk of uncharacteristic fire behavior.

The effects on minerals would be permanent, as consumption of non-renewable mineral resources under this project would remove the availability of these resources in the future.

Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs "To the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with… other environmental review laws and executive orders."

1. Implementation of restoration activities, temporary road construction, and road decommissioning may require Section 404 permits from the U.S. Army Corps of Engineers and/or Section 401 permits from the Arizona Department of Environmental Quality (ADEQ) or tribes, as required by the Clean Water Act, if they involve dredging or discharging fill into waters of the U.S., or if they may result in discharges to state or tribal waters.
2. In-woods processing and storage sites would likely be regulated as industrial sites subject to permitting under ADEQ's Multi-Sector General Permit program. This permit program requires that certain industrial facilities implement control measures and develop site-specific stormwater pollution prevention plans to comply with Arizona Pollutant Discharge Elimination System (AZPDES) requirements.
3. All operators at rock pit sites must have or obtain coverage under an Arizona Pollutant Discharge Elimination System permit and establish and implement a stormwater pollution prevention plan, if required, to comply with state water requirements based on the magnitude of the specific rock pit operation.
4. Permits for installation of aboveground storage tanks at in-woods processing sites, and for temporary fuel storage tanks used to implement restoration treatments would have to be obtained through the Arizona State Fire Marshall's Office.
5. Petroleum storage in aboveground containers with a total aggregate capacity of 1,320 gallons or more, would be subject to the Spill Prevention, Countermeasures, and Contingency (SPCC) Rule and an SPCC plan would be required (40 CFR Part 112).
6. Best management practices would be implemented and monitored for all activities with the potential to impair water quality in accordance with the intergovernmental agreement between ADEQ and the Forest Service Southwestern Regional Office to control and manage nonpoint source pollution.
7. All prescribed burning would be coordinated daily with ADEQ to comply with state and federal regulatory requirements and to ensure ADEQ is aware of potential smoke impacts to receptors. Burning would not take place without prior approval from ADEQ.
8. The U.S. Fish and Wildlife Service, in accordance with the Endangered Species Act regulations for projects with threatened or endangered species, provided informal project design input as the alternatives were developed. Formal consultation was initiated on April 26, 2021.
9. Current denning/rendezvous site locations of Mexican gray wolves and any necessary changes to planned restoration activities due to proximity to those sites would be determined through coordination with the Mexican Wolf Interagency Field Team.
10. If cultural sites are found during pre-implementation surveys or during activity implementation, the Forest Service would follow guidance found at 36 CFR 800.12 and in the Programmatic Agreement between the Southwestern Region of the Forest Service, the Arizona, New Mexico, Texas and Oklahoma State Historic Preservation Offices and the Advisory Council on Historic Preservation. Implementation of this guidance is done in consultation with the Arizona State Historic Preservation Office and tribes, if appropriate, and an effort is made to minimize effects to the discovery.

11. In accordance with the National Historic Preservation Act (NHPA), Executive Order 13175, the Programmatic Agreement, and other regulations and policies, the Tonto Tribal Liaison has begun government-to-government consultation for the Rim Country project. Consultation with Native American tribes on the Rim Country project was initiated on August 16, 2016 and would continue throughout the project's life span.
12. Appendix J of the Programmatic Agreement is a protocol for large-scale fuels reduction, vegetation treatment, and habitat improvement projects developed in consultation with and signed by the Regional Forester, all four State Historic Preservation Offices, and the Advisory Council. Appendix J describes the methods to be used to achieve a No Adverse Effect determination for the Rim County analysis as a whole, while providing a strategy for a phased NHPA Section 106 evaluation for individual task orders.
13. Individual task orders, or undertakings, would be inventoried when each specific project area is identified. A NHPA Section 106 report would be produced for each proposed individual undertaking, and all consultation with the Arizona State Historic Preservation Office and appropriate tribes would be completed prior to implementing the task order.

See Appendix I. Law, Regulation, and Policy for more information on applicable laws, regulations, and policies.

Chapter 4. List of Preparers and Contributors

The following personnel were involved in preparation of the final environmental impact statement (FEIS).

Preparers and Contributors

Table 50. Rim Country FEIS preparers and contributors

Name	Title	FEIS/DEIS Contribution	Education and Experience
Aaron Fargo	Landscape Architect, Enterprise Program	FEIS, Scenery	M.L.A., University of Michigan, 2013. Years of Experience: 6
Alex Seung	Support Service Specialist	FEIS	*
Allison Borchers	Economist, Enterprise Program	FEIS, Socioeconomics and Environmental Justice	PhD, Economics (2010), MS, Resource Economics (2006), University of Delaware; Years of Experience: 11
Annette Fredette	(Former) 4FRI Planning Coordinator, Interdisciplinary Team (IDT) Leader	IDT Leadership, NEPA/Planning	B.S., Forest Management, Northern Arizona University, 1978. Years of Experience: 27
Bernadette Barthelenghi	(Former) Recreation Program Manager, Apache-Sitgreaves NFs	Recreation and Scenery	B.S., Environmental Planning & Design, Rutgers University, 1991. Years of Experience: 27
Bill Noble	(Former) 4FRI Wildlife Biologist	Wildlife	M.S., Wildlife Sciences and Forest Sciences, Oregon State University, 1994; B.S., Wildlife Biology, University of Montana, 1985. Years of Experience: 26
Bill Overland	Hydrologist, Enterprise Program	FEIS, Soils	B.S., Forestry and Natural Resources with emphasis in forest hydrology, California Polytechnic State University – San Luis Obispo, 1993. Years of Experience : 27
Brady VanDragt	Recreation Planner, Mogollon Rim Ranger District, Coconino NF	Recreation	B.S., Geography, Western Michigan University, 1996. Years of Experience: 21
Cary Thompson	Wildlife Biologist, Flagstaff Ranger District, Coconino NF	Wildlife	B.S., Biology (fish and wildlife emphasis), Northern Arizona University, 1995. Years of Experience: 22
Charlotte Minor	(Former) Landscape Architect, Coconino NF	Recreation and Scenery	M.L.A., University of Arizona; B.S., Forestry, Northern Arizona University. Years of Experience: 26
Christina Akins	Zones District Wildlife Biologist, Tonto NF	FEIS, Wildlife	B.S., Wildlife Habitat Management and Restoration Ecology, Arizona State University - Polytechnic, 2008; Years of Experience 14
Christopher Nelson	(Former) Watershed Program Manager, Apache-Sitgreaves NFs	Hydrology and Riparian Resources, Air Quality	B.S., Watershed Management, University of Arizona. Years of Experience: 39
Christopher Welker	(Former) North Zone Recreation and Lands Staff, Tonto NF	Recreation and Lands	B.S., Forest Management and Spatial Information Management Systems, Colorado State University, 2002. Years of Experience: 15
Clint Dalton	(Former) Archeologist, Tonto NF	Cultural Resources	M.A., Cultural Resource Management, Adams State University, ongoing; B.A, Anthropology, Metropolitan State University of Denver, 2005. Years of Experience: 11
Craig Johnson	(Former) Forest Tribal Liaison, Coconino NF	Tribal Consultation	M.A., Applied Archeology, Northern Arizona University, 1998. Years of Experience: 18

Name	Title	FEIS/DEIS Contribution	Education and Experience
Daniel Kipervaser	(Former) 4FRI Monitoring Coordinator	Monitoring and Adaptive Management Plan	M.S., Ecology, Colorado State University, 2007; B.S., Biology and Environmental Policy, Colby College, 1998. Years of Experience: 15
Dave Dorum	Habitat, Evaluation, and Lands Program Manager, Region I, AGFD	Wildlife/Aquatics	B.S., Wildlife Biology, Arizona State University, 1990. Years of Experience: 28
David Bailey	(Former) GIS Specialist, Tonto NF	GIS, Data Analysis	*
Debra Crisp	(Former) Forest Botanist, Coconino NF	FEIS, Botany	M.S., Forestry, Northern Arizona University, 2004. Years of Experience: 32
Deborah MacIvor	(Former) Forest Engineer, Apache-Sitgreaves NFs	Transportation	B.S., Civil Engineering, University of New Mexico. Years of Experience: 29
Deirde Marx	Lands and Minerals Program Manager, Coconino NF	FEIS, Lands and Minerals	B.S. Forestry, State University of New York, College of Environmental Science and Forestry, 1990. Years of experience: 30
Delilah Jaworski	(Former) Social Scientist, Enterprise Program	Socioeconomics	M.S., Environment and Development, London School of Economics, 2008; B.A., Middle Eastern Studies, George Washington University, 2007. Years of Experience: 10
Denise Ryan	(Former) Archeologist, Payson Ranger District, Tonto NF	Cultural Resources	*
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Esther Morgan	Forest Archaeologist and Tribal Liaison, Apache-Sitgreaves NFs	Cultural Resources	M.A., Bioarchaeology, Arizona State University, 1995; B.A., Anthropology, Humboldt State University, 1989. Years of Experience: 30
Gayle Richardson	Silviculturist, Black Mesa Ranger District, Apache-Sitgreaves NFs	Silviculture	B.S., Forestry, Northern Arizona University, 1981. Years of Experience: 36
Grant Loomis	(Former) Forest Hydrologist, Tonto NF	Watershed and Water Resources	M.S., Hydrology and Water Resources (all but thesis), University of Arizona, 1979. Years of Experience 39
Gregory Schuster	Recreation Program Manager, Tonto NF	Recreation	M.A., Parks, Recreation, and Tourism Management, North Carolina State University; B.S., Geology, University of North Carolina - Wilmington. Years of Experience: 22
Hannah Griscom	Habitat Specialist, AGFD	Wildlife/Aquatics	M.S., Rangeland Ecology and Watershed Management, University of Wyoming, 2007; B.S., Wildlife Biology, University of Arizona, 2000. Years of Experience: 15
Jami Clark	AGFD	Wildlife/Aquatics	*
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Jennifer Wright	Recreation Specialist, Enterprise Program	FEIS, Recreation	M.S., Ecological Planning and Graduate Certificate in Ecological Economics, University of Vermont, 2011; B.S. Forest Management, Université Laval, Québec, 1999. Years of Experience: 18
Jeremy Human	(Former) Forest Fuels Specialist, Apache-Sitgreaves NFs	Fire and Fuels	Fire Ecology and Management Certificate, Northern Arizona University. Years of Experience: 26

Name	Title	FEIS/DEIS Contribution	Education and Experience
Jessica Haas	(Former) Ecologist, Rocky Mountain Research Station	Fire Ecology and Air Quality	M.S., Natural Resource Management, University of Montana, 2010; B.A., Psychology and Anthropology, University of Albany, 2003. Years of Experience: 17
Jill Holderman	(Former) Forest Wildlife Biologist, Tonto NF	Wildlife	M.S., Land Use Planning, University of Nevada - Reno; B.S., Integrated Pest Management, University of Nevada - Reno. Years of Experience: 30
John Souther	4FRI Monitoring Coordinator	NEPA, Monitoring and Adaptive Management Plan	M.S., Geography, University of Wisconsin - Madison, 2014; B.S., Geology, West Virginia University, 2003. Years of Experience: 3
John Wilcox	(Former) Wildlife Biologist, Payson Ranger District, Tonto NF	Wildlife	B.A., Wildlife and Range Management, Texas A&M University, 2001. Years of Experience: 12
Judy Adams	Forest Lands Team Leader, Coconino NF	Lands and Special Uses	B.S. Forestry, Michigan Technological University. Years of Experience: 31
Julie Rowe	Special Uses Program Manager, Coconino NF	Lands and Special Uses	B.A., University of California - Santa Cruz, 1992. Years of Experience: 25
Justin Schofer	4FRI Wildlife Biologist	FEIS, Wildlife	M.S., Biological Science, Northern Arizona University, 2007; B.S., Wildlife and Fisheries Conservation, University of Massachusetts - Amherst, 1998. Years of Experience: 22
Kara Kirkpatrick-Kreitinger	4FRI NEPA Planner	FEIS, NEPA, Inventoried Roadless Areas	B.S., Geosciences, Boise State University, 2013. Years of Experience: 6
Katherine Sánchez Meador	Environmental Coordinator, Enterprise Program	FEIS, NEPA	M.A., New Mexico State University, 1997. Years of Experience 16
Kathleen Sevy	Rangeland Management Specialist, Mogollon Rim and Red Rock Ranger Districts, Coconino NF	Range	B.S., Renewable Natural Resources, University of Arizona, 1985. Years of Experience: 30
Kelly Wolff	Habitat, Evaluation, and Lands Program Manager, AGFD	Wildlife/Aquatics	B.S., Environmental Resources with Wildlife Habitat focus, Arizona State University, 1999. Years of Experience: 19
Kendell Hughes	Rangeland Management Specialist, Black Mesa and Lakeside Ranger Districts, Apache-Sitgreaves NFs	FEIS, Range	B.S., Agriculture, Lincoln University, 1992. Years of Experience: 27
Kenna Belsky	(Former) 4FRI Planning Coordinator, Interdisciplinary Team (IDT) Leader	IDT Leadership, FEIS, NEPA, Planning	M.A.S. Geographical Information Services, B.S. in Urban and Environmental Design, Arizona State University. Years of Experience: 11
Kimber Jones	(Former) Forest Landscape Architect, Tonto NF	Recreation and Scenery	B.S., Landscape Architecture, Iowa State University. Years of Experience: 26
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Name	Title	FEIS/DEIS Contribution	Education and Experience
Mark Nigrelli	4FRI Geospatial Analyst	FEIS, GIS, Data Analysis	GIS Graduate Certificate, University of Northern Arizona, 2011; B.S., Biology/Biopsychology and Cognitive Science, University of Michigan, 2004. Years of Experience: 11
Mary Lata	(Former) 4FRI Fire Ecologist	Fire Ecology, Air Quality	Ph.D., Geoscience, University of Iowa, 2006; M.S., Physical Geography, emphasis on fire and process geomorphology, University of Iowa, 1997; B.S., Interdisciplinary Studies, University of Iowa, 1995. Years of Experience: 20
Matthew Cole	(Former) 4FRI Wildlife Biologist	Wildlife	B.S., Wildlife, University of Minnesota, 1980. Years of Experience: 36
Matthew O'Neill	Forest Fisheries Biologist, Coconino NF	Aquatics	Ph.D., Biology, Northern Arizona University, 2012; M.S., Biology, Northern Arizona University, 2005; B.S., Biology, Florida Institute of Technology, 1999. Years of Experience: 8
Max Wahlberg	(Former) Fire Ecologist, Enterprise Program	FEIS, Fire Ecology, Air Quality	B.A., Environmental Studies, Prescott College, 2004. Years of Experience: 16
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Monica Boehning	(Former) Forest Silviculturist, Apache-Sitgreaves NFs	Silviculture	B.S., Forestry, Northern Arizona University. Years of Experience: 35
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Patricia Ringle	Silviculturist, Payson and Pleasant Valley Ranger Districts, Tonto NF	Silviculture	B.S., Forestry, Northern Arizona University, 2002; Years of Experience: 17
Patrick Moore	4FRI Silviculturist	FEIS, Silviculture	USFS Certified Silviculturist, 2013 to Present; Ph.D., Forest Ecology, Utah State University, 2013; M.S., Forestry, Southern Illinois University, 2006; B.S., Biology, Maryville University, 1998. Years of Experience: 13
Paul Brown	Watershed Program Manager, Apache-Sitgreaves NFs	FEIS, Hydrology and Riparian Resources	M.S., Hydrology, University of Idaho, 1998; B.S., Geology, University of North Dakota, 1993. Years of Experience: 19
Peter Pilles	Forest Archeologist, Coconino NF	Cultural Resources	B.A., Anthropology, Arizona State University, 1967. Adjunct Professor at Northern Arizona University. Years of Experience: 51
Phillip Dobesh	(Former) Wildlife Biologist, Springerville Ranger District, Apache-Sitgreaves NFs	Wildlife	M.S., Wildlife Ecology, University of Nebraska – Lincoln, 2007; B.S., Fisheries and Wildlife, University of Nebraska – Lincoln, 2002. Years of Experience: 10
Randall Chavez	Recreation & Lands Staff, Sitgreaves Zone, Apache-Sitgreaves NFs	Recreation and Lands	B.S., Range Management, New Mexico State University, 1996. Years of Experience: 23
Randy (Lloyd) Fuller	(Former) 4FRI Silviculturist	Silviculture, Flexible Tool Box, Initial Modelling, Existing Conditions, No Action Alternative, Climate	Ph.D., Botany and Forest Pathology, Forest Entomology, and Mycology, Oregon State University, 1979; B.S., Forest Science, Northern Arizona University, 1974. Years of Experience: 35

Name	Title	FEIS/DEIS Contribution	Education and Experience
Richard Adkins	Tribal Programs Manager, Tonto NF	FEIS, Tribal Relations	Ph.D. American Indian History, Western History, Water and Land resources, University of Oklahoma, 2007; MA, Western US History, Europe, Public History, Historic Archaeology, University of Nevada – Reno, 1990; BA, Western History, University of Nevada – Reno, 1988. Years of Experience: 33
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Rob Nelson	Habitat, Evaluation, and Lands Program Manager, Region II, AGFD	Wildlife/Aquatics	B.S., Wildlife Biology, Kansas State University, 2002. Years of Experience: 16
Robbin Bundrock	(Former) 4FRI Planning Coordinator, Interdisciplinary Team (IDT) Leader	IDT Leadership, NEPA/Planning	BS- Forestry-University of Montana-1994; BS Paralegal Studies- Providence University-2000l NEPA Certificate from Utah State University-2003. Years of Experience: 28
Robert Madera	Forest Botanist, Tonto NF	Botany	M.S., Plant Biology and Conservation, Arizona State University, 2016; B.S., Conservation Biology, Arizona State University, 2013. Years of Experience: 6
Robert Rich	Southwestern Region, Forest Operations Specialist	Transportation	M.S., Forestry, University of Montana, 2012; B.S., Forestry, University of Montana, 1980. Years of Experience: 37
Roger Joos	Wildlife Biologist, Mogollon Rim Ranger District, Coconino NF	Wildlife	B.S., Wildlife Science, University of Arizona. Years of Experience: 19
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Steve Rosenstock	(Former) Statewide Coordinator, Habitat Enhancement, AGFD	Wildlife/Aquatics	B.S., Fishery and Wildlife Biology, Colorado State University, 1984; M.S., Fishery and Wildlife Biology, Colorado State University, 1988. Years of Experience: 30
Steven Johnson	(Former) Engineer, Sitgreaves Zone, Apache-Sitgreaves NFs	Transportation	B.S., Civil Engineering, University of Arizona, 1991. Years of Experience: 26
Suzanne DeRosier	Wildlife Biologist, Black Mesa Ranger District, Apache-Sitgreaves NFs	Wildlife	B.S., Zoology, University of Washington, 1985. Years of Experience: 28
Theresa Tanner	(Former) Aquatics Program Manager, Apache-Sitgreaves NFs	Aquatics	M.S., Fisheries Science, University of Alaska - Fairbanks, 2008; B.S., Wildlife Biology, University of Alaska - Fairbanks, 2004. Years of Experience: 19

Name	Title	FEIS/DEIS Contribution	Education and Experience
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Victor Morfin	Forest Fuels Specialist, Coconino NF	Fire Ecology and Air Quality	M.S., Forest Science, Northern Arizona University, 1998. Years of Experience: 29
William Dudley	North Zone Fuels Specialist, Tonto National Forest	Fire Ecology and Air Quality	Fire Ecology and Management Certificate, Northern Arizona University, 2018. Years of Experience: 4

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Several other individuals contributed to development of the DEIS and FEIS by providing data, attending internal planning meetings, or providing content review:

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Chapter 5. Distribution List

Introduction

This chapter lists tribes, agencies, organizations, and persons to whom the final environmental impact statement (FEIS) was provided. Distribution methods include electronic documents posted on the 4FRI Website (http://www.fs.usda.gov/4FRI) and electronic versions mailed via flash drive.

Tribes and Tribal Chapters

As part of this project, the Forest Service consulted with following tribes and tribal chapters who have historic ties and interests in the Apache-Sitgreaves, Coconino, and Tonto National Forests: Fort McDowell Yavapai Nation, Gila River Indian Community, Havasupai Tribe, Hopi Tribe, Hualapai Tribe, Kaibab Band of Paiute Indians, Navajo Nation, Mescalero Apache Tribe, Salt River Pima–Maricopa Indian Community, San Carlos Apache Tribe, San Juan Southern Paiute Tribe, Tonto Apache Tribe, White Mountain Apache Tribe, Yavapai–Apache Nation, Yavapai–Prescott Indian Tribe, Pueblo of Acoma, and Pueblo of Zuni. Eight Navajo Chapters in proximity to the project area – the Alamo, Bodaway/Gap, Cameron, Coalmine Canyon, Dilkon, Lechee, Leupp, Ramah, Tolani Lake, and To'Nanees'Dizi Chapters – and the Dine Medicine Man's Association are also included.

Federal, State, and Local Agencies and Representatives

Federal

Advisory Council on Historic Preservation, Washington, DC

National Oceanic and Atmospheric Administration, Office of Policy and Strategic Planning, Washington, DC

National Oceanic and Atmospheric Administration, Southwest Region Fisheries Habitat Conservation Division, Long Beach, CA

U.S. Army Corps of Engineers, South Pacific Division CESPD-CMP, San Francisco, CA

U.S. Coast Guard, Office of Environmental Management, Washington, DC

U.S. Department of Agriculture, Animal and Plant Health Inspection Service, PPD/EAD, Riverdale, MD

U.S. Department of Agriculture, National Agricultural Library, Beltsville, MD

U.S. Department of Agriculture, Natural Resources Conservation Service, Washington, DC

U.S. Department of Energy, NEPA Policy & Compliance, Washington, DC

U.S. Department of the Interior, Fish and Wildlife Service, Phoenix, AZ

U.S. Department of the Interior, Office of Environmental Policy & Compliance, Washington, DC

U.S. Department of the Interior, National Park Service, Flagstaff, AZ

U.S. Environmental Protection Agency, Region 9, San Francisco, CA

U.S. Federal Aviation Administration, Western-Pacific Region, Lawndale, CA

U.S. Federal Highway Administration, Arizona Division, Phoenix, AZ

U.S. Navy, Energy and Environmental Readiness Division, Washington, DC

Western Area Power Administration, Lakewood, CO

State

Arizona Department of Environmental Quality, Phoenix, AZ

Arizona Department of Forestry and Fire, Flagstaff, AZ

Arizona Department of Transportation, Flagstaff, AZ

Arizona Game and Fish Department, Flagstaff, AZ – Cooperating Agency

Arizona State Historic Preservation Office, Phoenix, AZ

Arizona Junior Senator Martha McSally

Arizona Senior Senator Kyrsten Sinema

Arizona Congressman Tom O'Halleran, Congressional District 1

Arizona Congressman Paul Gosar, Congressional District 4

Local

Apache County, St. Johns, AZ

City of Camp Verde, Camp Verde, AZ

City of Clarkdale, Clarkdale, AZ

City of Cottonwood, Cottonwood, AZ

City of Flagstaff, Flagstaff, AZ

City of Payson, Payson, AZ

City of Sedona, Sedona, AZ

City of Show Low, Show Low, AZ

City of Tusayan, Tusayan, AZ

City of Williams, Williams, AZ

Clarkdale Fire Department, Clarkdale, AZ

Coconino County, Flagstaff, AZ

Eastern Arizona Counties Organization, Show Low, AZ

Gila County, Globe, AZ

Graham County, Safford, AZ

Greenlee County, Clifton, AZ

Mountainaire Community Council, Flagstaff, AZ

Navajo County, Holbrook, AZ

Williams Fire Department, Williams, AZ

Yavapai County, Prescott, AZ

List of Individuals and Organizations

The below individuals and organizations submitted comments during the Rim Country Project scoping period in 2016 and DEIS comments period in 2019. In addition to the individuals listed, 765 others on the project mailing list will receive notification of the release of the FEIS. The full list of people notified is contained in the Rim Country Project record.

4FRI Stakeholder Group

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Chad Hanson, John Muir Project

Danny Smith, Graham County Board of Supervisors

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Garrett Hanks, Trout Unlimited

Gentry Smith, Desert Fly Casters

Greg Dyson, Wild Earth Guardians

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John Hamill, Theodore Roosevelt Conservation Partnership

John Johnson, Flying H Ranch

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Joyce Francis, Arizona Game and Fish Department

Judy Prosser, Bar-T-Bar Ranch

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Nate Reisner, Arizona Department of Transportation

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Peter Steere, Tohono O'odham Nation

Rob Marshall, The Nature Conservancy

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Todd Schulke, Center for Biological Diversity

Tom Mackin, Coconino Sportsmen

Tommie Martin, Gila County Board of Supervisors

Travis Bruner, Grand Canyon Trust

William Baker

Woody Cline

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40 CFR Parts 51 and 52. 40 CFR Part 51 - Requirements For Preparation, Adoption, And Submittal of Implementation Plans. Website Accessed February 2, 2021: https://www.law.cornell.edu/cfr/text/40/part-51.

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Appendix A – Maps

Note: Due to the larger page size for the maps, Appendix A is provided in a separate file. Viewers of the electronic version of the FEIS can find the eleven maps listed under Appendix A – Map Packet on the Rim Country Project page of the 4FRI Planning website at this address: https://www.fs.usda.gov/detail/4fri/planning/?cid=stelprd3837085.

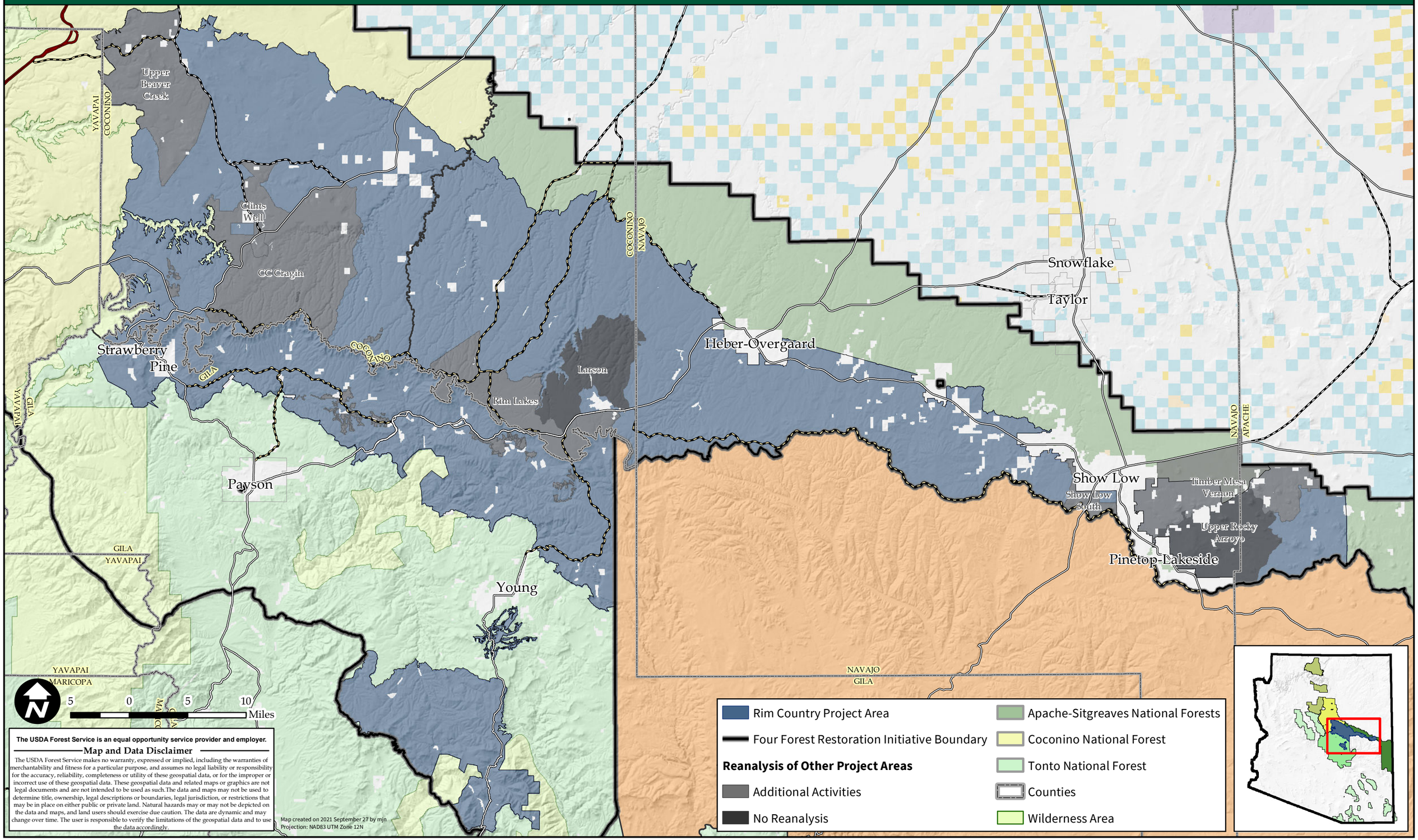
Appendix A includes the following maps:

- Map 1: Project Area
- Map 2: Forest Types
- Map 3: Forest Types within WUI and Critical Infrastructure Buffer
- Map 4: Grassland/Wet Meadow/Riparian Restoration
- Map 5: Stream Restoration
- Map 6: In-Woods Processing Sites
- Map 7: Rock Pits
- Map 8: Alternative 2 – Modified Proposed Action
- Map 9: Alternative 3 – Focused Alternative
- Map 10: Alternative 2 – Modified Proposed Action within WUI and Critical Infrastructure Buffer
- Map 11: Alternative 3 – Focused Alternative within WUI and Critical Infrastructure Buffer

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Project Area



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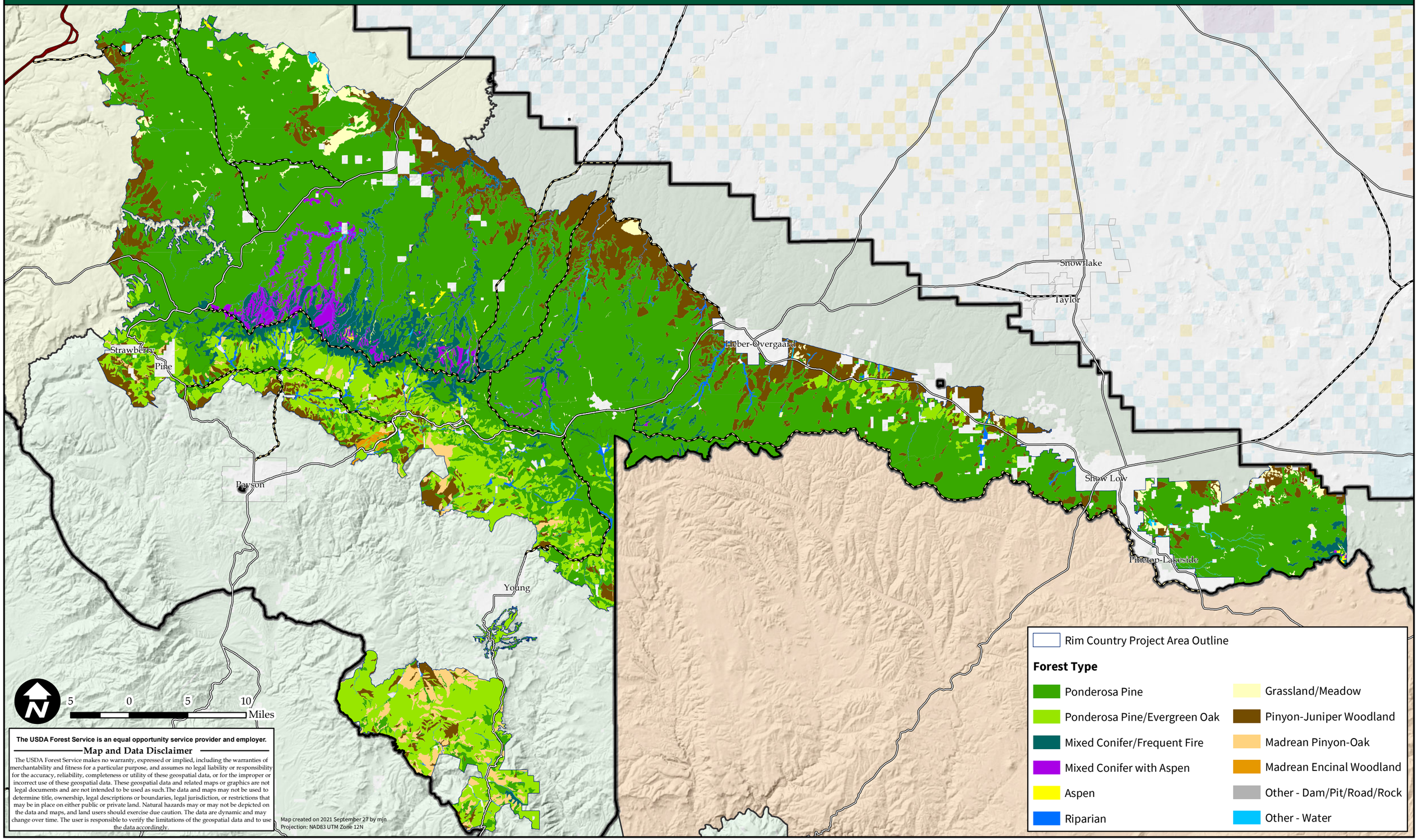
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Forest Types



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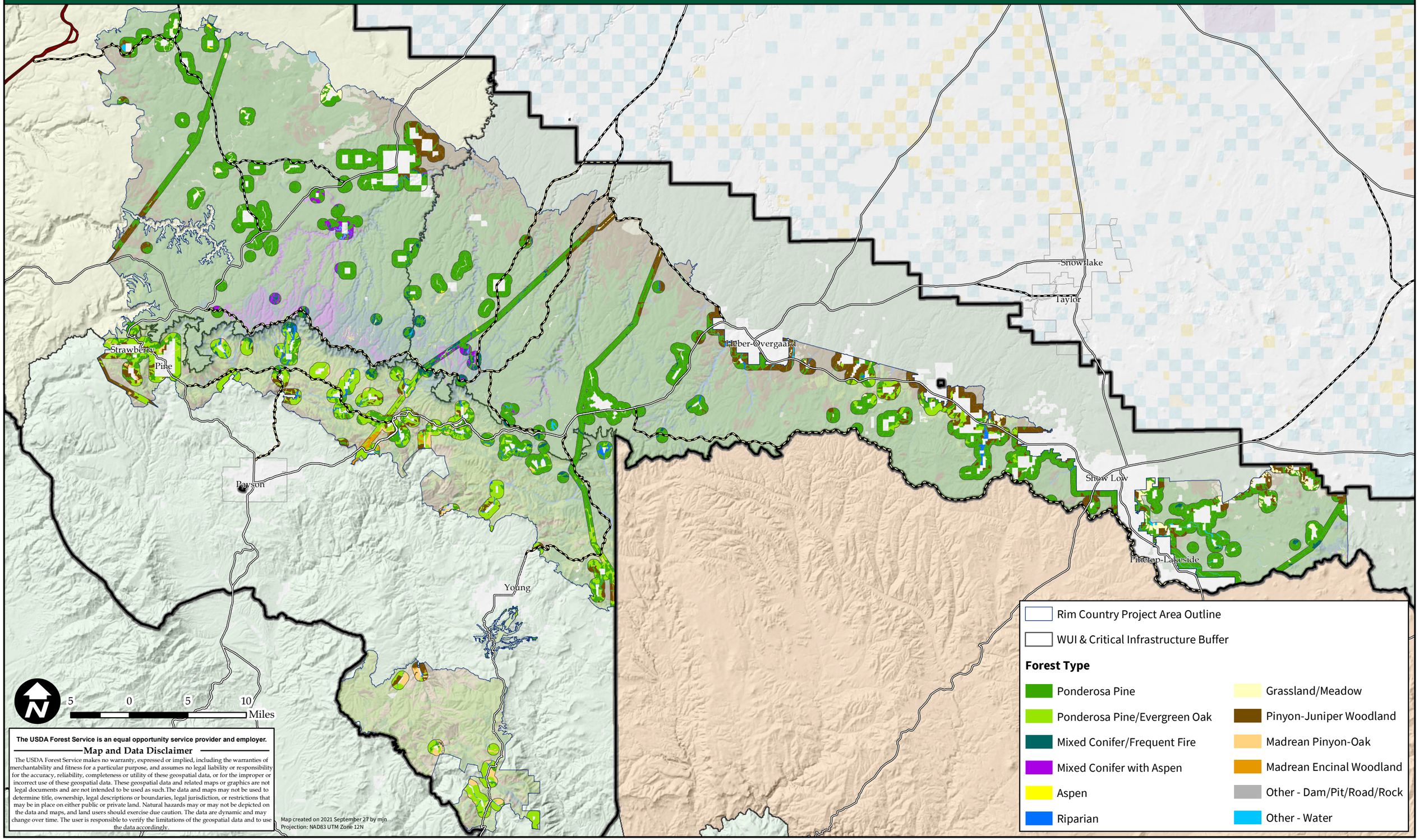
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Forest Types within WUI and Critical Infrastructure Buffer



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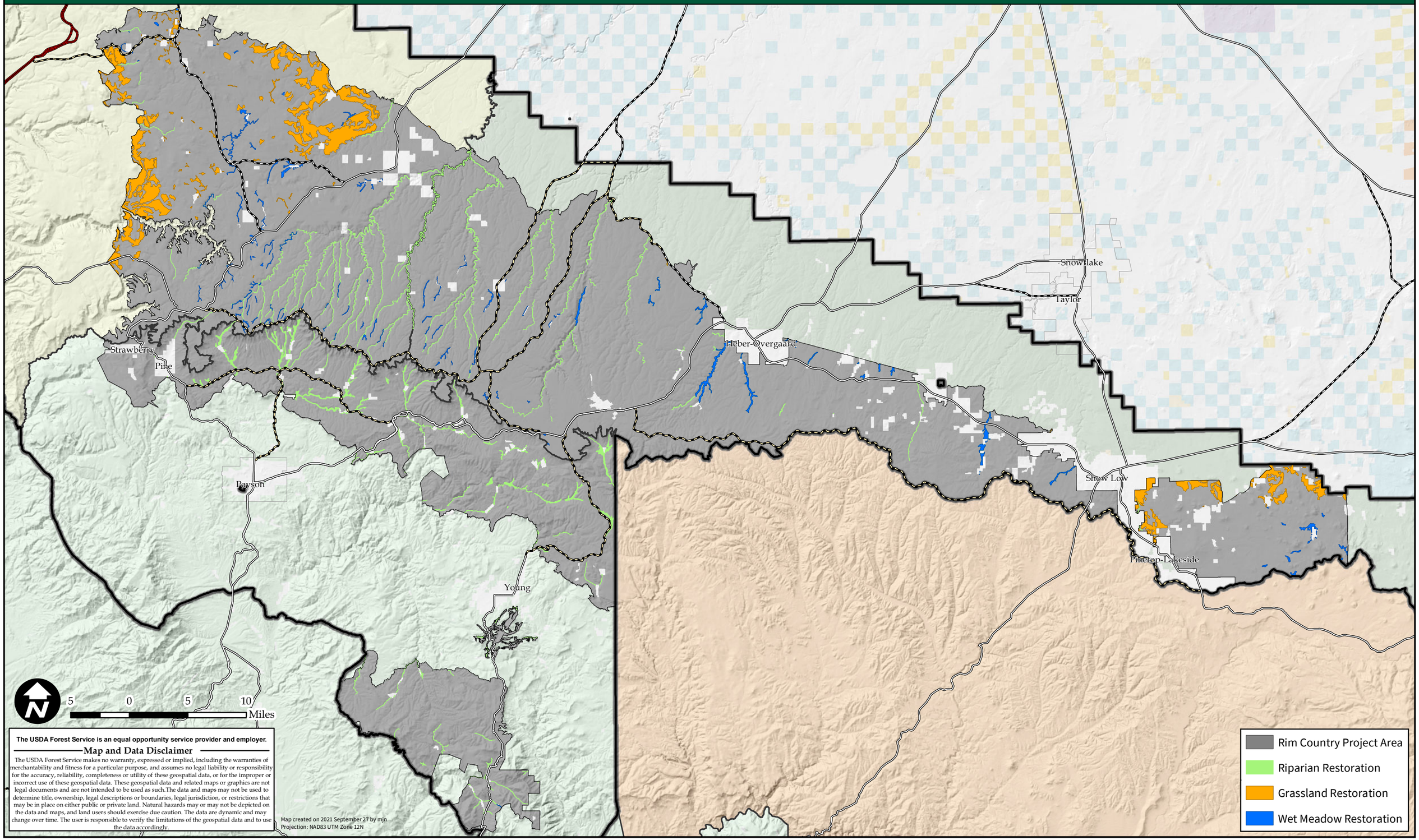
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Grassland/Wet Meadow/Riparian Restoration



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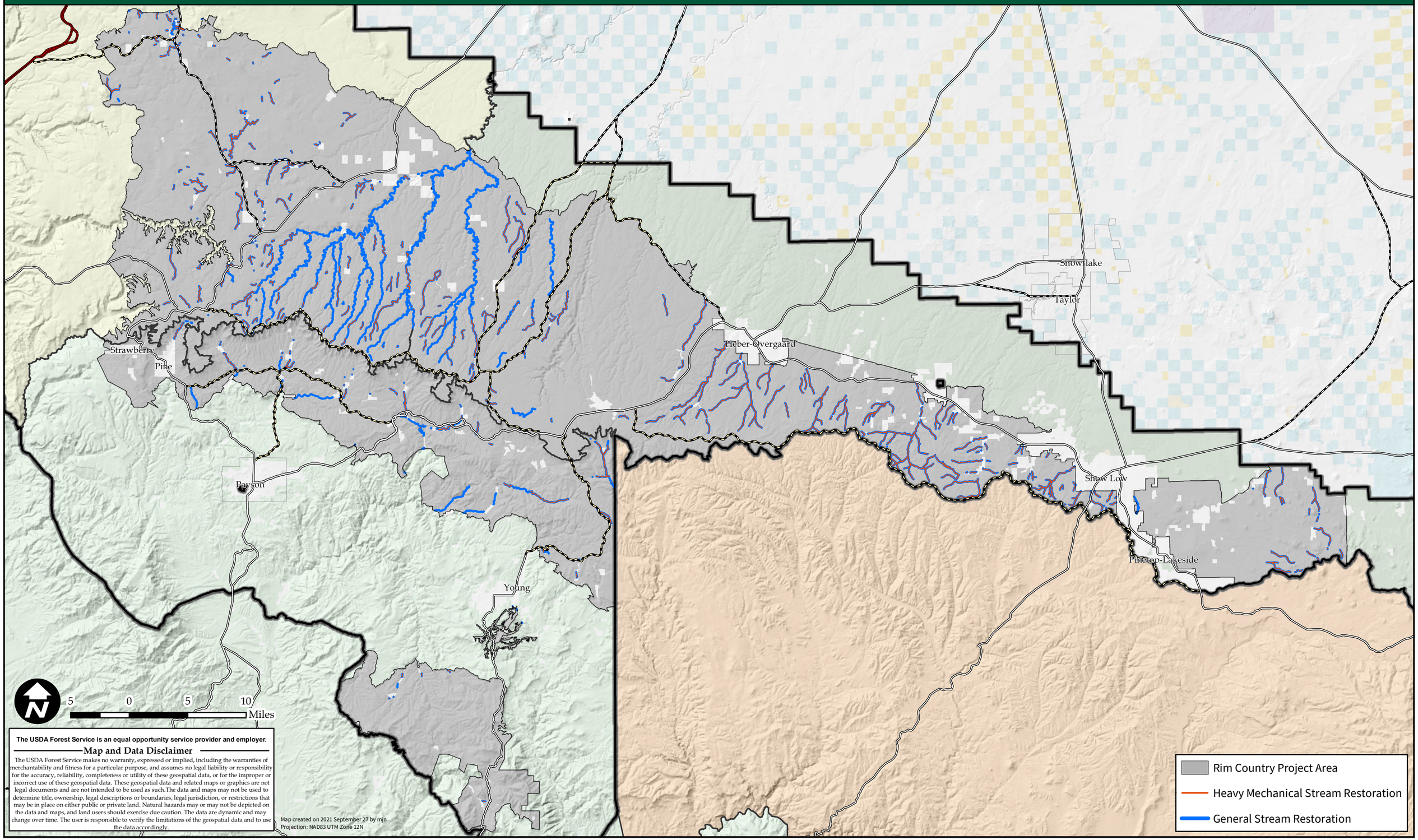
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Stream Restoration



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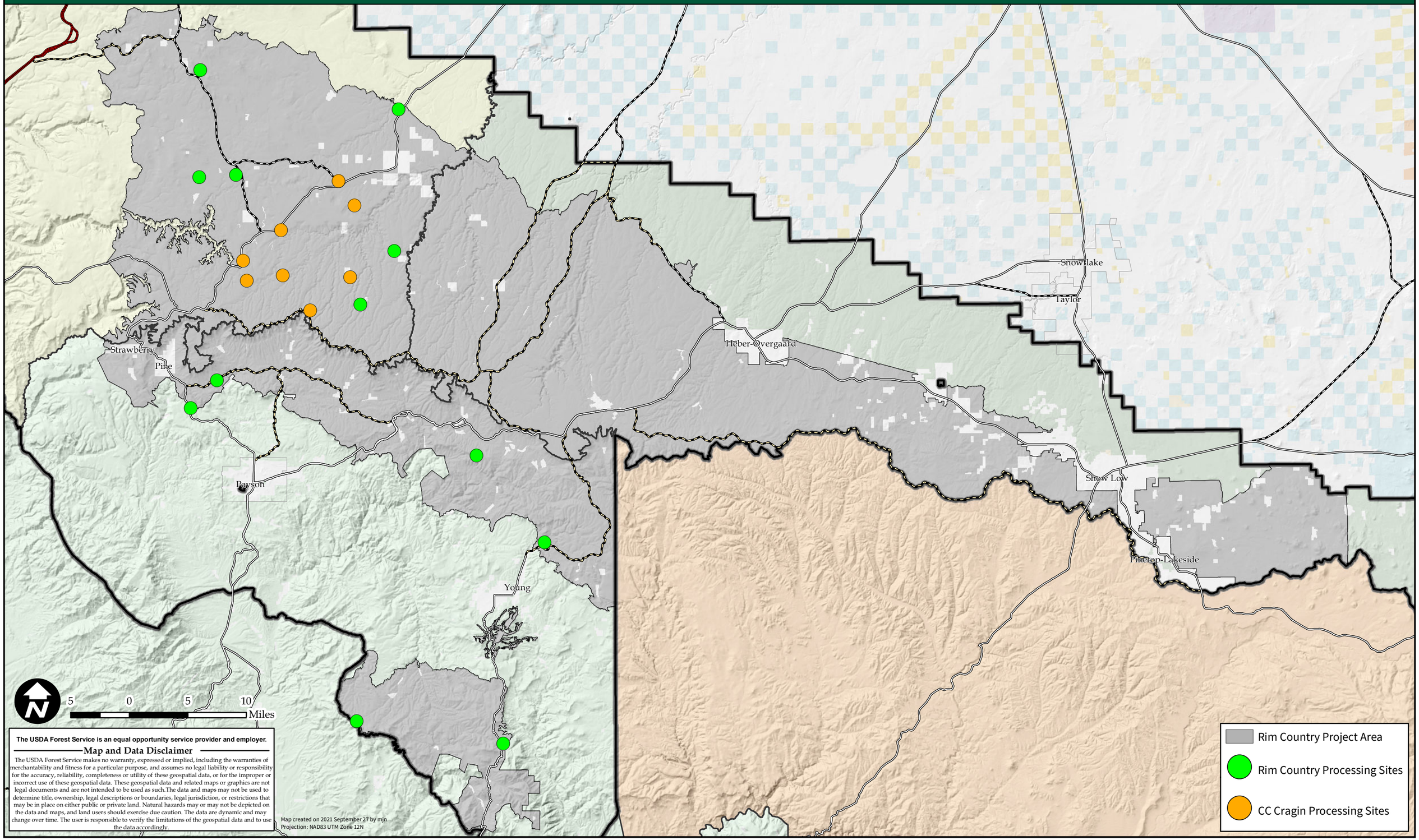
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In-Woods Processing Sites



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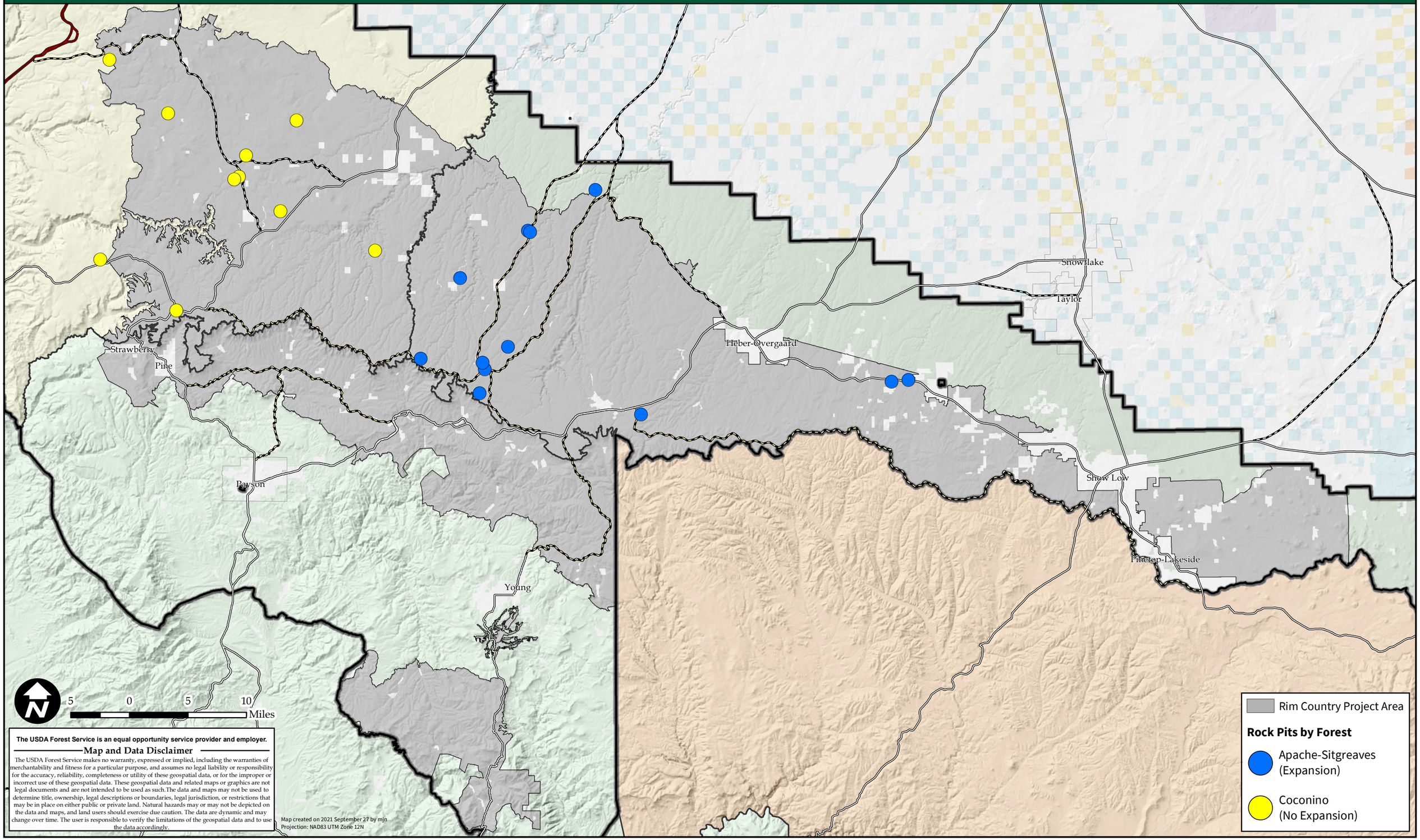
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Rock Pits



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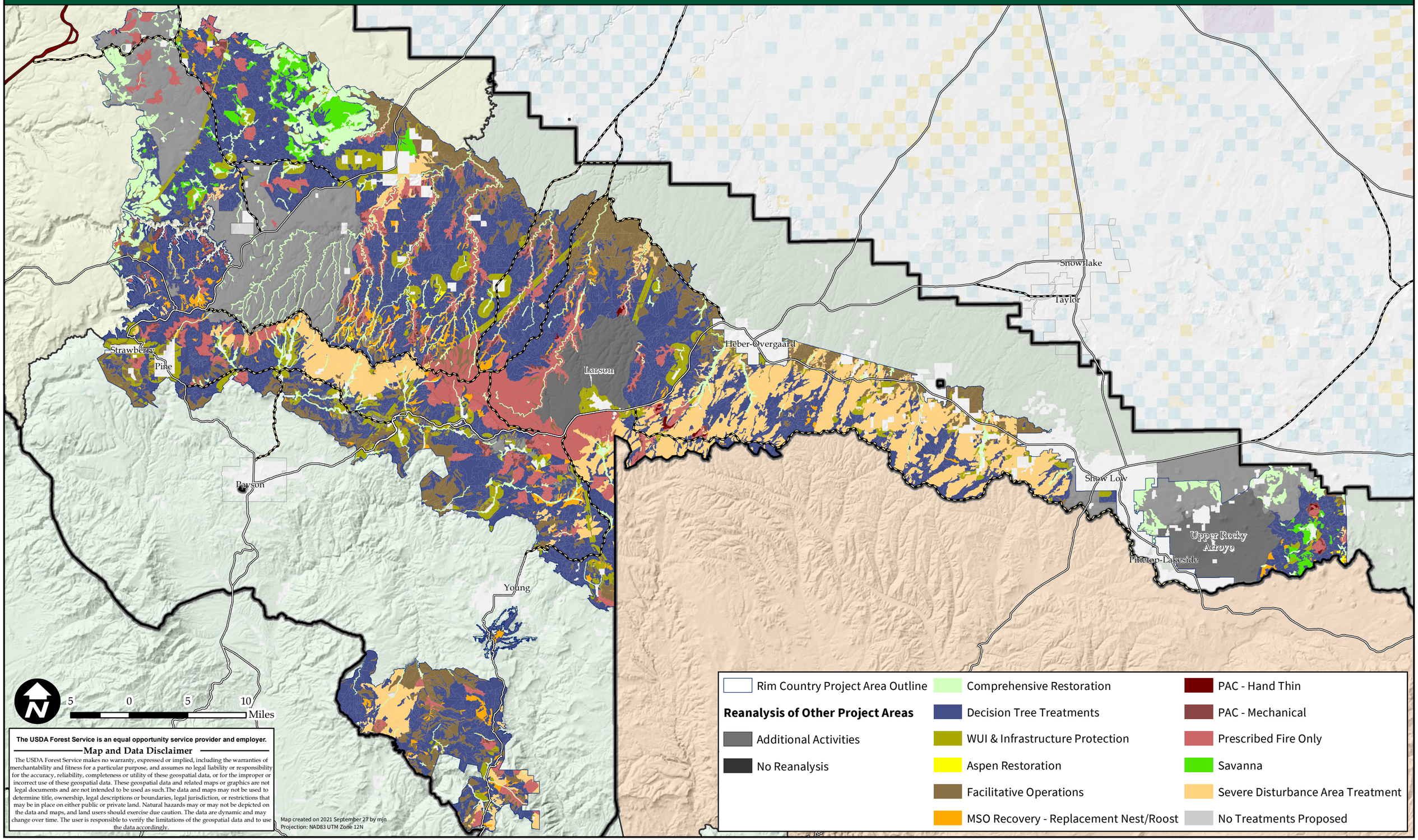
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Alternative 2: Modified Proposed Action



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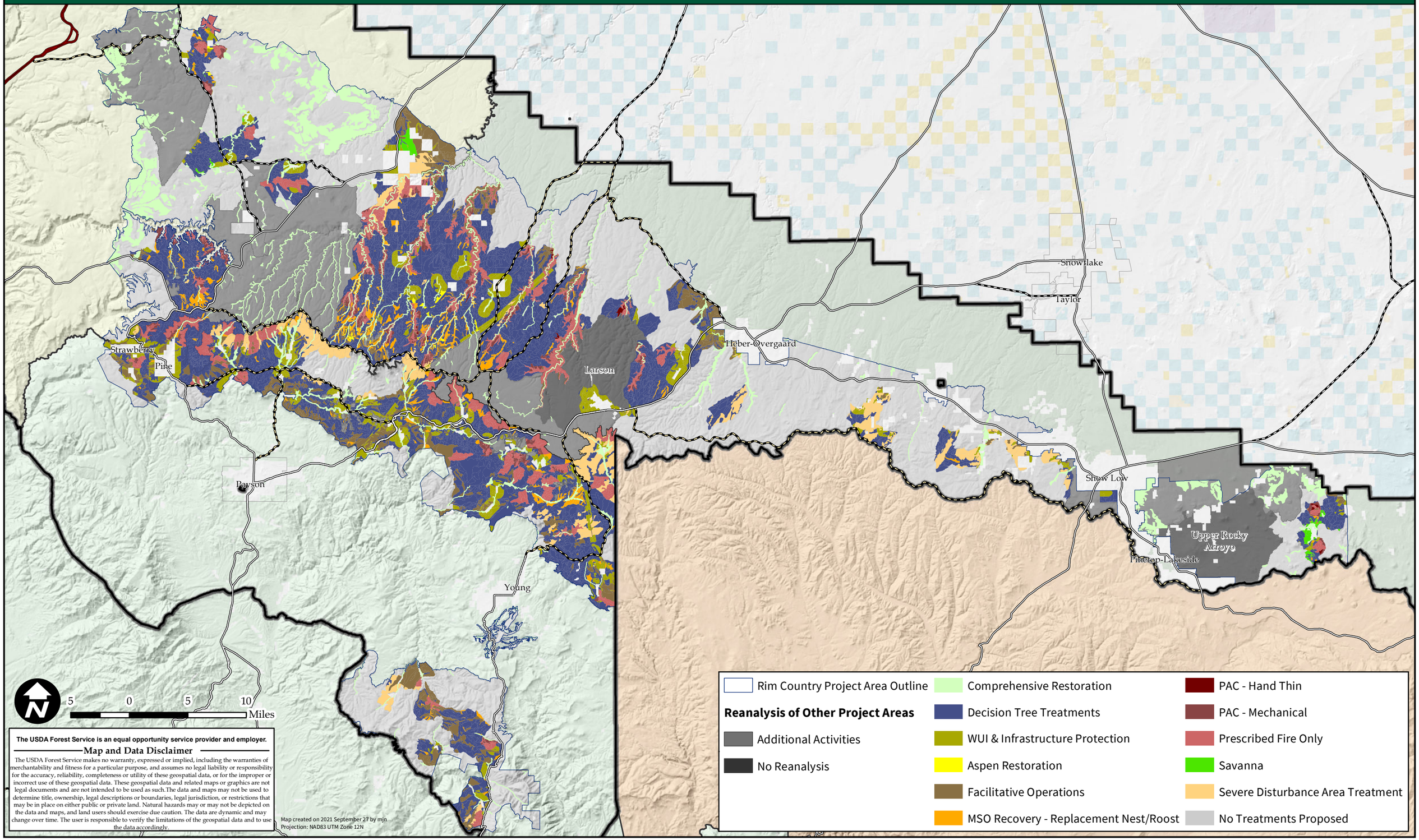
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Alternative 3: Focused Alternative



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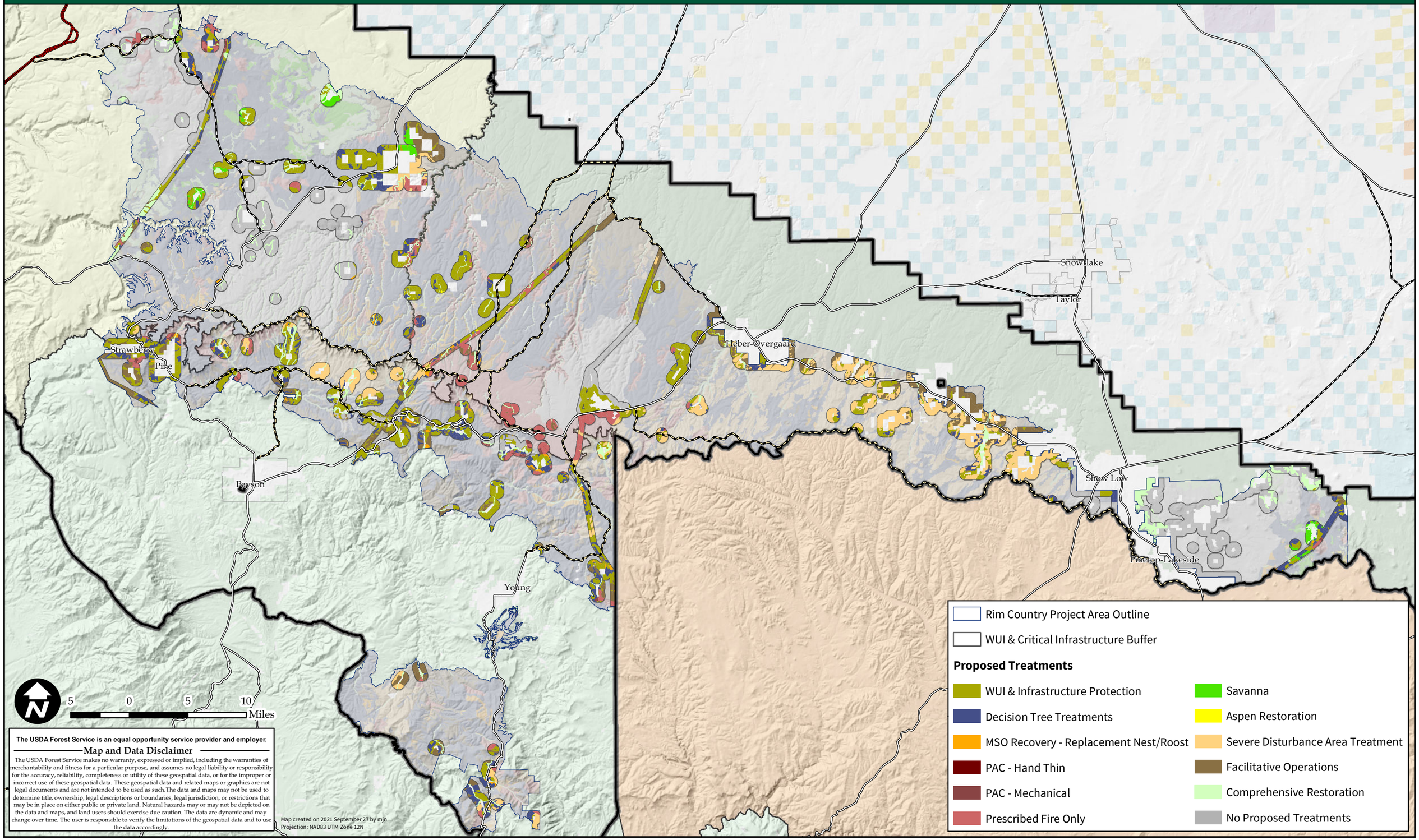
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Alternative 2: Modified Proposed Action within WUI and Critical Infrastructure Buffer



Rim Country Project Area Outline

WUI & Critical Infrastructure Buffer

Proposed Treatments

- WUI & Infrastructure Protection
- Decision Tree Treatments
- MSO Recovery - Replacement Nest/Roost
- PAC - Hand Thin
- PAC - Mechanical
- Prescribed Fire Only
- Savanna
- Aspen Restoration
- Severe Disturbance Area Treatment
- Facilitative Operations
- Comprehensive Restoration
- No Proposed Treatments

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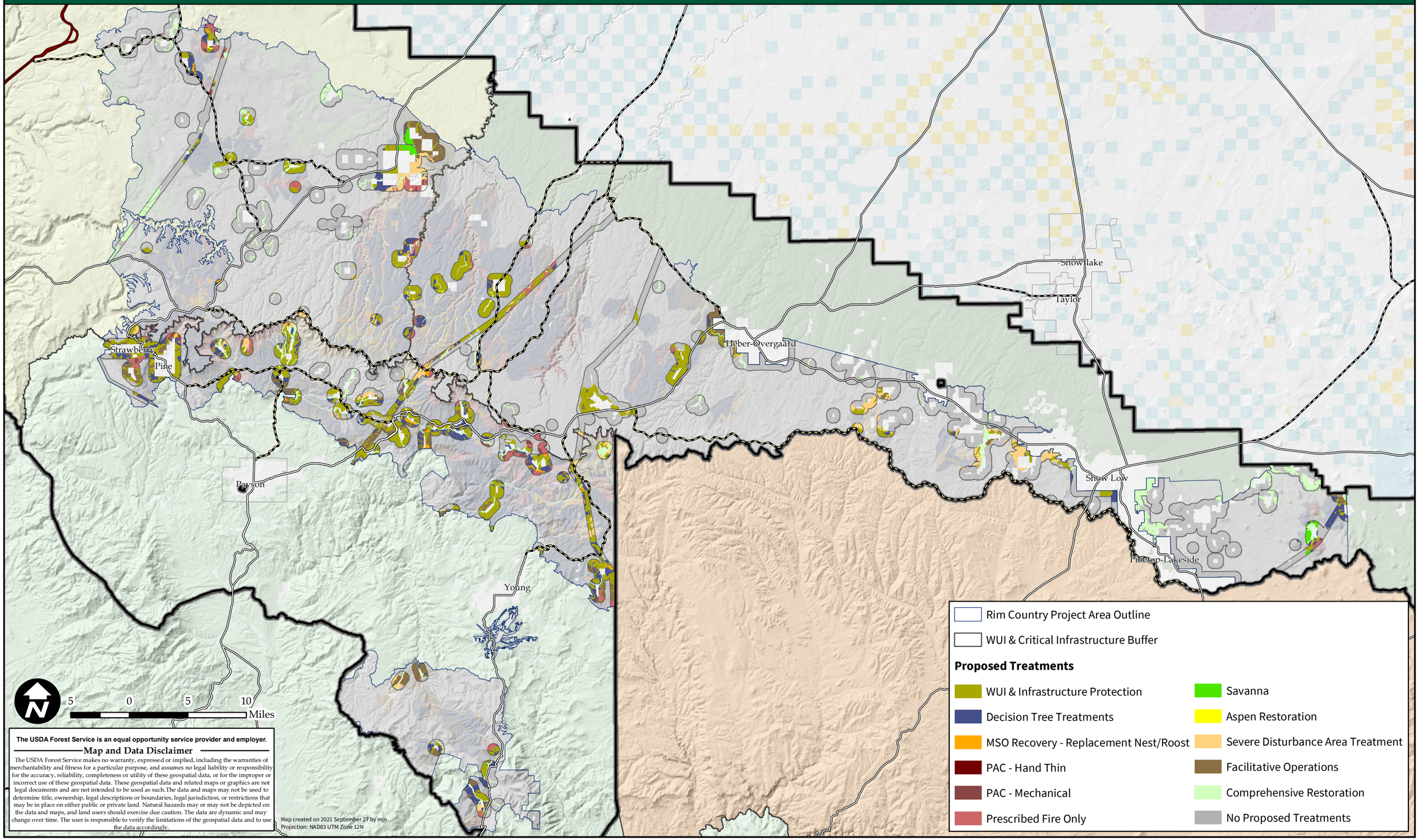
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Alternative 3: Focused Alternative within WUI and Critical Infrastructure Buffer



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Appendix B – Land Management Plan Amendment for the Tonto National Forest

Introduction

A project-specific amendment with three areas of exceptions to the Tonto National Forest Land Management Plan are evaluated in the Rim Country Final Environmental Impact Statement (FEIS). The proposed land management plan amendment is in accordance with 36 CFR 219, the Forest Service 2012 Planning Rule (USDA 2012c) and FSH 1909.12, Land Management Planning Handbook. This project-specific amendment is needed to except the Rim Country project from specific standards and guidelines in the current 1985 Tonto National Forest Land Management Plan. This amendment applies only to the Rim Country project for the area within the Tonto National Forest. There is no need for project-specific amendments to the Apache-Sitgreaves or Coconino National Forests (NF) because the Rim Country project was prepared to be consistent with their recently revised land management plans that reflect current science, policy and technology. This project-specific plan amendment would not be needed if the draft land management plan or other action alternatives for the revised Tonto Land Management Plan were in effect.

Exception 1 would except the Rim Country project from the current 1985 Land Management Plan (LMP) standards and guidelines for old growth and Vegetative Structural Stage (VSS) distribution. These prescriptive requirements are no longer supported by the best available science (for example, Reynolds et al. 2013) and are not included in the revised LMPs for the Apache-Sitgreaves or Coconino National Forests or in direction for the Tonto's proposed LMP. The Rim Country project meets the original intent of the standards and guidelines by protecting old growth and implementing treatments that make progress toward the desired conditions for fire-adapted forests in the Southwest.

Exception 2 would except the project from the Tonto National Forest land management plan direction that reiterates the outdated Mexican Spotted Owl Recovery Plan (1995) and would make it consistent with the current Mexican Spotted Owl Recovery Plan, First Revision (2012). Specifically, it would except the project from the monitoring requirement in the Tonto National Forest Land Management Plan and would instead implement the monitoring specified in the U.S. Fish and Wildlife Service (USFWS) biological opinion specific to this project.

Exception 3 would except the project from the Tonto National Forest Land Management Plan direction limiting the use of mechanical equipment to slopes less than 40 percent. The proposed amendment would allow the use of mechanized ground-based equipment to operate on slopes greater than 40 percent where it is not otherwise restricted and where it would not result in adverse effects on soil and water resources. This exception reflects that advances in technology allow for mechanical equipment to be used on steeper slopes without resulting in adverse resource impacts. This exception is needed to meet the purpose and need of the Rim Country project to restore these steeper slope areas, while meeting the original intent of the standard/guideline of protecting soils on steep slopes.

Exception 1. Ponderosa Pine Vegetation Treatment/Forest Cover Types

The Apache-Sitgreaves and Coconino National Forests revised land management plans reflect the change in conditions and ecological understanding that has occurred since the 1980s that acknowledge vegetation conditions (structure, composition, and function) are divergent from reference conditions and the natural fire regime. Because a final Tonto National Forest (hereafter referred to as Tonto National Forest) revised land management plan is not expected until Fall 2022, this project-specific land management plan amendment is needed to except the project from the following land management plan standards and guidelines for ponderosa pine/bunchgrass, ponderosa pine/Gambel oak, ponderosa pine/evergreen oak, dry mixed conifer, and old growth (Table B-1). Table B-2 provides terms that are not incorporated into the Rim Country project that provide added clarification for the analysis and implementation on how the project meets the canopy cover requirement.

Table B-1. Current 1985 Tonto Land Management Standards and Guidelines and amendment rationale for Exception 1

Tonto National Forest Land Management Plan Excepted Standards and Guidelines	Rationale for Amendment Exception
Until the land management plan is revised, allocate no less than 20 percent of each forested ecosystem management area to old growth as depicted in the table in Appendix L, page 271 (Tonto Land Management Plan, p. 40).	The Rim Country project would meet the intent of the standards/guidelines for providing for old growth by following the Large Tree Implementation Plan (LTIP) and Old Tree Implementation Plan (OTIP) found in Appendix D. Implementation Plan of the FEIS. Additionally, it would help to provide for old growth over time by making progress toward the following desired conditions that are based on the best available scientific information (such as Reynolds et al. 2013). **Desired Conditions for ponderosa pine-bunchgrass, ponderosa pine-Gambel oak, and dry mixed conifer forest types:** At the landscape-scale (10,000 acres and greater) the ponderosa pine/bunchgrass, ponderosa pine/Gambel oak and dry mixed conifer forest is a mosaic of structural states ranging from young to old trees in approximately balanced proportions. Forest structure is variable but uneven-aged and open in appearance. Sporadic areas of even-aged structure may be present on 10 percent or less of the landscape to provide structural diversity. Old growth occurs throughout the landscape, in small, discontinuous areas consisting of clumps of old trees, or occasionally individual old trees. Other old growth components are also present including dead trees (snags), downed wood (coarse woody debris), and/or structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). At the mid-scale (100 to 1,000 acres) the ponderosa pine/bunchgrass, ponderosa pine/Gambel oak and dry mixed conifer forest is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. The more biologically productive sites contain more trees per group and more groups per area, resulting in less space between groups. Interspaces typically range from 10 percent in more biologically productive sites to 70 percent in the less productive sites. Tree density within forested areas ranges from 20 to 80 square feet basal area per acre. The tree group mosaic composes an uneven-aged forest with all age classes, size-classes, and structural stages present in approximately balanced proportions (area based). Occasionally, patches of even-aged forest structure are present (less than 50 acres). Disturbances sustain the overall age and structural distribution.

Tonto National Forest Land Management Plan Excepted Standards and Guidelines	Rationale for Amendment Exception
	Northern goshawk post-fledging family areas (PFAs) should have 10 to 20 percent higher basal area in mid-aged to old tree groups than northern goshawk foraging areas and the surrounding forest. Northern goshawk nest areas have forest conditions that are multi-aged and dominated by large trees with relatively denser canopies than the surrounding forest. At the fine scale (less than 10 acres), trees typically occur in irregularly-shaped groups and are variably spaced with some tight clumps. Crowns of trees within mature to old age groups are interlocking or nearly interlocking within portions of tree groups providing for species that require these forest structure conditions. Interspaces surrounding tree groups are variably shaped and composed of a grass, forb, and shrub mix. Some may contain individual trees or snags. **Desired conditions for ponderosa pine-evergreen oak forest type:** ***Landscape-scale (1,000 – 10,000 acres)*** The ponderosa pine-evergreen oak forest is composed of trees from structural stages ranging from young to old. Forest appearance is variable but generally uneven-aged and open at landscape-scales; areas of even-aged structure may be present. The forest arrangement is in individual trees, small clumps, and larger groups of trees interspersed within variably-sized openings of grass/forbs/shrub vegetation associations. Openness may range from 10 percent to 70 percent depending on site productivity. However, in the shrub subtype, the general trend would be toward less openness to maintain canopy cover and inhibit growth of the shrub component. Size, shape, number of trees per group, and number of groups per acre are variable across the landscape. All structural stages of oak are present, with old trees occurring as dominant individuals or in small groups. Denser tree conditions may exist in some locations, such as north facing slopes and canyon bottoms. Old growth occurs throughout the landscape, generally in small areas as individual old growth components, or as clumps of old growth. Old growth components include old trees, dead trees (snags), downed wood (coarse woody debris) and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). The ponderosa pine-evergreen oak forest is composed predominantly of vigorous trees, but declining trees and shrubs may be a component. Declining trees provide for snags, top-killed, lightning – and fire-scarred trees, and coarse woody debris (> 3 inches diameter), all well-distributed throughout the landscape. Ponderosa pine snags are typically 18 inches or greater at d.b.h. and average 1 to 2 snags per acre; large oak snags (> 10 inches) are a well-distributed component. Downed logs (> 12 inch diameter at mid-point, >8 feet long) average 3 logs per acre within the forested area of the landscape. Coarse woody debris, including downed logs, ranges from 3 to 10 tons per acre. The composition, structure, and function of vegetative conditions are resilient to the frequency, extent and severity of disturbances and climate variability. The landscape is a functioning ecosystem that contains all its component, processes, and conditions that result from natural disturbances (insects, diseases, fire, and wind), including old growth. Dwarf mistletoe occurs in less than 15 percent of host trees in uneven-aged forest structures and less than 25 percent in even-aged forest structure. Limited grasses, forbs,

Tonto National Forest Land Management Plan Excepted Standards and Guidelines	Rationale for Amendment Exception
	and a low to moderate density of shrubs, needle cast, and small trees maintain the natural fire regime. Organic ground cover and herbaceous vegetation provide protection of soil, moisture infiltration, and contribute to plant and animal diversity and to ecosystem function. Shrubs may be a component of the ecosystem and may average 30 percent canopy cover. Low to mixed-severity fires (fire regimes I and III) are characteristic in this type, including throughout northern goshawk home ranges. Natural and anthropogenic disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling. ***Mid-Scale Desired Conditions (100 - 1,000 acres)*** The ponderosa pine-evergreen oak forest is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. Openness may range from 10 percent to 70 percent, depending on site productivity. However, in the shrub subtype, the general trend would be toward less openness to maintain canopy cover and inhibit growth of the shrub component. Tree density within forested areas generally ranges from 20 to 100 square foot basal area per acre. The mosaic of tree groups comprises a mix of even-aged and uneven-aged patches with all age classes and structural stages present. The mix of natural disturbances sustains the overall age and structural distribution. Patch sizes range from less than 1 acre to 10s of acres. Ground cover consists of shrubs, perennial grasses, and forbs with basal vegetation values ranging between about 5 and 15% depending on the TEUI unit (USDA Forest Service 1986). Fires are low to mixed-severity, depending upon the amount of shrubs in the understory. In areas dominated by perennial grasses, fires primarily burn on the forest floor. In areas dominated by shrubs, fires may burn on the forest floor as well as in the overstory. Crown fires occur in small patches. Forest conditions in northern goshawk post-fledging family areas (PFAs) are similar to general forest conditions except these forests contain 10 to 20 percent higher basal area in the mid- to old-age tree groups than northern goshawk foraging areas and the general forest. Northern goshawk nest areas have forest conditions that are multi-aged but are dominated by large trees with relatively denser canopies than other areas in the ponderosa pine-evergreen shrub type. ***Fine-Scale Desired Conditions (less than 10 acres)*** Trees may occur individually or in small to large groups in which they are variably-spaced with some tight clumps. Crown of trees within mature- to old- age groups are interlocking or nearly interlocking within portions of tree groups. Interspaces between tree groups are variably-shaped and comprised of shrubs and limited grass cover. Some natural openings may contain a high density of shrubs and/or individual trees, including large oaks. Trees within groups are of similar or variable ages and may contain species other than ponderosa pine. Size of tree groups typically is less than 2 acres, but occasional larger sized groups may occur.

Tonto National Forest Land Management Plan Excepted Standards and Guidelines	Rationale for Amendment Exception
All analyses should be at multiple scales - one scale above and one scale below the ecosystem management areas. The amount of old growth that can be provided and maintained will be evaluated at the ecosystem management area level and be based on forest type, site capability, and disturbance regimes (Tonto NF Land Management Plan, p. 40)	The intent of this requirement is met because the analysis addresses the desired conditions at the fine, mid, and landscape-scales.
Strive to create or sustain as much old growth compositional, structural, and functional flow as possible over time at multiple area scales. Seek to develop or retain old growth function on at least 20 percent of the naturally forested area by forest type in any landscape (Tonto NF Land Management Plan, p. 40).	Old growth is provided for though the Large Tree Implementation Plan (LTIP) and Old Tree Implementation Plan (OTIP) found in Appendix D. Implementation Plan of the FEIS. The intent of this requirement is met by the analysis because it addresses the desired conditions for old growth (listed in exception above) at multiple scales.
Forested sites should meet or exceed the structural attributes to be considered old growth in the five primary forest cover types in the southwest as depicted in the table in Appendix L, page 271 (Tonto NF Land Management Plan, p. 40).	The Rim Country project is excepted from the guideline specifics for meeting the old growth structural attributes in Appendix L. The intent of the standard/guideline is being met by using best available scientific information and the desired conditions for old growth (see above).
Inventory Guidelines	
For areas where complete inventories cannot be done, use aerial photographs to locate vegetative structural stages (VSS) 4-6 within the project area and inventory just those sites for northern goshawk nest areas using R3 inventory protocol. All uninventoried areas (VSS 1-3) would be managed to post-fledgling family area (PFA) specifications while in that stage. If while using this inventory option evidence suggests northern goshawks are present (such as finding plucking perches or molted northern goshawk feathers), conduct a complete inventory as outlined above (Tonto Land Management Plan, p. 40-9).	The Rim Country project is excepted from this guideline. The project meets the intent of this guideline by using the newer inventory protocols specified in GTR-071, Woodbridge and Hargis 2006 Inventory and Monitoring Guide (Woodbridge 2006) which is considered best available scientific information for inventory and monitoring of northern goshawks, meeting the standards of the Data Quality Act.
If forests have northern goshawks commonly nesting in stands classified as VSS 1-3, use the complete inventory methods for those areas. There may be situations where an area is classified as a VSS 3, based on the predominant VSS class, but in actuality a combination of VSS 4 & 5 predominate the area. For those situations, use the complete inventory methods (Tonto NF Land Management Plan, p. 40- 10).	The Rim Country project is excepted from this guideline. The project meets the intent of this guideline by using the newer inventory protocols specified in GTR-071, Woodbridge and Hargis 2006 Inventory and Monitoring Guide (Woodbridge 2006) which is considered best available scientific information for inventory and monitoring of northern goshawks, meeting the standards of the Data Quality Act.
Vegetation Management Direction - Landscapes Outside of Northern Goshawk Post-fledging Areas	
General: The distribution of vegetation structural stages for ponderosa pine, mixed conifer and spruce-fir forests is 10 percent grass/forb/shrub (VSS 1), 10 percent seedling-sapling (VSS 2), 20 percent young forest (VSS 3), 20 percent mid-aged forest (VSS 4), 20 percent mature forest (VSS 5), 20 percent old forest (VSS 6). NOTE: The specified percentages are a guide and actual percentages are expected to vary + or – up to 3 percent (Tonto Land Management Plan, p. 40-10).	The Rim Country project is excepted from this prescriptive standard/guideline as the best available scientific information derived desired conditions (see above) and project prescriptions meet the original intent of providing for a range of vegetative structural conditions needed for the northern goshawk and its prey.
The distribution of VSS, tree density, and tree age are a product of site quality in the ecosystem management area. Use site quality to guide in the distribution of VSS, tree density, and tree ages. Use site quality to identify and manage dispersal post-fledging family areas and nest habitat at 2 - 2.5 mile spacing across the landscape (Tonto Land Management Plan, p. 40-10).	The Rim Country project is excepted from this prescriptive standard/guideline as the best available scientific information derived desired conditions provide for the intent of providing for a range of vegetative structural conditions needed for the northern goshawk and its prey. See ponderosa pine/bunchgrass, ponderosa pine/Gambel oak, dry mixed conifer and ponderosa pine/evergreen oak desired conditions listed above.

Tonto National Forest Land Management Plan Excepted Standards and Guidelines	Rationale for Amendment Exception
Spruce-Fir: Canopy cover for mid-aged forest (VSS 4) should average 1/3 60 percent and 2/3 40 percent, mature forest (VSS 5) should average 60+ percent, and old forest (VSS 6) should average 60+ percent. Maximum opening size is 1 acre with a maximum width of 125 feet. Provide 2 groups of reserve trees per acre with 6 trees per group when opening size exceeds 0.5. Leave at least 3 snags, 5 downed logs, and 10–15 tons of woody debris per acre (Tonto Land Management Plan, p. 40-11).	The Rim Country project is excepted from this prescriptive standard/guideline as the best available scientific information derived desired conditions provide for the intent of managing for old and mature spruce-fir and associated snags, logs, and course woody debris. See spruce-fir desired conditions listed above.
Mixed Conifer: Canopy cover for mid-aged forest (VSS 4) should average 1/3 60+ percent and 2/3 40+ percent, mature forest (VSS 5) should average 50+ percent, and old forest (VSS 6) should average 60+ percent. Maximum opening size is up to 4 acres with a maximum width of up to 200 feet. Retain 1 group of reserve trees per acre of 3–5 trees per group for openings greater than 1 acre in size. Leave at least 3 snags, 5 downed logs, and 10–15 tons of woody debris per acre (Tonto Land Management Plan, p. 40-11).	The Rim Country project is excepted from this prescriptive standard/guideline as the best available scientific information derived desired conditions provide for the intent of managing for old and mature mixed conifer and associated snags, logs, and course woody debris. See mixed conifer desired conditions listed above.
Ponderosa Pine: Canopy Cover for mid-aged forest (VSS 4) should average 40+ percent, mature forest (VSS 5) should average 40+ percent, and old forest (VSS 6) should average 40+ percent. Opening size is up to 4 acres with a maximum width of up to 200 feet. One group of reserve trees, 3–5 trees per group, would be left if the opening is greater than an acre in size. Leave at least 2 snags per acre, 3 downed logs per acre, and 5–7 tons of woody debris per acre (Tonto Land Management Plan, p. 40-11).	The Rim Country project is excepted from this prescriptive standard/guideline as the best available scientific information derived desired conditions provide for the intent to manage for mature tree groups with interlocking or nearly interlocking crowns and associated snags, logs, and course woody debris. See ponderosa pine desired conditions listed above.
Within post fledging areas	
General: Provide for a healthy sustainable forest environment for the post-fledging family needs of northern goshawks. The principal difference between the post-fledging family area and outside the post-fledging family area is the higher canopy cover within the post-fledging family area and smaller opening size within the post-fledging family area. Vegetative Structural Stage distribution and structural conditions are the same within and outside the post-fledging family area (Tonto Land Management Plan, p. 40-11).	The Rim Country project is excepted from this standard/guideline as the best available scientific information derived desired conditions provide for the post-fledging family needs of northern goshawks.
Mixed Conifer: Canopy Cover for mid-aged (VSS 4) to old forest (VSS 6) should average 60+ percent (Tonto Land Management Plan, p. 40-11).	The Rim Country project is excepted from this prescriptive standard/guideline as the best available scientific information derived desired conditions provide for the intent of managing for mature tree groups with interlocking or nearly interlocking crowns. See mixed conifer desired conditions listed above.
Ponderosa Pine: Canopy Cover for mid-aged forest (VSS 4) should average 1/3 60+ percent and 2/3 50+ percent. Mature (VSS 5) and old forest (VSS 6) should average 50+ percent (Tonto Land Management Plan, p. 40-12).	The Rim Country project is excepted from this prescriptive standard/guideline as the best available scientific information derived desired conditions provide for the intent of managing for mature tree groups with interlocking or nearly interlocking crowns. See ponderosa pine desired conditions listed above.
Within Nesting Areas	
General: Provide unique nesting habitat conditions for northern goshawks. Important features include trees of mature to old age with high canopy cover (Tonto Land Management Plan, p. 40-12).	The Rim Country project is excepted from this standard/guideline as the best available scientific information derived desired conditions meet the intent of managing for unique nesting habitat conditions for northern goshawks. See the habitat desired conditions listed above.
When necessary, hand piling should be used to minimize compaction within piles and to minimize displacement and destruction of the forest floor and the herbaceous layer. Do not grapple or dozer pile debris. Manage road densities at the lowest level	The Rim Country project is excepted from this standard/guideline as the best available scientific information incorporated into the design features for the project provide for the intent to maintain desired structure within nesting areas.

Tonto National Forest Land Management Plan Excepted Standards and Guidelines	Rationale for Amendment Exception
possible to minimize disturbance in the nest area. Use small, permanent skid trails in lieu of roads for timber harvesting (Tonto Land Management Plan, p. 40-12).	This project is consistent with the Apache Sitgreaves and Coconino National Forests land management plan standards/guidelines which state: preferred treatments should be maintained to maintain and improve the desired nest structure. Lopping and scattering of thinning debris is preferred if prescribed fire cannot be used. Piling of debris should be limited. When necessary, hand piling should be used to minimize compaction within piles and to minimize displacement and destruction of the forest floor and the herbaceous layer. Manage road densities at the lowest level possible to minimize disturbance in the nest area. Designate skid trails in lieu of creating new roads for timber harvesting.
Spruce-fir, Mixed Conifer and Ponderosa Pine Cover Types: The nesting area contains only mature to old forest (VSS 5 & 6) having a canopy cover (measured vertically) between 50-70% with mid-aged VSS 6 trees 200-300 years old. Non-uniform spacing of trees and clumpiness is desirable (Tonto Land Management Plan, p. 40-12).	The Rim Country project is excepted from this prescriptive standard/guideline as the BASI desired conditions provide for the intent to manage for northern goshawk habitat and nesting sites. See ponderosa pine/bunchgrass, ponderosa pine/Gambel oak, dry mixed conifer and ponderosa pine/evergreen oak desired conditions listed above.

The following glossary definitions would be included to provide clarification for the analysis and implementation:

Interspaces as defined by RMRS-GTR-310 (Reynolds et al. 2013) are areas within a stand that are not currently under the vertical projection of the outermost perimeter of tree canopies (drip-line). They are generally composed of grass-forb-shrub cover but could also be areas with scattered rock or exposed mineral soil. As spaces between trees, tree groups and tree clumps, interspaces contribute to the "open canopy" character of frequent-fire forests. They often connect with other interspaces and thus are variably shaped and sized. Also see "openings". Interspaces and tree group locations are dynamic and shift over time.

Openings may result from different causes. They may be defined as generally persistent treeless areas having a fairly distinct shape or size, occurring naturally due to differences in soil types as compared to sites that support forests or woodlands. Openings include meadows, grasslands, rock outcroppings, and wetlands. They may also result from disturbances like severe fire or windthrow, or management activities to intentionally create space for new tree regeneration. Natural and created openings are not the same as interspaces found in the frequent-fire forests or woodlands. See "interspaces."

Uneven-aged forests are forests that comprise three or more distinct age classes of trees, either intermixed or in small groups.

Uneven-aged management is the application of combined actions needed to simultaneously maintain continuous forest cover and support the recurring regeneration of desirable species and the orderly growth and development of trees through a range of diameter or age classes to provide a sustained yield of forest products. Cutting is usually regulated by specifying the number or proportion of trees of particular sizes to retain within each area, thereby maintaining a planned distribution of size-classes. Cutting methods that develop and maintain uneven-aged stands are single-tree selection and group selection. An uneven-aged, regulated forest is one which has a balanced progression of three or more age/size-classes, such that each younger/smaller class is advancing to replace the class above it on approximately the same acreage, until it is mature for harvest or other resource objectives. A regulated forest reaches sustained yield when the volume cut periodically equals the amount of net volume growth for that same period.

Exception 2. Align With Current Mexican Spotted Owl Recovery Plan

In 2012, the Mexican Spotted Owl Recovery Plan, First Revision, was published (USDI FWS 2012). There is a need for the 4FRI Rim Country analysis to be in alignment with the management direction provided in the revised Recovery Plan and the other land management plans that are part of this project. This exception is needed because the 1985 Tonto National Land Management Plan includes direction from the former (1995) recovery plan. This land management plan amendment exception is needed to:

- Update definitions and management direction for protected activity centers (PACs), recovery habitat, and other forest and woodland types to be in alignment with the current recovery plan and best available scientific information.
- Except the Rim Country project for treatment diameters of 9 inches d.b.h. to 18 inches d.b.h. in Mexican spotted owl PACs and will allow the removal of larger trees (greater than 18 inches d.b.h. in PACs and 24 inches d.b.h. in recovery habitat).
- Except the Rim Country Project to allow the Mexican spotted owl nest roost recovery area identified within the project area to be treated to meet the minimum habitat requirements for Mexican spotted owl nest roost recovery habitat under the 2012 revised Mexican spotted owl Recovery Plan.

- Update language and management direction related to prescribed cutting and fire treatments in PACs to be consistent with the current recovery plan.
- Update survey information and except the project from the LMP requirements for population and habitat monitoring. The Mexican spotted owl monitoring plan from Coconino and Kaibab National Forest 4FRI decision would serve as a starting point for continuing monitoring across Mexican spotted owl habitat on Tonto National Forest, in consultation with the USFWS.
- Except the Rim Country project from the direction for treating habitat in incremental percentages. The Mexican spotted owl monitoring plan for the Coconino and Kaibab National Forests 4FRI decision would serve as a starting point for continuing monitoring across Mexican spotted owl habitat on Tonto National Forest, in consultation with the USFWS. The monitoring plan includes a phased implementation and monitoring strategy.

At the request of the 4FRI planning team, Dr. Joseph Ganey and other Mexican spotted owl experts published the "Status and ecology of Mexican spotted owls in the Upper Gila Mountains Recovery Unit, Arizona and New Mexico" in 2011 (RMRS GTR-256). The intent of this report was to aid planners in evaluating potential benefits or impacts of management actions for Mexican spotted owls and their habitat.

Each stand within PACs on the Tonto National Forest would be modeled to identify silvicultural and prescribed fire treatments that would yield the best existing and future Mexican spotted owl habitat conditions. Selecting trees for removal would prioritize the release of large and old trees including oak. The goal for PAC treatments would be to move existing owl habitat toward the desired conditions described in the 2012 Mexican spotted owl Recovery Plan, First Revision (USDI FWS 2012). Whether nesting and roosting habitat would benefit from selectively cutting trees greater than 9 inches diameter at breast height would be determined with the USFWS. Treatments up to 9 inches diameter at breast height are consistent with the current Tonto National Forest land management plan. The proposal would be in alignment with the revised Mexican spotted owl Recovery Plan (USDI FWS 2012).

Prescribed fire is an appropriate and effective tool for improving habitat conditions within most PACs, including core areas. Excluding PACs and/or core areas from prescribed fire is either done by drawing burn units that do not include the PAC/core area. This can result in thousands of additional acres outside of the PAC being excluded from prescribed fire. The other way PACs are excluded is by creating firelines. Firelines can range from approximately 3 feet wide (hand line) to over 12 feet wide (dozer line). The number of acres of potential ground disturbance needed to exclude PACs from burning could range from about ½ acre (hand line) to about 2.5 acres (dozer line), and would also include limbing, thinning, and cutting as needed along the lines, depending on site specific burning conditions (weather, fuel, topography). Additionally, burning off of firelines built through heavy fuels increases the risk to fire managers implementing proposed actions.

There is concern that constructed firelines could encourage recreation use in areas of spotted owl nesting and roosting, and increased human disturbance could lead to indirect effects, including removal of snags and logs inside PACs by firewood cutters and campers.

Burning in Mexican spotted owl PACs is difficult as there is a need to address the high fuel loadings while maintaining many of the habitat elements that contribute to fuel loading. There is often a short burn window available in order to avoid the breeding season (such as the nonbreeding season – September 1 to February 28). Lining numerous core areas greater than or equal to 100 acres would be expensive in terms of time, money, and other resource commitments. In many projects, PAC treatments have been eliminated for these reasons. Applying low-severity prescribed fire within the 100-acre core areas may eliminate the need for fireline construction and would potentially minimize impacts to protected habitat.

A geographic layer for recovery habitat across the 4FRI Rim Country project area would be developed and would merge all available pine-oak and mixed conifer data. A landscape-scale approach would meet the goal of providing continuous replacement nesting and roosting habitat over time at a landscape-scale, as described in the revised Recovery Plan.

Recovery habitat would be managed to meet a 110 square feet basal area or greater for Mexican spotted owl nest and roost habitat as recommended in the revised Recovery Plan. The purpose is to allow more of the uncharacteristically dense in-growth in most diameter size classes in the Rim Country project area to be removed while retaining nesting and roosting habitat components. The purpose is to improve forest health while retaining large trees and increasing large tree growth rates as described in the revised recovery plan. Based on a cursory review of existing condition data there will likely be a need to increase forest spatial heterogeneity and improve Mexican spotted owl prey habitat. Increasing the basal area range would provide opportunities to mimic canopy gap processes which produce horizontal variation in stand structure. These changes would both increase and retain nesting and roosting structure and increase understory cover. Research suggests that small mammal biomass (including voles and mice) drives spotted owl reproductive output. Thinning smaller trees would also improve sub-canopy flight zone, thereby increasing Mexican spotted owl foraging effectiveness.

Monitoring assesses the effectiveness of management actions and provides the adaptive framework for more successful management guidelines. Monitoring habitat allows for modeling future forest conditions to determine if there will be adequate habitat to support Mexican spotted owl populations. Occupancy, reproduction and habitat monitoring and final project design for all activities in all Mexican spotted owl habitat was developed for the first 4FRI analysis in consultation with the U.S. Fish and Wildlife Service. While the monitoring plan from the first 4FRI analysis will be reviewed, a new monitoring plan that is specific to this landscape will be developed in coordination with the USFWS. The USFWS identifies the minimum monitoring requirements as part of their biological opinion. Adaptive management would also allow modifying Rim Country Mexican spotted owl treatments with the monitoring results from the first 4FRI.

The Rim Country project would be excepted from the following standards and guidelines (Table B-2).

Table B-2. Current 1985 Tonto Land Management Standards and Guidelines and rationale for Exception 2

Current 1985 Tonto National Forest Land Management Standards and guidelines	Rationale for Amendment Exception
Provide three levels of habitat management - protected, restricted, and other forest and woodland types to achieve a diversity of habitat conditions across the landscape (Tonto NF Land Management Plan, page 40-1).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead use the newer definitions and management practices from the current 2012 Mexican Spotted Owl Recovery Plan.
Protected areas include delineated protected activity centers; mixed conifer and pine-oak forests with slopes greater than 40 percent where timber harvest has not occurred in the last 20 years; and reserved lands which include wilderness, research natural areas, wild and scenic rivers, and congressionally recognized wilderness study areas (Tonto NF Land Management Plan, page 40-2).	The Rim Country Project would be excepted from the outdated definitions found in the 1985 LMP and would instead use the newer definitions from the 2012 Mexican Spotted Owl Recovery Plan for protected areas. The revised Recovery Plan does not include direction for steep slopes (see direction for canyons) and reserved lands (below).
Restricted areas include all mixed-conifer, pine-oak, and riparian forests outside of protected areas (Tonto NF Land Management Plan, page 40-2).	The Rim Country Project would be excepted from the outdated definitions found in the 1985 LMP and would instead us the newer definitions from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. They include design features WL001-016, WL026, WL032, WL045-047, and WL050.
Other forest and woodland types include all ponderosa pine, spruce-fir, woodland, and aspen forests outside protected and restricted areas (Tonto NF Land Management Plan, page 40-2).	The Rim Country Project would be excepted from the outdated definitions found in the 1985 LMP and would instead us the newer definitions from the 2012 Mexican Spotted Owl Recovery Plan.
Survey all potential spotted owl areas including protected, restricted, and other forest and woodland types within an analysis area plus the area 1/2 mile beyond the perimeter of the treatment area (Tonto NF Land Management Plan, page 40-2).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. They include design features WL014, WL0145, and WL046.
Allow no timber harvest except for firewood and fire risk abatement in established protected activity centers. For protected activity centers destroyed by fire, windstorm, or other natural disaster, salvage timber harvest or declassification may be allowed after evaluation on a case-by-case basis in consultation with US Fish and Wildlife Service (Tonto NF Land Management Plan, page 40-2).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. They include design features WL001-016, WL026, WL032, WL045-047, and WL050. See page 268 of the 2012 Mexican Spotted Owl Recovery Plan (USFWS 2012) for guidance on forested Recovery Habitat managed for Nest/Roost and page 269 for guidance on Foraging/Non-breeding Habitat.
Allow no timber harvest except for fire risk abatement in mixed conifer and pine-oak forests on slopes greater than 40 percent where timber harvest has not occurred in the last 20 years (Tonto NF Land Management Plan, page 40-2).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. See amendment exception 3 for more information about slopes greater than 40 percent.
In protected and restricted areas, when activities conducted in conformance with these standards and guidelines may adversely affect other threatened, endangered, or sensitive species or may conflict with other established recovery plans or conservation agreements; consult with U.S. Fish and Wildlife Service to resolve the conflict (Tonto NF Land Management Plan, page 40-2).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. Coordination with USFWS on any action that effects threatened and endangered species will occur during implementation (see Appendix D).

Current 1985 Tonto National Forest Land Management Standards and guidelines	Rationale for Amendment Exception
Monitor changes in owl populations and habitat needed for delisting (Tonto NF Land Management Plan, page 40-2).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. They include survey available habitat, WL014 and New Mexican spotted owl PACs will be established as they are found (WL026) and yearly reporting of survey results to USFWS is done by districts.
General Guidelines	
Conduct surveys following Region 3 survey protocol (Tonto NF Land Management Plan, p. 40-2).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. They include survey available habitat (WL014) and new Mexican spotted owl PACs will be established as they are found (WL026) and yearly reporting of survey results to USFWS is done by districts.
Protected Area Guidelines	
Submit protected activity center maps and descriptions to the recovery unit working group for comment as soon as possible after completion of surveys (Tonto NF Land Management Plan, page 40-3).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. See above for the applicable design features.
Road or trail building in protected activity centers should be avoided but maybe permitted on a case-by-case basis for pressing management reasons (Tonto NF Land Management Plan, page 40-3).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. They include design features that call for breeding season restrictions and or ¼ mile buffer from noise as per the Revised Mexican Spotted Owl Recovery Plan (WL005, Wl006, and WL007).

Current 1985 Tonto National Forest Land Management Standards and guidelines	Rationale for Amendment Exception
Treat Fuel Accumulations to abate fire risk (Tonto Land Management Plan, page 40-3):	
--Select for treatment 10 percent of the protected activity centers where nest sites are known in each recovery unit having high fire risk conditions. Also select another 10 percent of the protected activity centers where nest sites are known as a paired sample to serve as control areas. -- Designate a 100-acre “no treatment” area around the known nest site of each selected protected activity center. Habitat in the no treatment area should be as similar as possible in structure and composition as that found in the activity center. --Use combinations of thinning trees less than 9 inches in diameter, mechanical fuel treatment and prescribed fire to abate fire risk in the remainder of the selected protected activity center outside the 100-acre "no treatment" area. --Retain woody debris larger than 12 inches in diameter, snags, clumps of broad-leafed woody vegetation, and hardwood trees larger than 10 inches in diameter at the root collar. --Select and treat additional protected activity centers in 10% increments if monitoring of the initial sample shows there were no negative impacts or there were negative impacts which can be mitigated by modifying treatment methods. --Use light prescribed burns in nonselected protected activity centers on a case-by-case basis. Burning should avoid a 100-acre "no treatment" area around the activity center. Large woody debris, snags, clumps of broad-leafed woody vegetation should be retained and hardwood trees larger than 10 inches diameter at the root collar. --Pre- and post-treatment monitoring should be conducted in all protected activity centers treated for fire risk abatement (see monitoring guidelines).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. They include design features WL001-016, WL026, WL032, WL045-047, and WL050.
C. Restricted Area Guidelines (Mixed conifer, pine-oak, riparian forests and rocky canyons) (Tonto NF Land Management Plan, p. 40-4)	The Rim country project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan.

Current 1985 Tonto National Forest Land Management Standards and guidelines	Rationale for Amendment Exception
Mixed Conifer and Pine-oak Forests (see glossary definition): Manage to ensure a sustained level of owl nest/roost habitat well distributed across the landscape. Create replacement owl nest/roost habitat where appropriate while providing a diversity of stand conditions across the landscape to ensure habitat for a diversity of prey species (Tonto Land Management Plan, page 40-5). The following table displays the minimum percentage of restricted area which should be managed to have nest/roost characteristics. The minimum mixed conifer restricted area includes 10% at 170 basal area and an additional amount of area at 150 basal area. The additional area of 150 basal area is +10%in BR-E and +15% in all other recovery units. The variables are for stand averages and are minimum threshold values and must be met simultaneously. In project design, no stands simultaneously meeting or exceeding the minimum threshold values should be reduced below the threshold values unless a district-wide or larger landscape analysis of restricted areas shows that there is a surplus of restricted area acres simultaneously meeting the threshold values (Tonto Land Management Plan, page 40-5). Management should be designed to create minimum threshold conditions on project areas where there is a deficit of stands simultaneously meeting minimum threshold conditions unless the district-wide or larger landscape analysis shows there is a surplus (Tonto Land Management Plan, page 40-4 to 40-6).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. They include design features WL001-016, WL026, WL032, WL045-047, and WL050. See page 268 of the 2012 Mexican Spotted Owl Recovery Plan (USFWS 2012) for guidance on forested Recovery Habitat managed for Nest/Roost and page 269 for guidance on Foraging/Non-breeding Habitat.
Allow natural canopy gap processes to occur, thus producing horizontal variation in stand structure (Tonto Land Management Plan, page 40-5).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. Design feature WL01-04 addresses 2012 Mexican Spotted Owl Recovery Plan recommendation.
Save all trees greater than 24 inches d.b.h. In pine-oak forests, retain existing large oaks and promote growth of additional large oaks (Tonto Land Management Plan, page 40-5).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead use the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan.
In pine-oak forests, retain existing large oaks and promote growth of additional large oaks (Tonto Land Management Plan, page 40-5).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead use the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan.
Emphasize uneven-aged management systems. However, both even-aged and uneven-aged systems may be used where appropriate to provide variation in existing stand structure and species diversity. Existing stand conditions will determine which system is appropriate (Tonto Land Management Plan, page 40-5).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. Treatment prescriptions in Mexican spotted owl habitat will promote large trees and snags with uneven management where applicable.

Current 1985 Tonto National Forest Land Management Standards and guidelines	Rationale for Amendment Exception
Retain substantive amounts of key habitat components: --Snags 18 inches in diameter and larger --Down logs over 12 inches midpoint diameter --Hardwoods for retention, recruitment, and replacement of large hardwoods (Tonto Land Management Plan, p. 40-6)	The Rim Country project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead use the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. See page 268 of the 2012 Mexican Spotted Owl Recovery Plan (USFWS 2012) for guidance on forested Recovery Habitat managed for Nest/Roost and page 269 for guidance on Foraging/Non-breeding Habitat.
Riparian Areas: Emphasize maintenance and restoration of healthy riparian ecosystems through conformance with land management plan riparian standards and guidelines. Management strategies should move degraded riparian vegetation toward good condition as soon as possible. Damage to riparian vegetation, streambanks, and channels should be prevented (Tonto Land Management Plan p. 40-6).	The Rim Country project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. One of the goals of the Rim Country project is to promote healthy riparian areas and stream channels and the overall project design features shape treatment prescriptions that meet the intent of the standard/guideline.
Monitoring Guidelines	
Monitoring and evaluation should be collaboratively planned and coordinated with involvement from each national forest, U.S. Fish and Wildlife Service Ecological Services Field Office, U.S. Fish and Wildlife Service Regional Office, Forest Service Regional Office, Rocky Mountain Research Station, recovery team, and recovery unit working groups (Tonto National Land Management Plan, p. 40-7).	The Rim country project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. The monitoring and evaluations are done yearly with coordination between the Forest Service and USFWS. Mexican spotted owl survey results are shared, and new PACs delineated where necessary each year. See Appendix E – Rim Country Monitoring and Adaptive Management Plan for more information.
Population monitoring should be a collaborative effort with participation of all appropriate resource agencies (Tonto National Land Management Plan, page 40-7).	The Rim country project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. Population Monitoring has been implemented through the R3 Wildlife Division and Bird Conservation of the Rockies, from 2014 to the present and is a collaborative effort. See Appendix E – Rim Country Monitoring and Adaptive Management Plan for more information.
Habitat monitoring of gross habitat changes should be a collaborative effort of all appropriate resource agencies. (Tonto National Land Management Plan, page 40-7).	The Rim country project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. Habitat monitoring is included in the R3 and BCOR monitoring mentioned above. See Appendix E – Rim Country Monitoring and Adaptive Management Plan for more information.
Habitat monitoring of treatment effects (pre- and post-treatment) should be done by the agency conducting the treatment (Tonto Land Management Plan, p. 40-7).	The Rim country project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. Species and habitat monitoring for the project will follow the Mexican Spotted Owl Recovery Plan for this project, which is being provided by USFWS with the BO which will concur with the effects determinations for the Mexican spotted owl and its critical habitat. See Appendix E – Rim Country Monitoring and Adaptive Management Plan for more information.

Current 1985 Tonto National Forest Land Management Standards and guidelines	Rationale for Amendment Exception
Prepare an annual monitoring and evaluation report covering all levels of monitoring done in the previous year. The annual report should be forwarded to the regional forester with copies provided to the recovery unit working groups, U.S. Fish and Wildlife Service Ecological Services field offices, and the U.S. Fish and Wildlife Service Regional Office (Tonto National Land Management Plan, page 40-7).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. See above. Annual reporting to USFWS will be included in the Mexican spotted owl monitoring plan for this project. See Appendix E – Rim Country Monitoring and Adaptive Management Plan for more information.
Rangewide: Track gross changes in acres of owl habitat resulting from natural and human-caused disturbances. Acreage changes in vegetation composition, structure, and density should be tracked, evaluated, and reported. Remote sensing techniques should provide an adequate level of accuracy. In protected and restricted areas where silvicultural or fire abatement treatments are planned, monitor treated stands pre- and post-treatment to determine changes and trajectories in fuel levels; snag basal areas; live tree basal areas; volume of down logs over 12 inches in diameter; and basal area of hardwood trees over 10 inches in diameter at the root crown (Tonto National Land Management Plan, page 40-7).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country Project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan. Range-wide tracking of Mexican spotted owl trends will occur at the regional level. Monitoring in Mexican spotted owl Protected and Recovery habitat will follow the Mexican Spotted Owl Monitoring Plan for this project as provided by USFWS with the BO. See Appendix E – Rim Country Monitoring and Adaptive Management Plan for more information.
Upper Gila Mountain, Basin and Range East, and Basin and Range West Recovery Units: Assist the recovery team and recovery unit working groups to establish sampling units consisting of 19 to 39 square mile quadrats randomly allocated to habitat strata. Quadrats should be defined based on ecological boundaries such as ridge lines and watersheds. Quadrat boundaries should not traverse owl territories. Twenty percent of the quadrats will be replaced each year at random. Using the sample quadrats, monitor the number of territorial individuals and pairs per quadrat; reproduction; apparent survival; recruitment; and age structure. Track population density both per quadrat and habitat stratum (Tonto National Land Management Plan, p. 40-7).	The Rim Country Project would be excepted from the outdated definitions and management practices found in the 1985 LMP and would instead us the newer definitions and management practices from the 2012 Mexican Spotted Owl Recovery Plan. The design features for the Rim Country project address the recovery plan requirements and meet the intent of the 1985 Tonto Plan.

Table B-3 provides details from the 2012 Mexican Spotted Owl Recovery Plan. It includes the minimum desired conditions for basal and standing live trees in ponderosa pine and mixed conifer. In ponderosa pine snags and coarse woody debris are well distributed throughout the landscape. Ponderosa pine snags are typically 18 inches or greater in diameter and average 1 to 2 per acre. Coarse woody debris, including logs, ranges from 3 to 10 tons per acre. Logs average 3 per acre within the forested area of the landscape. In dry mixed conifer snags and coarse woody debris are well distributed throughout the landscape. Snags are typically 18 inches in diameter or greater and average 3 per acre. Coarse woody debris, including logs, ranges from 5 to 15 tons per acre. Logs average 3 per acre within the forested area of the landscape.

Table B-3. Minimum desired conditions for the Basin and Range West (BRW) and Upper Gila Mountain (UGM) Ecological Management Unit (EMU) (2012 Mexican Spotted Owl Recovery Plan)

BRW and UGM EMU Forest Type	% of Area	% BA by Size Class-12 18 inch	% BA by Size Class->18 inch	Minimum Tree BA	Minimum Density of Large Trees (trees per acre)
Mixed Conifer	25	>30	>30	120	12
Pine-Oak	10	>30	>30	110	12

Exception 3. Mechanical Treatments on Steep Slopes

The current land management plan restricts the use of mechanical equipment to slopes less than 40 percent. Exception 3 would except the Rim Country project from the standards/guidelines related to 40 percent slopes and identifying slopes above 40 percent as inoperable. This exception would allow mechanical harvesting on slopes greater than 40 percent within the project area.

This exception is needed to allow for use of specialized mechanical equipment to cut and remove trees and to mechanically treat other vegetation on steep slopes to carry out restoration treatments in portions of the Rim Country project area on the Tonto National Forest. Advances in technology since the 1985 Tonto National Forest Land Management Plan was written allow for operations on steep slopes without adverse effects on soil resources (Holzfeind et al. 2020). This land management plan amendment exception is needed to implement the Rim County Project and to make progress toward desired conditions on these steeper slopes in the project area.

The Rim Country project would be excepted from the following standards and guidelines (Table B-4):

Table B-4. Current 1985 Tonto Land Management Standards and Guidelines and rationale for Exception 3

Current 1985 Tonto National Forest Land Management Standards and Guidelines	Rationale for Amendment Exception
Allow no timber harvest except for fire risk abatement in mixed conifer and pine-oak forests on slopes greater than 40% where timber harvest has not occurred in the last 20 years (Tonto Land Management Plan, p. 40-2).	The Rim country project would be excepted from this Standard/Guideline to conduct needed restoration treatments in areas where adverse impacts to soils are not anticipated. Within the Rim Country project area, mechanical treatments may occur on slopes greater than 40% where mechanical treatments are not otherwise restricted and the use of modern mechanized ground-based equipment that would not result in adverse effects on soil and water resources. Mechanical restoration treatments on slopes greater than 40% will adhere to the Rim Country Project design features and Best Management Practices designed to protect soils and water quality.
Restrict tractor skidding to those areas that have sustained slopes of 40% or less (Tonto Land Management Plan, p.158).	The Rim country project would be excepted from this Standard/Guideline to conduct needed restoration treatments in areas where adverse impacts to soils are not anticipated. Within the Rim Country project area, mechanical treatments are allowed on slopes greater than 40% where mechanical treatments are not otherwise restricted and the use of mechanized ground-based equipment would not result in adverse effects on soil and water resources. Mechanical restoration treatments on slopes greater than 40% will adhere to the Rim Country Project design features and Best Management Practices designed to protect soils and water quality.

Appendix C – Design Features, Best Management Practices, Mitigation, and Conservation Measures

Table C-1 lists design features, best management practices, and mitigation and conservation measures (collectively referred to as design features) that are designed to minimize or avoid effects common to all action alternatives. They are integral parts of the action alternatives that help align proposed activities with land management plan objectives, desired conditions, standards, and guidelines. As such, they have been included in the analysis presented in this FEIS. Design features in the table are organized by resource.

Legend:

AQ- Aquatics

BT- Botany

CK- Caves and Karst Features

CT- Cultural and Tribal Relations

FE- Fire Ecology

NW- Noxious Weeds

RM- Range Management

RS- Recreation and Scenery

SI- Silviculture

SU- Special Uses

SW- Soils and Watershed

TR- Transportation

WL- Wildlife

Table C-1. Design features, best management practices, mitigation, and conservation measures

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
AQ001	Any equipment or personnel for activities in and around streams, natural or constructed waters, springs, or wetlands of any kind will use decontamination procedures to prevent the spread of disease (Chytrid fungus) and aquatic invasive species. Personnel entering the water will follow Appendix G in the 2007 Chiricahua Leopard frog Recovery Plan and the Stop Aquatic Hitchhikers Clean, Drain, Dry procedure: http://stopaquatichitchhikers.org/prevention/#clean-drain-dry.	To minimize potential for spreading aquatic diseases or invasive species.	Land Management Plan compliance
AQ002	**Porous Boulder Structures and Vane Restoration Treatments:** • Full channel spanning boulder structures are to be installed only in highly uniform, incised, bedrock-dominated channels to enhance or provide fish habitat in stream reaches where log placements are not practicable due to channel conditions (not feasible to place logs of sufficient length, bedrock dominated channels, deeply incised channels, artificially constrained reaches, etc.), where damage to infrastructure on public or private lands is of concern. • Install boulder structures low in relation to channel dimensions so that they are completely overtopped during channel-forming flow events (approximately a 1.5 flow event). • Boulder step structures are to be placed diagonally across the channel or in more traditional upstream pointing “V” or “U” configurations with the apex oriented upstream. • Boulder step structures are to be constructed to allow upstream and downstream passage of all native fish species and life stages that occur in the stream. Plunges shall be kept to less than 6 inches in height. • The use of gabions, cable, or other means to prevent the movement of individual boulder in a boulder step structure is not allowed. • Rock for boulder step structures shall be durable and of suitable quality to assure long-term stability in the climate in which it is to be used. Rock sizing depends on the size of the stream, maximum depth of low, planform, entrenchment, and ice and debris loading. • The project designer or an inspector experienced in these structures should be present during installation. • Full spanning boulder step structure placement should be coupled with measures to improve habitat complexity and protection of riparian areas to provide long-term inputs of large wood.	To guide porous boulder structures and vane restoration treatments for aquatic and watershed restoration.	Specialist recommendation
AQ003	When using pressure treated lumber for fence posts, complete all cutting/drilling offsite of the designated aquatic management zone (AMZ) (to the extent possible) so that treated wood chips and debris do not enter water or flood prone areas.	To prevent detrimental effects of chemicals from entering aquatic habitats.	Specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
AQ004	**Set-back or removal of existing berms:** • Design actions to restore floodplain characteristics-elevation, width, gradient, length, and roughness—in a manner that closely mimics, to the extent possible, those that would naturally occur at that stream and valley type. • Remove drainpipes, fences, and other capital projects to the extent possible. • To the extent possible, remove nonnative fill material from the floodplain to an upland site. • Where it is not possible to remove or set-back all portions of berms, or in areas where existing berms support abundant riparian vegetation, openings will be created with breaches. Breaches shall be equal to or greater than the active channel width to reduce the potential for channel avulsion during flood events. In addition to other breaches, the berm, dike, or levee shall always be breached at the downstream end of the project or at the lowest elevation of the floodplain to ensure the flows will naturally recede back into the main channel thus minimizing fish entrapment.	To guide set-back or removal of existing berms, dikes, and levees to reconnect stream channels with floodplains as a means to increase habitat diversity and complexity, moderate flow disturbances, and provide refuge for fish during high flows.	Land Management Plan compliance and specialist recommendation
AQ005	**Channel Reconstruction/Relocation Treatments:** • Construct geomorphically appropriate stream channels and floodplains within a watershed, valley, and reach context. • Design actions to restore floodplain characteristics – elevation, width, gradient, length, and roughness-in a manner that closely mimics, to the extent possible, those that would naturally occur at that stream and valley type. • To the greatest degree possible, remove nonnative fill material from the channel and floodplain to an upland site. • When necessary, loosen compacted soils once overburden material is removed. Overburden or fill comprised of native materials, which originated from the project area, may be used within the floodplain where appropriate to support the project goals and objectives. • Structural elements shall fit within the geomorphic context of the stream system. For bed stabilization and hydraulic control structures, constructed riffles shall be preferentially used in pool-riffle stream types, while roughened channels and boulder step structures shall be preferentially used in step-pool and cascade stream types. • Material selections (large wood, rock, gravel) shall also mimic natural stream system materials. • Construction of the stream bed should be based on Stream Simulation Design principles as described in section 6.2 of Stream Simulation: An Ecological Approach to Providing Passage of Aquatic Organisms at Road-Stream Crossings or other appropriate design guidance documents (United States Department of Agriculture (USDA) - Forest Service (USFS) 2008).	To guide stream, floodplain, and other stream/watershed restoration treatments to minimize detrimental effects to aquatic habitats.	Land Management Plan compliance and specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
AQ006	All aquatic bearing stream crossings must be approved by approved by the sale administrator or contracting officer's representative after coordination with the resource specialist and authorized Forest Service officer in advance of use to minimize the number and length of stream crossings. Such crossings would be at right angles and avoid potential spawning or breeding areas to the greatest extent possible. Stream crossings shall not increase the risk of channel re-routing at low and high-water conditions. After project completion, temporary stream crossing would be restored per TR008. Timing of crossings is addressed in AQ017.	To minimize ground disturbance in aquatic and associated habitats during site preparation and sedimentation to aquatic habitats.	Land Management Plan compliance and specialist recommendation
AQ007	For recreation relocation projects—such as trails—move out of the riparian area or as far away from the stream as possible.	To reduce recreation effects on aquatic habitats.	Land Management Plan compliance
AQ008	To the extent feasible, heavy equipment will work from the top of the bank, unless working from within the stream bed would result in less damage to the aquatic ecosystem, as determined by a biologist.	To minimize ground disturbance in aquatic and associated habitats during site preparation and sedimentation to aquatic habitats.	Land Management Plan compliance and specialist recommendation
AQ009	Any fence placement must allow for lateral movement of a stream and to allow establishment of riparian plant species. To the extent possible, fences will be placed outside the channel migration zone. Fences that cross the channel migration and the stream channel proper should include breakaway portions that will not collect debris on the fence and cause potential breach of the debris jam.	To maximize success of riparian planting and reduce maintenance on fencing.	Specialist recommendation
AQ010	When building riparian exclosure fences, minimize vegetation removal, especially potential large wood recruitment sources, when constructing fence lines (see RM006 and SI003).	To reduce detrimental effects to riparian species (flora and fauna) and floodplains.	Specialist recommendation
AQ011	Leave sufficient numbers of cut trees (large woody debris) on site for needed surface flow grade control in systems where large woody debris is appropriate. Fisheries, wildlife, and hydrologist personnel will identify locations for large woody debris during sale preparation.	To minimize impacts to streams and soils in meadows from tree thinning operations.	Land Management Plan compliance and specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
AQ012	**Streambank Restoration Treatments:** Without changing the location of the bank toe, restore damaged streambanks to a natural slope and profile suitable for establishment of riparian vegetation. This may include sloping of unconsolidated bank material to a stable angle of repose or the use of benches in consolidated, cohesive soils. • Complete all soil reinforcement earthwork and excavation when soils are sufficiently dry to prevent excessive rutting. When necessary, use soil layers or lifts that are strengthened with biodegradable fabrics and penetrable by plant roots. • Include large wood to the extent it would naturally occur for streambank restoration. If possible, large wood should have untrimmed root wads to provide functional refugia habitat for fish. Wood that is already within the stream or suspended over the stream may be repositioned to allow for greater interaction with the stream. • Rock will not be used for streambank restoration, except as ballast to stabilize large wood. • Use a diverse assemblage of vegetation species native to the action area or region, including trees, shrubs, and herbaceous plants. Vegetation, such as willow, sedge and rush mats, may be gathered from abandoned floodplains, stream channels, etc. Sedge and rush mats should be sized to prevent their movement during high flow events. • Do not apply surface fertilizer within the AMZ of any stream channel. • Install fencing as necessary to prevent access to revegetated sites by grazing ungulates or unauthorized persons. • Conduct post-construction monitoring and treatment or removal of invasive plants until native plant species are well established in accordance with annual budgetary and program of work considerations.	To guide streambank and channel restoration/resilience treatments.	Land Management Plan compliance and specialist recommendation
AQ013	Minimize removal of desirable vegetation around springs, streams and wetlands.	To reduce detrimental effects to sensitive habitats.	Land Management Plan compliance and specialist recommendation
AQ014	When removing a culvert from a first or second order, non-fish bearing stream, roads managers, biologists, and watershed personnel shall determine if culvert removal should include stream isolation and rerouting in project design. Culvert removal on fish bearing streams shall adhere to the measures described in Fish Passage Restoration.	To reduce impacts to fish passage.	Specialist recommendation
AQ015	For culvert removal projects, restore natural drainage patterns and channel morphology. Evaluate channel incision risk and construct in-channel grade control structures when necessary.	To reduce detrimental effects to floodplains, riparian areas, stream channels and aquatic habitat.	Land Management Plan compliance and specialist recommendation
AQ016	Structural erosion control measures will not include materials (such as straw waddles) that can trap reptiles or amphibians in their habitat. Structural erosion control measures not made of biodegradable material (for example, silt fences) will be removed and material contoured in or removed once the site is stabilized to prevent them from causing resource issues and decomposing on site.	To minimize detrimental effects to federally listed, sensitive, or other reptiles and amphibians.	Land Management Plan compliance and specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
AQ017	• Given the potential for multiple aquatic species to occur in a given location, Forest Service, U.S. Fish and Wildlife Service (USFWS), and Arizona Game and Fish Department (AGFD) biologists will cooperatively prioritize aquatic species of concern on a site-specific basis regarding timing restrictions for instream and riparian restoration activities • Work will occur during base-flow conditions, and on dry or frozen riparian soil conditions where possible.	To minimize direct effects to critical habitat (for example, spawning and breeding) for federally listed and forest sensitive species.	Land Management Plan compliance and specialist recommendation
AQ018	Biologists will be consulted during pre-planning for all treatments that will occur in springs, streams, and riparian areas, as well as fens or bogs where histic soils are present, to determine presence of federally listed or sensitives species (plants or animals), as well as mitigations needed for rare or sensitive species in/near the work areas. Also see SI019.	To minimize effects to rare/sensitive aquatic species during project implementation.	Land Management Plan compliance and specialist recommendation
AQ019	**Narrow-headed gartersnakes:** • AMZ in Narrow-headed gartersnake proposed critical habitat will be 150 ft. on either side of the stream. • No mechanical or hand piling will occur within the gartersnake AMZ to minimize harm during controlled burns or pile burning because gartersnakes utilize piles for cover (also see FE006). • Disturbance of rock/boulder piles and large woody debris in narrow-headed gartersnake habitat or proposed critical habitat will be avoided to the greatest extent practical during their brumation/inactive period (November/December-February, depending on elevation). • Do not build temporary roads in narrow-headed gartersnake AMZs.	To minimize detrimental effects to federally listed gartersnakes.	Land Management Plan compliance and specialist recommendation
AQ020	Coordinate with AGFD, USFWS and the Forest Service district biologist early (at least 6 months prior to implementation) within narrow-headed gartersnake and Chiricahua leopard frog occupied habitat to determine if surveys are required and to determine agreed upon, short-term care facilities for any Chiricahua leopard frog or narrow-headed gartersnakes found prior to or during implementation.	To minimize direct effects to federally listed amphibians and reptiles.	Specialist recommendation
AQ021	Precautions would be taken to ensure fish are isolated from instream work areas during heavy mechanical stream restoration or any road/crossing work where equipment is in the stream or water may be diverted. If dewatering is necessary, ensure diversion passes flows and aquatic species to minimize detrimental effects. If surface water needs to be diverted to meet construction needs and aquatic species are or may be present, fish screen(s) will be installed, operated, and maintained.	To minimize sedimentation and detrimental effects to aquatic species and habitat during aquatic and watershed restoration projects.	Specialist recommendation
AQ022	Avoid water withdrawals from streams bearing aquatic species whenever possible. Water drafting must take no more than 10% of the stream flow and must not dewater the channel to the point of isolating species. Pump intakes shall have fish screens of 3/32 inch mesh or less and will have an intake flow of less than 1 foot/second to prevent entraining fish. Implement decontamination procedures as outlined in AQ001 when drafting from waterbodies and streams. Biologists must be consulted in all situations when pumping water from streams or other natural waterbodies.	To avoid or minimize detrimental effects to native or desirable aquatic species and habitats.	Land Management Plan compliance
AQ023	Avoid discharging water from one source into a different body of water, such as dumping unused water from a water tender in or near a water body other than the water body from which it was acquired.	To avoid spread of invasive species, disease, and contaminants.	Land Management Plan compliance

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
AQ024	**Restoring fish passage during Headcut and Grade Stabilization Treatments:** • In streams with current or historic fish presence, provide fish passage over stabilized headcut through constructed riffles for pool/riffle streams or series of log or rock structures for step/pool channels. If large wood and boulder placement is used for headcut and grade stabilization, refer to Large Wood, Boulder, and Gravel Placement. • Armor headcut with sufficiently sized and amounts of material to prevent continued up-stream migration of the headcut. Materials can include both rock and organic materials which are native to the area. Material shall not contain gabion baskets, sheet pile, concrete, articulated concrete block, and cable anchors. • Focus stabilization efforts in the plunge pool, the headcut, as well as a short distance of stream above the headcut. • Minimize lateral migration of channel around headcut ("flanking") by placing rocks and organic material at a lower elevation in the center of the channel cross section to direct flows to the middle of the channel. • Short-term headcut stabilization may occur without associated fish passage measures. However, fish passage must be incorporated into the final headcut stabilization action and be completed during the first subsequent in-water work period. • In streams without current or historic fish presence, it is recommended to construct a series of downstream log or rock structures to expedite channel aggradation. • Construct structures in a 'V' or 'U' shape, oriented with the apex upstream, and lower in the center to direct flows to the middle of the channel. • Key structures into the stream bed to minimize structure undermining due to scour, preferably at least 2.5 times their exposure height. The structures should also be keyed into both banks – if feasible greater than 8 ft. • If several structures will be used in a series, space them at the appropriate distances to promote fish passage of all life stages of native fish. Incorporate jump height, pool depth, etc. in the design of step structures. Recommended spacing should be no closer than the net drop divided by the channel slope (for example, a one-foot-high step structure in a stream with a two-percent gradient will have a minimum spacing of 50-feet. • Include gradated (cobble to fine) material in the rock structure material mix to help seal the structure/channel bed, thereby preventing subsurface flow and ensuring fish passage immediately following construction if natural flows are sufficient. • If a project involves the removal of multiple barriers on one stream or in one watershed over the course of a work session, remove the most upstream barrier first if possible.	To minimize loss of fish passage during headcut and channel grade stabilization treatments.	Specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
AQ025	**Large Wood, Boulder, and Gravel Placement Treatments:** • Place large wood and boulders in areas where they would naturally occur and in a manner that closely mimic natural accumulations for that particular stream type. For example, boulder placement may not be appropriate in low gradient meadow streams. • Structure types shall simulate disturbance events to the greatest degree possible and if appropriate, could include, but are not limited to, log jams, debris flows, windthrow, and tree breakage. • No limits are to be placed on the size and shape of structures as long as such structures are within the range of natural variability of a given location and do not block fish passage. • Projects can include grade control and bank stabilization structures, while size and configuration of such structures will be commensurate with scale of project site and hydraulic forces. • The partial burial of large wood and boulders is permitted. This applies to all stream systems but more so for larger stream systems where use of adjacent riparian trees or channel features is not feasible or does not provide the full stability desired. • Large wood includes whole conifer and hardwood trees, lobs, and root wads. Large wood size (diameter and length) should account for bankfull width and stream discharge rates. When available, trees with root wads should be a minimum of 1.5 times bankfull channel width, while logs without root wads should be a minimum of 2.0 times bankfull width. • Structures may partially or completely span stream channels or be positioned along stream banks. • Stabilizing or key pieces of large wood must be intact, hard, with little decay, and if possible, have root wads (untrimmed) to provide functional refugia habitat for fish. Consider orienting key pieces such that the hydraulic forces upon the large wood increases stability. • Anchoring large wood – Anchoring alternatives may be used in preferential order: 1) Use of adequately sized wood sufficient for stability. 2) Orient and place wood in such a way that movement is limited. 3) Ballast (gravel or rock) to increase the mass of the structure to resist movement. 4) Use of large boulders as anchor points for large wood. 5) Pin large wood with rebar to large rock to increase its weight. For stream that are entrenched (Rosgen F, G, A, and potentially B) or for other streams with very low width to depth ratios (less than 12) and additional 60% ballast weight may be necessary due to greater flow depths and higher velocities.	To guide successful large wood and boulder stream restoration treatments.	Land Management Plan compliance and specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
AQ026	**Engineered Logjam Treatments:** • Engineered log jams will be patterned, to the greatest degree possible, after stable natural log jams. • Grade control engineered log jams are design to arrest channel downcutting or incision by providing a grade control that retains sediment, lowers stream energy, and increases water elevations to reconnect floodplain habitat and diffuse downstream flood peaks. • Stabilizing or key pieces of large wood that will be relied on to provide streambank stability or redirect flows must be intact and solid (little decay). If possible, acquire large wood with untrimmed root wads to provide functional refugia habitat for fish. • When available, trees with root wads should be a minimum of 1.5 times bankfull channel width, while logs without root wads should be a minimum of 2.0 times bankfull width. • The partial burial of large wood and boulders may constitute the dominant means of placement, and key boulders (footings) or large wood can be buried into the stream bank or channel. • Angle and Offset – The large wood portions of engineered log jam structures should be oriented such that the force of water upon the large wood increases stability. If a root wad is left exposed to the flow, the bole placed into the stream bank should be oriented downstream parallel to the flow direction so the pressure on the root wad pushes the bole into the streambank and bed. Wood members that are oriented parallel to flow are more stable than members oriented at 45 or 90 degrees to the flow. • If large wood anchoring is required, a variety of methods may be used. These include buttressing the wood between riparian trees, the use of manila, sisal or other biodegradable ropes for lashing connections. If hydraulic conditions warrant use of structural connections, such as rebar pinning or bolted connections, may be used. Rock may be used for ballast but is limited to that needed to anchor the large wood. • There is no d.b.h. (diameter at breast height) restriction for large wood, but consider the following before removing and placing trees:	To guide engineered log jam stream treatments.	Land Management Plan compliance and specialist recommendation

<table>
<tr><th>DF/BMP/M&CM Number</th><th>Description</th><th>Primary Purpose</th><th>Basis</th></tr>
<tr><td>AQ026
(Continued)</td><td>
Diameter:
This key to establishing a logjam is utilizing larger diameter wood that resists decay. These pieces of wood are often called “key pieces,” and serve as the anchors for the logjam structure. Wood can improve fish habitat only if the wood is large enough to stay, influence flow patterns, and sediment sorting. Larger diameter wood retains its size longer as abrasion and decay occurs over the years. Larger diameter wood is more effective in creating pools and complex channels that improve fish populations. The minimum diameter required for a key piece of wood depends on bankfull width of the stream is found in the following table.
Bankfull widths and minimum diameter of logs to be considered key pieces.
Bankfull Width* - Feet Minimum Diameter* - Inches
Bankfull widths and minimum diameter of logs to be considered key pieces.
<table>
<tr><th>Bankfull Width* - Feet</th><th>Minimum Diameter* - Inches</th></tr>
<tr><td>0 to 10</td><td>10</td></tr>
<tr><td>10 to 20</td><td>16</td></tr>
<tr><td>20 to 30</td><td>18</td></tr>
<tr><td>Over 30</td><td>22</td></tr>
</table>
* This table was taken from ‘1995 Guide to Placement of Large Wood in Streams.’
Length:
The length of the wood is also important to stability. To be considered a key piece a log with a rootwad still attached should be at least one and one-half times (1.5X) the bankfull or a log without a rootwad should be twice (2X) the length of the stream’s bankfull width. As the best fish habitat is formed around jams composed of 3 to 7 logs, at least 2 key pieces should be used at each structure.

Mimic natural accumulations of large woody debris based on stream type, valley setting, and community type and ensure future large woody debris recruitment.
Tailholds as part of tree tipping operations are permitted across perennial, intermittent, and ephemeral streams but the use of protective straps will be required to prevent tree damage.

</td><td>To guide engineered log jam stream treatments.</td><td>Land Management Plan compliance and specialist recommendation</td></tr>
</table>

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
AQ027	**Gravel Augmentation Stream Restoration Treatments:** • Gravel can be placed directly into the stream channel, at tributary junctions, or other areas in a manner that mimics natural debris flows and erosion. • Augmentation will only occur in areas where the natural supply has been eliminated, significantly reduced through anthropogenic disruptions, or used to initiate gravel accumulations in conjunction with other projects, such as simulated log jams and debris flows. • Gravel to be placed in streams shall be a properly sized gradation for that stream, clean, and non-angular. When possible, use gravel of the same lithology as found in the watershed. Reference the Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings (USDA-USFS 2008) to determine gravel sizes appropriate for the stream. • Gravel can be mined from the floodplain at elevations above bankfull, but not in a manner that would cause stranding during future flood events. Crushed rock is not permitted. • After gravel placement in areas accessible to higher stream flow, allow the stream to naturally sort and distribute the material. • Do not place gravel directly on bars and riffles that are known spawning areas, which may cause fish to spawn on the unsorted and unstable gravel, thus potentially resulting in red destruction.	To guide gravel augmentation treatments for aquatic and watershed restoration.	Land Management Plan compliance and specialist recommendation
AQ028	Imported gravel for use in or around aquatic systems must be free of invasive species, non-native seeds, and aquatic diseases. If necessary, wash gravel prior to placement and allow it to completely dry for a minimum of 2 days to prevent spread of chytrid fungus. More time for drying may be needed depending on the amount of gravel.	To prevent spread or introduction of invasive species and aquatic diseases in stream habitat.	Land Management Plan compliance and specialist recommendation
AQ029	**Off and Side Channel Stream Habitat Restoration:** • When a proposed side channel contains more than 20% of the bankfull flow, the action agencies will ensure that the action is reviewed by the forest or regional fisheries biologist and the forest or regional engineer. • Data requirements and analysis for off- and side-channel habitat restoration include evidence of historical channel location, such as land use surveys, historical photographs, topographic maps, remote sensing information, or personal observation. • Allowable excavation: Off- and side channel improvements can include minor excavation (less than 10% of volume) of naturally accumulated sediment within historic channels. There is no limit as to the amount of excavation of anthropogenic fill within historic side channels as long as such channels can be clearly identified through field or aerial photographs. Excavation depth will not exceed the maximum thalweg depth in the main channel. Excavated material removed from off- or side-channels shall be hauled to an upland site or spread across the adjacent floodplain in a manner that does not restrict floodplain capacity.	To reconnect historic side-channels with floodplains by removing off-channel fill and plugs. Furthermore, new side-channels and alcoves can be constructed in geomorphic settings that will accommodate such features.	Land Management Plan compliance and specialist recommendation
AQ030	Ensure that an experienced engineer, fisheries biologist, hydrologist and/or geomorphologist are involved in the design of all aquatic restoration projects as needed. Their experience should be commensurate with the technical requirements of the project being undertaken.	To ensure technical skills and planning requirements for all aquatic and watershed restoration treatments.	Specialist recommendation

<table>
<tr><th>DF/BMP/M&CM Number</th><th>Description</th><th>Primary Purpose</th><th>Basis</th></tr>
<tr><td>AQ031</td><td>Replant each area requiring revegetation prior to or at the beginning of the first growing season following instream or riparian restoration activities. Achieve reestablishment of vegetation in disturbed areas to at least 70% of pre-project levels within three years. Barriers will be installed as necessary to prevent access to revegetated sites by ungulates or unauthorized persons.</td><td>To rehabilitate all disturbed areas from aquatic and watershed restoration treatments, minimize erosion and sedimentation to aquatic habitats and potential effects to species.</td><td>Land Management Plan compliance</td></tr>
<tr><td>AQ032</td><td>During all implementation within AMZ's, maintain shade, bank stability, and large woody material recruitment potential.</td><td>Minimize detrimental disturbance of desirable riparian/aquatic conditions to the greatest extent practical.</td><td>Land Management Plan compliance</td></tr>
<tr><td>AQ033</td><td>Live conifers and other trees can be felled or pulled/pushed over for in-channel large wood placement in streams only when conifers and trees are fully stocked by silvicultural standards. Tree felling shall not create excessive stream bank erosion, increase the likelihood of channel avulsion during high flows, and does not negatively impact use of spawning gravels or increase width to depth ratios.</td><td>To maintain forest structure and facilitate riparian restoration activities.</td><td>Specialist recommendation</td></tr>
<tr><td>AQ034</td><td>Within the primary shade zone for streams, springs and wet meadows retain 100% of the over-story canopy closure with the exception of hardwood treatments, unless other exceptions listed below are met. Source trees being extracted (either by tipping and/or felling) for stream restoration will not be cut from within the primary shade zone.
<table><tr><th>Hill Slope</th><th>Primary Shade Zone Width (slope distance)</th></tr><tr><td><30%</td><td>50 ft.</td></tr><tr><td>30-60%</td><td>55 ft.</td></tr><tr><td>>60%</td><td>60 ft.</td></tr></table>Exceptions:
The distances listed above may be reduced (but not less than 25 ft.) if any of the following conditions apply:
The trees are located on a south facing slope and therefore do not provide stream shade;
An appropriate level of analysis is completed and documents, such as shade modeling with LiDAR, using site-specific characteristics to determine the primary shade tree width; and/or
Field monitoring or measurements are completed to determine the width where Optimum Angular Canopy Density (65% or greater) is achieved.
If trees are being felled for safety reasons they can be felled toward the stream.</td><td>To maintain or improve the primary shade zone surrounding aquatic habitats.</td><td>Specialist recommendation</td></tr>
<tr><td>AQ035</td><td>In leopard frog occupied and dispersal habitat, a 150 ft. AMZ would be established around designated stream courses, stock tanks, or other water bodies. Designated skid trail crossings through the AMZ are only allowed with biologist recommendation.</td><td>To minimize direct effects to federally listed and sensitive amphibians.</td><td>Specialist recommendation</td></tr>
</table>

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
AQ036	Utilize prescribed firing techniques that ensure low-severity in native leopard frog AMZs and Arizona toad habitats within dispersal distance from occupied sites. No direct ignition will occur in occupied habitat (unless to ensure low-severity fire) or in riparian areas (FE006 and FE007). If fuel conditions result in significant ash and sediment flow into an occupied site that cannot be mitigated through erosion control measures following guidelines in AQ016, the resource advisor or biologist will contact AGFD and USFWS.	Minimize disturbance while restoring forest conditions.	Specialist recommendation
AQ037	Use of heavy mechanical equipment will temporarily cease in leopard frog dispersal or occupied habitat for the length of an isolated monsoon rain event producing greater than one tenth of an inch over a 24 hour period (based on the nearest rain gauge/station) in an active treatment area unless continuation of work is supported by a biologist and approved by a sale administrator or COR.	To minimize direct effects to federally listed and sensitive amphibians.	Specialist recommendation
AQ038	Do not use tanks for water sources that are known to have populations of leopard frogs as water sources for prescribed fire activities. Activities in and around natural or constructed waters would use decontamination procedures to prevent the spread of Chytrid (Bd) fungus and other invasive aquatic species unless an evaluation by a forest biologist determines it unnecessary.	To minimize direct effects to federally listed and sensitive amphibians and introduction of disease.	Specialist recommendation
AQ039	Prior to reinitiating operations in rock pits where standing water is pooled, a biologist will determine if aquatic surveys for sensitive or threatened species should occur.	To avoid or minimize potential impacts to threatened or sensitive aquatic species.	Land Management Plan compliance and specialist recommendation
AQ040	No cable operations would occur within spinedace occupied or critical habitat or slopes above said habitat.	To avoid or minimize potential impacts to threatened aquatic species.	Specialist Recommendation
BT001	During layout and marking, protect Southwestern Region sensitive plants and species of conservation concern where practical by including the plants within tree groups and using areas not occupied by the plants as interspaces. If species of conservation concern could benefit from thinning operations work with local specialist to develop marking guidelines.	Provide protection and shade needed by the sensitive plants while allowing for the least effect on clump/group/interspace design and layout during implementation and help mitigate effects on Southwestern Region sensitive plants and Land Management Plan analysis species.	Specialist recommendation
BT002	Survey springs and channels for Bebb's willow before implementation and identify locations. If plants are found, operational modifications will include avoiding plants, altering designs, or including plants in enclosures in coordination with the forest botanist or district wildlife biologist. Identify opportunities to enhance Bebb's willow where plants are decadent or dying. Manual grubbing of grasses may be used to increase the likelihood of planting success.	Protects populations and habitat of Bebb's willow. Bebb's willow stands would be enhanced by using cuttings, planting locally cultivated plants, and fencing existing or newly planted willows.	Land Management Plan compliance
BT003	Prescribed fires will be conducted under conditions that promote native plant communities, hinder weed species germination, aid with controlling existing weed infestations, and prevent the spread of existing weeds to the extent possible.	Promote healthy native plant communities and reduces the risk of noxious or invasive weed invasions.	Land Management Plan compliance

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
BT004	Review various sites such as spring restoration for opportunities to introduce and restore Bebb's willow to supplement existing locations on the forest and introduce young plants into areas where plants are decadent and dying. Bebb's willow stands would be enhanced by using cuttings, planting locally cultivated plants, and using barriers as needed to protect existing or newly planted willows from browsing. Manual grubbing of grasses may be used to increase the likelihood of planting success. Where needed, fire lines for prescribed fire would be placed around Bebb's willows and/or fuels would be removed from the vicinity of willow clumps to ensure there is only low to very low burn severity (fire effects to soil) and low- to very low-severity (fire effects to vegetation) in and around willow clumps.	Aids in restoring Bebb's willow which is a Southwestern Region sensitive species for the A-S and Coconino National Forests (NF) and a rare species on the landscape for both forests.	Specialist recommendation
BT005	When planning for implementation, identify at-risk species (Southwest Region sensitive plant species and species of conservation concern) and narrow endemics, and determine potential habitat based on past occurrences and the known ranges of the species. If there are no documented surveys, the appropriate specialist (for example, forest or regional botanist, wildlife biologist) should be consulted to determine the need for, and extent of, new surveys. If the appropriate specialist is unavailable, the area to be treated should be surveyed prior to implementation and implementation plans should be adjusted if/as needed, based on survey results. Surveys should focus on areas most likely to contain plants or potential habitat for the targeted species, based on conditions such as soil or vegetation type, rather than covering the entire area. Habitat modeling, or the use of habitat descriptions of species from past documentation, etc. will be used to help define survey areas. Narrow endemics should receive more attention than more widespread species because the loss of individuals would have greater impact on the overall population of the species than in more widely distributed species. Work with partners on developing suitability layers for at-risk plant species within the 4FRI footprint.	Complies with Forest Service Manual direction 2670. Manual direction (FSM 2670.5(19)) emphasizes that management actions should avoid or minimize effects on sensitive species.	Land Management Plan compliance
BT006	Monitor the effects of treatment on Southwestern Region sensitive plants and Species of Conservation Concern after treatments at select sites.	Provides opportunities to obtain knowledge on local species that are often poorly understood. Allows for adaptive management in future treatments.	Land Management Plan compliance
BT007	Mitigate loss of individuals and groups of Southwestern Region sensitive plants and species of conservation concern during management activities by avoiding plants as much as possible while achieving management objectives. Preserve plants and habitat during implementation of management activities, while realizing there may be some short-term losses of individuals or groups and short-term effects to habitat while moving toward desired conditions.	Complies with FSM direction, minimizes effects on Southwestern Region sensitive plants and Species of Conservation Concern.	Land Management Plan compliance
BT008	Where possible, landings, machine slash piles and other ground disturbing activities (for example, firelines, parking areas, temporary road construction, road reconstruction, and pits) should not occur directly on Southwestern Region sensitive plant populations and species of conservation concern.	Mitigates effects of disturbance, loss of plants, and severe burning effects on soils. Reduces loss of native seed bank and limits extent of severe disturbances.	Land Management Plan compliance and specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
CK001	A buffer to restrict mechanical treatment within a radius of 300 feet should be used to restrict activities that can negatively alter the resources, functions, and associated features of caves or karst features unless site-specific adjustments are made in coordination with the appropriate specialist(s), based on the characteristics and importance of the cave or karst features and the expected impact of the proposed activity. Thinning or other vegetation treatments with chainsaws or other light equipment, as needed to implement mechanical treatments or prescribed fire, may be used up to cave openings or edges of the sinkholes/pits if specialists determine that there is some risk to the cave/karst environment if nothing is done. Directional felling should be used to fell trees away from karst features. If felled trees must be removed from within the buffer, avoid yarding over or through karst features.	Minimize alteration of the chemical, physical, and biological conditions of karst features, to protect human health and safety, and to reduce potential disturbance to roosting bats. To protect cave ecosystems from negative fire effects and to minimize alteration of the chemical, physical, and biological conditions of karst features.	Land Management Plan compliance and specialist recommendation
CT001	All activities will comply with the National Historic Preservation Act for all ground-disturbing undertakings as appropriate. Effects on cultural resources would be determined in consultation with the State Historic Preservation Office and other consulting parties. Potential effects would be addressed through site avoidance strategies and implementing the site protection measures listed in Appendix J of the Southwestern Region Programmatic Agreement (PA) and in the 4FRI heritage strategy and section 106 clearance report.	Regulatory requirement. Compliance with NHPA and Southwestern Region Programmatic Agreement (PA) with Arizona SHPO.	Land Management Plan compliance and specialist recommendation
CT002	Consult with Federally Recognized Native American Tribes, particularly when projects and activities are planned in sites or areas of known religious or cultural significance.	Regulatory requirement. Compliance with NHPA, the American Indian Religious Freedom Act of 1978 , Southwestern Region PA with Arizona SHPO, Executive Order 13007, EO 13175, and other applicable Executive Orders and legislation.	Land Management Plan compliance
CT003	Eligible, or potentially eligible, cultural resources would be managed to achieve a “no effect” or “no adverse effect” determination whenever possible, in consultation with the SHPO and ACHP (36 CFR 800).	Regulatory requirement. Compliance with NHPA and Southwestern Region PA with Arizona SHPO.	Land Management Plan compliance and specialist recommendation
CT004	Monitoring during and after project implementation shall occur to document site protection and condition.	Compliance with Southwestern Region PA (Appendix J) with Arizona SHPO.	Land Management Plan compliance and specialist recommendation
CT005	Proposed treatment activities and schedules would accommodate tribal traditional and ceremonial use.	Compliance with the Food, Conservation, and Energy Act of 2008 (Public Law 110-234).	Land Management Plan compliance and specialist recommendation
CT006	In accordance with regulations (43 CFR 10) governing application of the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA), if human remains, funerary objects, sacred objects, or objects of cultural patrimony are inadvertently encountered, operations in the area must immediately cease and the Forest Archaeologist must be notified. The Forest will work to initiate consultation with the affected tribe (s) to implement any requirements listed in NAGPRA and the PA and to develop a plan to mitigate for the effects on the find.	Regulatory requirement. Compliance with NAGPRA, NHPA and Southwestern Region PA with Arizona SHPO.	Land Management Plan compliance and specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
CT007	Should any previously unidentified cultural materials be discovered during project implementation, work must cease immediately, and the forest archaeologist must be contacted to initiate the consultation process as outlined in the Advisory Council on Historic Preservation Regulations (36 CFR Part 800.13).	Regulatory requirement. Compliance with NHPA and Southwestern Region PA with Arizona SHPO.	Land Management Plan compliance and specialist recommendation
CT008	Contracts, permits, or leases that have the potential to affect cultural resources shall include appropriate clauses specifying site protection responsibilities and liabilities for damage.	To ensure that mitigations measures identified during the analysis phase to protect cultural sites from being adversely affected are addressed during the implementation portion of the project.	Land Management Plan compliance and specialist recommendation
CT009	Fines, etc., for the costs of restoration and repair resulting from breaches of contracts, permits, or leases that cause inadvertent or intentional damages to cultural or tribal resources shall be strictly enforced.	Archaeological Resource Protection Act of 1979 (ARPA), Site protection	Land Management Plan compliance and specialist recommendation
CT010	Locate, record, and evaluate the General Crook and other significant historic trails within the project area well before implementation. Maintain historic and scenic integrity of National Register-eligible historic roads, including the preservation of associated historic features, tread width, curve radii, and other features that contribute to the National Register eligibility of the historic roads.	Regulatory requirement. Compliance with NHPA and Southwestern Region PA with Arizona SHPO. Site protection, ARPA (prevention of looting).	Land Management Plan compliance and specialist recommendation
CT011	Plate over National Register-eligible and unevaluated sites located within roads that will be maintained or reconstructed	NHPA compliance, 4FRI Rim Country Site Plating protocol.	Land Management Plan compliance and specialist recommendation
CT012	Coordinate with forest cultural resource specialists to design and implement projects (or don't implement projects) located in areas of very high site density.	Site protection, ARPA (prevention of looting).	Land Management Plan compliance and specialist recommendation
CT013	Culturally modified trees such as blazed trees, lookout trees, phone line trees, arborglyphs, peeled trees, etc. will be avoided. Protection measures may include removing ladder fuels around the trees by hand, establishing buffer zones to keep equipment from damaging trees or affecting root systems, etc.	Regulatory requirement. Compliance with NHPA and Southwestern Region PA with Arizona SHPO.	Land Management Plan compliance and specialist recommendation
CT014	Roads to National Register-eligible and unevaluated sites identified to be closed post implementation will be closed after identified treatments are completed.	Regulatory requirement. Compliance with NHPA and Southwestern Region PA with Arizona SHPO.	Land Management Plan compliance and specialist recommendation
CT015	All rock pit locations will be surveyed for cultural resources. As a general rule, all identified cultural resources that are considered eligible for the purposes of Section 106 of the National Register of Historic Places within or adjacent to the rock pit boundary shall be flagged prior to implementation. In addition to flagging, rock pit extraction areas shall include fencing along the pit boundary to minimize the potential for indirect effects on cultural resources outside of the pit boundary where applicable. The forest may recommend other types of site mitigation measures as they see fit.	Reduces disturbance footprint, protects cultural and historic sites, and retains seed sources for eventual reestablishment of residual plant cover, potentially enhancing fruit, seed, and plant production.	Land Management Plan compliance and specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
CT016	During layout and implementation, identify traditionally used plants, including Emory oak, that are at risk or have been identified as culturally, medicinally, or economically important to tribal communities. Design and apply management prescriptions and activities to protect and enhance specified plant populations. Opportunities to harvest plants before implementation will be provided to Federally recognized tribes whose traditional territory is within the project area.	To protect and enhance populations of plants used traditionally by tribes and to improve tribal access to harvest those plants prior to implementation of restoration treatments.	Specialist recommendation
CT017	Restoration activities and uses should be administered in a manner that is sensitive to traditional American Indian beliefs and cultural practices	Compliance with the Food, Conservation, and Energy Act of 2008 (Public Law 110-234), 36 CFR 261.53(g) Closure Authority, EO 13007, EO 13175, and other applicable Executive Orders and legislation.	Land Management Plan Compliance
CT018	The Forest will coordinate with Tribal practitioners to ensure they have access to areas that provide them an opportunity to practice traditional activities, such as plant gathering and ceremonial activities that are essential in maintaining their cultural identity and the continuity of their culture, with reasonable limitations, consistent with public safety and multiple uses by other forest users. There are opportunities for solitude and privacy for ceremonial activities.	Compliance with the Food, Conservation, and Energy Act of 2008 (Public Law 110-234), 36 CFR 261.53(g) Closure Authority, EO 13007, EO 13175, and other applicable Executive Orders and legislation.	Specialist recommendation
CT019	Where appropriate, reduce fuels on archaeological sites in accordance with Section II of Appendix J of the Region 3 Programmatic Agreement. This process can include hand treatments within site boundaries, mechanical removal of trees along the edge of sites, and light burning through sites that are not fire sensitive.	To protect cultural sites from being adversely affected during the implementation portion of the project.	Specialist Recommendation
FE001	Prescribed fire will be implemented in such a way that, whenever possible, damage to fencing and other infrastructure used for managing livestock will be minimized. Any damage incurred to fences or other infrastructure associated with grazing management resulting from prescribed fire will be fixed as soon as possible following the burn, or on a timeline agreed on with range managers that would not affect planned grazing management.	To minimize damage to grazing infrastructure. Fire can easily damage grazing infrastructure, particularly fences, gates, and their supporting structure. Fencing can be costly and is critical to the effective implementation of grazing management strategies.	Specialist recommendation
FE002	Burn unit size, as well as strategic placement, would be a consideration in designing units and implementation prioritization.	Fire effects & behavior: Large treatment areas arranged across a landscape are generally more effective at reducing fire behavior than arrangements of small treatment areas are. The arrangement of treatment units, regardless of size, can also make a significant difference in the effectiveness of treatments.	Specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
FE003	As burn plans and burn units are developed, ensure consideration is given to the spatial and temporal effects of broadcast burning in the upper levels of a watershed.	To mitigate the cumulative effects to aquatic habitats and riparian areas of broadcast burning multiple adjacent levels within a watershed. Such effects include but are not limited to sedimentation and ash delivery to aquatic habitat.	Land Management Plan compliance and specialist recommendation
FE004	When necessary and practicable, damage or mortality to old trees and large trees would be mitigated by implementing prescription parameters, ignition techniques, raking, wetting, thinning, compressing slash, or otherwise mitigating fire effects to the degree necessary to meet burn objectives and minimize fire effects and behavior that could threaten old trees. Trees identified as being of particular concern (for example, trees with known nests or roosts for herons, eagles, osprey, or other raptors, occupied nest cores, or in Mexican spotted owl protected activity centers (PACs) would be managed in accordance with wildlife design features (see Wildlife). Prepare old trees before a burn if possible.	Old trees are rare components and are under-represented across much of the project area. Implementing mitigation measures when possible is a critical component of restoration on a landscape-scale. Large trees that are not old are not as susceptible to damage from fire as old trees. Mitigation measures that can be implemented before a burn, such as thinning or raking, may improve the response of the effectiveness of the mitigation measures.	Specialist recommendation
FE005	Fire personnel should confer with the appropriate district or forest personnel to identify noxious or invasive weeds within the perimeter of the prescribed burn unit, and areas that will be utilized as part of the implementation (such as staging areas), before burning is implemented. Jointly they shall identify the necessary mitigations as identified in the applicable forest weed management document. Mitigations may include, but are not limited to, avoiding noxious weeds while implementing and/or pretreatment of weeds before implementation. Follow-up monitoring should be conducted, especially in areas of severe disturbance. Large slash pile sites should be monitored after burning, and noxious or invasive weeds should be controlled according to the applicable forest weed management document.	Detect new weed infestations before they spread. Controls weeds, reduces risk of invasion and reduces risk to native species by reducing weed competition.	Specialist recommendation
FE006	Prescribed fire within narrow-headed gartersnake AMZs will not occur during the inactive period (November/December-February, depending on elevation) when gartersnakes are more likely to be brumating in wood piles, debris jams, etc., unless cleared by a biologist (Also see AQ019).	To avoid, improve, or minimize effects on the narrow-headed gartersnake.	Land Management Plan compliance and specialist recommendation
FE007	Prescribed fire ignitions will not occur within any AMZ, unless approved by a watershed specialist and/or a biologist.	To prevent the introduction of chemicals, such as drip torch fuel, into soils and water.	Land Management Plan compliance and specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
FE008	Firelines would be used to facilitate prescribed fire operations as needed to balance fire management and other resource protection objectives: (1) Firelines may consist of natural barriers, roads and trails, or may be constructed, if necessary, in coordination with other resource specialists (See RS004). (2) Fireline width would be determined as adjacent fuels and expected fire behavior dictate, assuming compliance with the requirements of cultural, wildlife, and other resource areas. (3) Constructed firelines would be rehabilitated when they are no longer needed, using methods appropriate to the site.	To provide for activities needed to implement prescribed fire while minimizing disturbance to all resources.	Specialist recommendation
FE009	Concerned/interested public would be given as much warning as possible in advance of prescribed burns via notices, press releases, email lists, public announcements, phone lists, or other notification methods as appropriate.	To provide advanced notice for publics concerned about potential effects from emissions resulting from prescribed fires.	Land Management Plan compliance and specialist recommendation
FE010	Prescribed fires may be conducted before or after mechanical treatments. The sequencing of prescribed fires and mechanical treatments would be decided on a site-specific basis, depending on the site, burn windows, available resources, thinning schedules, etc.	Increase the flexibility for implementing both prescribed fire and mechanical treatments.	Specialist recommendation
FE011	Mechanical treatments following broadcast burns would occur after surface vegetation has recovered sufficiently to minimize soil disturbance from the mechanical treatments. Prescribed fire treatments following mechanical treatments would occur after there has been adequate surface vegetation recovery that fuel loads are sufficient to meet the objectives of a prescribed burn.	Minimize effects from the combined effects from mechanical treatments and prescribed fire on vegetation and soil. To maintain soil condition and productivity, and to meet prescribed fire objectives.	Specialist recommendation
NW001	Survey for noxious or invasive weeds in treatment areas prior to treatment and follow appropriate guidance based on location: • Apache-Sitgreaves National Forests: Follow the guidance in Appendix A of the Environmental Assessment for the Forest Integrated Forest-Wide Noxious Or Invasive Weed Management Program • Coconino National Forest: Follow the guidance in appendix B of the "Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds, Coconino, Kaibab, and Prescott NFs within Coconino, Gila, Mojave, and Yavapai Counties, Arizona" • Tonto National Forest: Follow the guidance in Appendix C of the Tonto National Forest Weed Treatment EA when operating on the Forest	Provides guidance and mitigation for noxious or invasive weeds.	Land Management Plan compliance

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
NW002	Prevent spread of potential and existing noxious or invasive weeds by vehicles and equipment used in management activities by washing vehicles and equipment to remove seeds, soil, vegetative matter, and other debris that could contain or hold seeds prior to entering the project area and when moving from one treatment unit to another. For example, see timber sale contract provision 2400-6/6T B/BT6.35.	Reduces the potential for introduction of noxious weeds into National Forest Service (NFS) lands and mitigates effects of management actions on existing and potential noxious or invasive weed infestations; Land Management Plan direction is complementary to Timber Sale Contract Clause 2400-6/BT B6.35, and Stewardship Contract G/GT.3.5 and watershed best management practices.	Land Management Plan compliance and specialist recommendation
NW003	If contractor desires to clean off-road equipment on national forest land, such as at the end of a project or prior to moving to, or through an area that is free of invasive species of concern, contractor shall obtain prior approval from contracting officer or timber sale administrator as to the location for such cleaning and measures, if any, for controlling impacts.	This measure is designed to prevent the spread of noxious weeds from one treatment unit to another.	Land Management Plan compliance and specialist recommendation
NW004	If forest priority noxious or invasive weeds are identified during or post-implementation, treat the weeds and monitor for a minimum of three to five growing seasons. Consider seeding treated areas with the appropriate native plant materials to restore native plant communities and suppress invasive species.	This measure is designed to eliminate noxious or invasive weeds identified within a treatment area and provide assurance that the treatments were successful.	Land Management Plan compliance and specialist recommendation
NW005	Timing of prescribed fire and herbicide application in areas with leafy spurge will be determined on a site-specific basis by the district fuels specialist and district weeds coordinator at the time of implementation. Herbicide treatments in the fall are most effective, though spring herbicide treatments following fall burns may be necessary to facilitate control.	Allows prescribed fire to occur in our near existing populations of leafy spurge while providing for control of it. Allows on the ground, site-specific assessment and coordination of the prescribed fire and control of leafy spurge on a site-specific basis.	Specialist recommendation
NW006	Before ground disturbing activities begin, inspect material sources on site annually (or before disturbance for new sites) to ensure they are weed- free before use and transport. Treat weed-infested sources for eradication, and strip, stockpile, and treat contaminated materials before using pit materials.	Prevent establishment and spread of invasive weed populations.	Land Management Plan compliance and specialist recommendation
NW007	If weed treatments are not successful or not possible, operators would be informed of locations of noxious or invasive weed populations and ground disturbance associated with rock pit sites would be located away from noxious or invasive weed populations.	Prevent establishment and spread of invasive weed populations.	Specialist recommendation
NW008	Maintain stockpiled, uninfested material in a weed-free condition.	Prevent establishment and spread of invasive weed populations.	Land Management Plan compliance

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
RM001	Historic range monitoring sites including witness trees/posts, 1-inch angle iron stakes, and any other site location markers would be protected. These sites would not be excluded from treatment, but care needs to be taken to avoid loss of these site markers and damage to the areas and shown as a protected improvement on the sale/contract/agreement area map. These sites would not be used as locations for temporary access roads, skid trails, landing areas, or large slash piles. District range and timber personnel will coordinate on these locations during presale packaging and prior to implementation.	Avoid monitoring site damage.	Specialist recommendation
RM002	The sale administrator would work closely with the district range staff to determine pasture use during thinning activities. On the ground placement of in-woods processing sites would also be coordinated with District range staff.	Avoid infrastructure damage and retain allotment and pasture fences within a thinning treatment area. Provides for coordination of different activities within the same areas.	Specialist recommendation
RM003	All fences and range improvements will be included as protected improvement on the sale/contract/agreement area. Skid trail layout would attempt to keep equipment on one side fences to avoid having to cut fences. If fences need to be cut, a gate or temporary cattle guard may need to be constructed/installed with appropriate bracing; these areas shall be coordinated with district range personnel prior to cutting. If the fence is cut or damaged it shall be repaired to conditions equal to or better than existed (to Forest Service Standards). When funding is available or a need exists, temporary cattle guards may be installed on haul roads where gates exist within active grazed pastures. All cattle guards on haul roads would be maintained throughout hauling activities and cleaned, if necessary, upon completion of a sale. Damage to other range improvements, such as tanks, drainage into tanks, spillways, drinkers, pipelines, corrals, etc., shall be repaired or cleaned to a condition that was as good as or better than existed. Skid trails, roads, landings, etc. should not be placed next to these range improvements. Minimize the location of skid trails, temporary roads, and landings adjacent to these range improvements.	Protect infrastructure.	Specialist recommendation
RM004	Rest or deferment of a pasture by livestock may occur after the completion of ground disturbing activities, such as prescribed burning and mechanical thinning. Range management personnel will evaluate conditions to determine when adjustment to livestock management, such as rest or deferment of a pasture is needed. Several factors may be used to assist in these determinations, such as plant recovery, plant vigor, and size of the disturbed area in relation to the pasture size. Plants that are well rooted, have multiple leaves or branches, and/or are producing seed head or flowers provide evidence of plant recovery, vigor, and reproductive ability.	Post ground-disturbing treatment assessment.	Specialist recommendation
RM005	The removal or exclusion of livestock water would be mitigated with alternative water sources, providing lanes to the water, or piping water to a livestock drinker.	Provide alternate water sources.	Specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
RM006	Prior to the construction of any exclosure fences or barriers, which exclude forage and/or water, or the removal of a water source, such as earthen tanks or trough, there needs to be a review by the district ranger, range management personnel and other specialist to evaluate the extent and amounts that may be excluded on an allotment/pasture (see AQ010 and SI003). If a pasture/allotment has a considerable amount or extent of fencing or water exclusion, which could change livestock management such as numbers, season of use, distribution, etc., then these proposals should be analyzed during the Allotment Management Planning process. During this process, livestock management on the allotment can be evaluated along with the resource concern that would have initiated the fence and other possible solutions may arise.	To ensure that changes to an allotment/ pastures will not hinder permittees' operations without coordination with local specialist expertise. This will also allow a review of water rights, if applicable.	Specialist recommendation
RM007	Range and fire managers will coordinate prescribed burning and grazing schedules to minimize disruption of grazing while maximizing the implementation of prescribed fires. Each allotment will have specific management needs to be considered as management actions are planned and implemented. Past and future burns, projected rest/deferment are examples of things that should be considered when burn plans are being written and prior to implementation of prescribed fire. Grazing options, such as swing pastures, may be utilized to increase flexibility for range and fire managers. Long-term and annual prescribed fire plans should be developed and adjusted to minimize burning in multiple pastures of an allotment, unless recognized and approved.	The process of planning and implementing prescribed fire is long and complex. The effects are beneficial to most resources, though there are a myriad of restrictions on where and when prescribed fire can be implemented. The Forest Service issues Term Grazing Permits, Allotment Management Plans, and/or Annual Operating Instructions describing numbers, season of use, pasture rotations, etc. that permittees follow. Coordination will help maintain good working relationships and will minimize hardships to the permittees, while managing for ecosystem health. Coordinating the management of these programs for minimal disruption to both is desirable.	Specialist recommendation
RS001	Coordination with the district recreation staff would occur during treatment area selection. Additional design components may be necessary to maintain scenic integrity along, the General Crook Trail, Arizona Trail, Highline Trail, Blue Ridge, other National Historic, Recreation, and Scenic trails, and designated roads and would be coordinated with district recreation staff. Recreation staff will coordinate with the Arizona Trail regional national scenic trail administrator on an annual basis or as needed. The forest would be responsible for signing trails to notify the public of restoration activity.	Resource protection	Land Management Plan compliance and specialist recommendation
RS002	Historic trails, historic roads and historic trail markers will be protected during project implementation.	Regulatory requirement. Compliance with NHPA and Southwestern Region PA with Arizona SHPO, National Recreational Trails compliance, National Historic Trails compliance	Land Management Plan compliance and specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
RS003	Efforts would be taken to limit forest treatment activities and hauling from rock pits within the project area during high-use weekends and holidays (for example, Memorial Day, 4th of July, Labor Day, etc.); especially in locations where recreation-based activities (for example, trails, trailheads, etc.) occur.	Protect public safety, decrease noise, reduce dust and minimize visibility issues on roads during high-use periods.	Land Management Plan compliance and specialist recommendation
RS004	**Control Lines:** (a) Whenever possible, firelines would be constructed in a manner that minimizes the visual impact in the middle and background views. Firelines will be rehabilitated in the foregrounds (within 300 feet) of sensitive roads, sensitive trails, developed recreation sites and private property. If national trails, including the Arizona Trail, are to be used as firelines, management actions should be reviewed and approved by the authorized Forest Service line officer prior to use, and adverse effects should be mitigated. Treatments to be implemented would be developed by fire/fuels working together with recreation/viewshed/scenic specialists. (b) Generally, rehabilitate firelines by rolling back the soil berm formed during line construction and constructing drainage features as necessary to prevent concentration of runoff. (c) To hasten recovery and help prevent unauthorized motorized and nonmotorized use of firelines, use measures such as recontouring, pulling slash and rocks across the line, and disguising entrances. When alternatives exist, do not use heavy machinery on non-motorized forest system trails that are used as a fireline, unless approved by the authorized Forest Service officer. Coordinate with the district recreation staff regarding use of national trails as firelines. (d) Control lines on National Scenic, Historic and Recreation trails can be used only if the trails are co-located on roads. Do not use heavy machinery on any forest system trail used as a control line, unless approved by an authorized Forest Service officer. Coordinate with the district recreation staff and the Arizona Trail regional national scenic trail administrator regarding use of national trails as control lines.	Resource protection.	Land Management Plan compliance and specialist recommendation
RS005	Where new temporary roads intersect existing roads or trails, native materials such as logs, slash, and/or boulders would be placed along temporary road to line-of-sight or 300 ft.	Reduce unauthorized use.	Land Management Plan compliance and specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
RS006	**Unit Marking:** (a) Strive to avoid using trails as marked boundaries. (b) Strive to avoid abrupt changes between treatment units. (c) Where feasible strive to have the minimal marking of trees within the Arizona Trail, General Crook Trail, and Highline Trail corridors. Avoid using the Arizona Trail as a boundary. (d) Utilize species designation where appropriate to minimize the amount of necessary marking. (e) Unit boundaries will be painted along trails on the side of trunk facing away from trails, roads or sensitive e travel ways. (f) Use the below techniques suggested for edges of treatment units. Edges of Individual Units: i. Ensure that forest stand composition changes are textural, with small, natural openings and not symmetrical in shape. Strive to avoid straight lines and right angles. Ensure that openings resemble the form, line, and texture of naturally appearing edges to avoid a shadowing effect. ii. Where treatment unit interfaces with an opening (including savanna and grassland treatments, and natural openings) the transition zone would progressively increase toward open edges of the unit. iii. Soften edges by thinning adjacent to the existing unit boundaries. Treat up to edges; do not leave a screen of trees. Favor groups of trees complying with prescribed treatments that visually connect with the unit's edge to avoid an abrupt and noticeable change. When feasible, treat both sides of open system roads and trails to avoid contrast. iv. Treatment boundaries should extend up and over ridgelines to avoid edge effect, where possible. v. The ridgeline silhouette should have a textural effect of small, natural-appearing openings rather than large, thinned areas and unnatural-appearing breaks. vi. Where mechanized treatments are authorized, consider additional contract provisions to maintain scenic integrity along trails in order to promote a more naturally appearing setting. Treat the edges of thinning areas to maintain the scenic integrity of the Arizona National Scenic Trail and other national trails. vii. Implementation will comply with the nature and purpose of the Arizona National Scenic Trail. The Forest Service will meet annually, as needed, with the Arizona Trail Association regional national scenic trail administrator to discuss and document monitoring activities.	Scenic integrity	Land Management Plan compliance and specialist recommendation
RS007	When possible, new fuelwood piles, and skid trails should be located out of view in areas of High Scenic Integrity to avoid observation of rutting. Rehabilitate fuelwood skid trails, fuelwood piles, or other disturbed areas. Strategies may include restoring original contours, fine grading, and seeding with native seed mix.	Avoid degrading recreation setting and resource protection.	Land Management Plan compliance and specialist recommendation
RS008	Mechanical thinning operations shall not damage cairns or markers that are displayed as protected improvements on the sale, contract or agreement map.	Resource protection and scenic integrity and avoid substantial interference with the nature and purpose of the trail (in compliance with Section 7(c)).	Land Management Plan compliance and specialist recommendation
RS009	If trails are temporarily closed due to thinning, trails shall be returned to pre-treatment conditions. The public will be notified of the closure and the closure duration should be as short as feasible.	Resource protection	Land Management Plan compliance and specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
RS010	**Temporary Road, Skid Trail, Landing, In-Woods Processing Site Construction, and Cable Operation:** (a) Utilize dust abatement methods for hauling during the season when dust is likely, and funding is available. Coordinate with the appropriate county on the application and timing of application of dust abatement on road segments that have county maintenance responsibilities. (b) When constructing temporary roads and skid trails blend them into the characteristic landscape of the surrounding area. Create cut and fill banks to be sloped to accommodate natural revegetation and to reduce sharp contrasts viewed from any distance. (c) When possible, shape the edges of log landings and in-woods processing sites to avoid straight lines, right angles, and abrupt changes between treated and untreated areas. Standing trees and shrubs around in-woods processing sites and landings should be left in strategic locations where possible to serve as screening in sensitive viewsheds. (d) When possible, landings, temporary roads, and skid trails should be located out of view of Concern Level (CL) 1 and CL2 travel routes and eligible and designated wild and scenic rivers (see RS022) to avoid observation of management activities. (e) Do not locate in-woods processing sites in view of Concern Level (CL) 1 and CL2 travel routes and eligible and designated wild and scenic rivers to avoid observation of management activities. Do not locate perpendicular to roads or trails, rather set off at an angle whenever possible. (f) In-woods processing sites, landings, temporary roads, and skid trails should be minimized within sensitive viewsheds, such as those within eligible or suitable wild and scenic river corridors or next to developed recreation sites, private homes, or communities, and along paved and passenger car level roads and trails. Stump heights should be treated per RS011. (g) Highest emphasis for slash treatment, temporary road closures and road decommissioning will be placed on eligible or suitable wild and scenic river corridors; foreground (up to 300 feet) of developed recreation sites, private homes or communities; and CL 1 roads (paved roads and passenger car roads) and trails, especially those designated as national scenic, historic, or recreation trails. (h) All constructed features including but not limited to fencing, office trailers, sanitation facilities, fuel storage containers, or temporary structures shall be designed to blend with the surrounding environment. Color of proposed above-ground features shall be non-reflective and treated to be Forest Service brown or for a rusty appearance, or as approved by a Forest Service landscape architect or other Forest Service official. (i) In-woods processing sites, landings, skid trails, and temporary roads will be rehabilitated, including restoring proper drainage and reseeding as needed with native species. (j) To hasten recovery and help eliminate unauthorized motorized and non-motorized use of skid trails, use physical measures where feasible, such as re-contouring, pulling slash and rocks across the line, and disguising entrances. (k) National Historic, Scenic, and Recreation Trails (motorized and non-motorized) will not be used for temporary roads or skid trails. Crossing of the nationally designated trails will be done sparingly and only if no other alternative exists. Crossings will be rehabilitated after use. These crossing locations will be coordinated with district recreation staff.	Resource protection and scenic integrity and avoid substantial interference with the nature and purpose of the trail (in compliance with Section 7(c)).	Land Management Plan compliance and specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
RS010 (continued)	(l) Avoid using forest system trails that are not nationally designated as temporary roads or skid trails to the extent possible. If they are determined to be necessary, district recreation staff will be involved to determine the preparation and post treatment of those trails. When system trails are needed, coordination with district recreation staff will occur. Temporary roads should be rehabilitated after use to avoid adverse effects in accordance with TR008. Locations of trail crossings will be designated and should be rehabilitated after use. When using system trails as skid trails, minimize widening, straightening, or changing the surface of the trail; retain character trees and vegetation that defines the trail tread. Trails would be restored to Forest Service standards and Trail Management Objective prescriptions (pre-project condition) following treatment. (m) Minimize the impact of cable logging corridors in visually sensitive areas. When possible, select skyline systems with lateral yarding capabilities. Design skyline corridors for cable yarding without linear edges by utilizing existing openings and clearing the vegetation to promote meandering edges. Strive to make corridor widths 14 ft. to reduce scenic impacts with 20 ft. as the maximum exception and rarely occurring.		
RS011	**Cull Logs, Stump Heights, and Activity Generated Slash Treatments:** (a) Cull logs would not be abandoned on landings. Cull logs may be used for closing temporary roads and decommissioning roads. Cull logs may also be suitable to use as down woody material but should be scattered away from the landings. (b) Stump heights should be cut as low as possible. Where possible, keep stump heights less than 1 foot from ground level. In the immediate foreground of Concern Level 1 and 2 travel routes (roads and trails), developed recreation sites, and private property, stumps should be flush cut, if possible, or cut less than 8 inches above ground (uphill side), where topography and operational safety allows, to maintain scenic integrity (See RS013). (c) Slash must be treated or removed in the immediate foreground of sensitive places (for example, in corridors of eligible or suitable wild and scenic rivers); within 300 feet of the centerline of Concern Level 1 roads, or national trails and sensitive trails; or 300 feet from the boundary of a recreation site or private land/communities. Prioritize slash burning in these locations within 3 years or as soon as possible after treatment. If conventional thinning practices are used and trees are delimbed and topped in the forest, machine-piled slash should be burned as soon as possible, or within 1 – 3 years. If scattering is required, scatter slash to 18 inches or less in depth on average. Root wads and other debris in sensitive foreground areas and in wild and scenic river corridors would be removed, burned, or chipped. Outside of these areas, it is acceptable to scatter root wads and debris or use them to help close temporary roads or skid trails in accordance with TR008. If slash is not removed in grassland treatment areas, it is acceptable to create machine piles 300 feet away from the centerline of CL1 and CL2 level roads and trails, developed recreation sites, and private land/communities. Within eligible or suitable wild and scenic river corridors, slash should be removed, burned, or otherwise treated to restore to the character to which it was designated.	Resource protection and avoid substantial interference with the nature and purpose of the trail. (In compliance with Section 7(c)).	Land Management Plan compliance and specialist recommendation
RS012	Coordinate with a designated Forest Service representative prior to implementing jackstraw, spring, and road restoration treatments. Do not implement jackstraw treatments within the line of sight and/or 300 feet of the Arizona Trail or other National Trails.	Maintain scenic integrity.	Land Management Plan compliance and specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
RS013	In semi-primitive non-motorized recreation opportunity spectrum classes (occurring on about 13 percent of the project area), in eligible or suitable wild and scenic river corridors, and in inventoried roadless areas (IRAs): (a) Temporary Roads • Temporary roads should not generally be built in semi-primitive non-motorized opportunity spectrum classes or eligible or suitable wild and scenic river corridors. If they are built, they would be rehabilitated after use in accordance with TR008. Avoid constructing long stretches of conspicuous temporary roads paralleling the riverbank. • Temporary roads shall not be built in inventoried roadless areas. No road realignment or reconstruction is allowed in inventoried roadless areas. (b) Strive to make stump heights 8 inches above ground (uphill side) or lower, with 12-inch heights the exception and rarely occurring; (c) Slash must be treated or removed in these areas; (d) Use existing barriers (roads) and natural barriers as control lines whenever possible; and (e) Cable operations shall not be conducted in inventoried roadless areas.	Protection of visitor experience.	Land Management Plan compliance and specialist recommendation
RS014	**Developed Recreation Sites:** Proposed mechanical treatments and prescribed fire adjacent to developed recreation sites must be reviewed and approved by the district ranger. Work with the district recreation staff to determine boundaries or no treatment zones around constructed features that need to be protected in campgrounds. Treatments around the perimeter of campgrounds are encouraged. The timing of treatments must be worked out with districts. Treatments would generally avoid summer. Activity slash must be removed within the line-of-sight of developed recreation sites. If campgrounds remain open into fall and winter, provide information about upcoming closures and management activities onsite, at Forest Service offices, and on Forest Service websites.	Protection of visitor experience.	Land Management Plan compliance and specialist recommendation
RS015	Implement road closures, one-way traffic, and area closure restrictions as deemed necessary by forest officials for health and safety concerns during any operation. Signs would be placed at major intersections on hauling routes during periods of active hauling. If it is necessary to close forest roads or areas of the forest, notices and signs would be posted at key locations adjacent to and within the project area, such as along major Forest Service roads accessing the area or on kiosks at trailheads, bulletin boards, electronic sign boards, etc. Closures due to operations would also be posted online and on social media as well as being publicized via news releases. Coordinate with the District Recreation Planner or trails specialist to ensure well marked and publicized detour routes for the Arizona Trail, General Crook Trail, and Highline Trail, and system trails during operational closures within the project. Any closures should be done for as short a time as possible.	Public safety	Land Management Plan compliance and specialist recommendation
RS016	When mechanical treatment occurs along open trails that are not National Trails, slash will be pulled back immediately within 20 feet of the centerline of the trail corridor within specified timeframes (coordinate with recreation specialist).	Maintain scenic integrity.	Land Management Plan compliance and specialist recommendation
RS017	Retain heathy, large diameter, or character trees that have unique shape or form along all trails in a manner that results in stable, wind -firm residuals within 100 ft. of the trail. Avoid lines of trees; strive to achieve a grouped appearance where appropriate to avoid abrupt changes in the landscape character along the trail corridor.	Protect visitor experience.	Land Management Plan compliance and specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
RS018	(a) Prior to blasting activities, nearby landowners or other permitted forest users near the blasting location would be notified. (b) Standing trees and shrubs would be left in strategic locations along the perimeter of active rock pits to serve as screening to sensitive viewsheds.	To improve public safety by increasing awareness of blasting activities and to minimize impacts to scenic resources	Land Management Plan compliance and specialist recommendation
RS019	Entrances to active rock pit sites would be gated to prevent inappropriate motor vehicle use, dumping, or other activities.	Decrease noise, protect public safety and minimize impacts to forest resource in and around rock pit sites.	Land Management Plan compliance and specialist recommendation
RS020	Material extraction activities should not be permitted in designated or recommended special areas or Chevelon Canyon.	To protect the unique character of these areas.	Land Management Plan compliance
RS021	All restoration activities within eligible or suitable wild and scenic river corridors will be designed to protect or enhance the free-flowing character and outstandingly remarkable values (ORVs) of rivers, and to maintain the rivers' current inventoried classifications (wild, scenic, or recreational), unless a suitability study is completed that recommends management for a less restrictive classification (See RS022).	To protect eligible and suitable wild and scenic rivers.	Land Management Plan compliance
RS022	Restoration activities within the corridors of eligible or suitable wild river segments on the Apache-Sitgreaves National Forests would not include any tree cutting.	To protect the primitive character of eligible or suitable rivers classified as wild.	Land Management Plan compliance
SI001	A phased approach can be used to complete light thinning with lop/scatter, so slash does not have to be piled or disposed of mechanically.	To facilitate desired fuel conditions for broadcast burning.	Specialist recommendation
SI002	Where livestock or wildlife grazing could be a threat to restoration of riparian deciduous vegetation and an immediate moderate-severity burn would consume large amounts of felled trees, consider delaying the burn and leaving felled trees in place to create grazing barriers to help assure plant growth. Felled trees may be left in place, lower limbs may be cut and scattered, or all or part of trees may be used for streambank or wetland restoration in order to provide surface roughness and bank stabilization or as necessary to protect riparian or wetland shrubs from grazing by livestock or wildlife (for example, jackstraw barriers).	To create grazing barriers and assure desirable vegetation response.	Specialist recommendation
SI003	Exclosure fencing to prevent utilization of plantings by deer, elk, and livestock is permitted (See RM006).	To provide desired vegetation composition in riparian areas.	Specialist recommendation
SI004	Source trees for placement in stream restoration should come from but are not limited to: over or fully stocked upland and riparian stands that are adjacent to the site, hazard trees, trees that have fallen naturally and are still suitable, trees generated from administrative sites (maintenance, expansion, or new construction), and hardwood restoration.	To maintain forest structure and facilitate riparian restoration activities.	Specialist recommendation
SI005	Danger trees, hazard trees, and trees killed through fire, insects, disease, blow-down and other means can be felled and used for in-channel placement regardless of live-tree stocking levels.	To facilitate riparian restoration activities.	Specialist recommendation
SI006	Identified wildlife trees shall not be felled.	To maintain nest/roost habitat.	Specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
SI007	Trees may be stockpiled from upland treatment for use in planned, upcoming instream restoration projects, or other erosion control projects. Stockpiles would not exceed 30 feet wide and the length of trees. Stockpiles would not persist on the landscape for more than 1 year and any unused material would be burned or hauled off site. Stockpiles would not occur in drainages, AMZs, protected areas (SW046), or species-specific buffers.	To facilitate riparian restoration activities.	Specialist recommendation
SI008	Remove juniper to natural stocking levels where Forest Service determines that juniper trees are expanding into neighboring plant communities to the detriment of other native riparian vegetation, soil, or streamflow.	To maintain desired vegetation composition in riparian areas and wetlands.	Specialist recommendation
SI009	For each area evaluated for juniper treatments, interdisciplinary teams would discuss the following questions in order to identify the attributed of an area and select the appropriate treatments: • What kind of site (potential natural vegetation, soils)? • Successional state of site? • Components that need to be restored? • How units may fit into the overall landscape mosaic? • Long-term goals and objectives?	To maintain desired vegetation composition in riparian areas and wetlands.	Land Management Plan Compliance
SI010	Do not cut old-growth juniper, which typically has several of the following features: sparse limbs, dead limbed or spiked-tops, deeply furrowed and fibrous bark, branches covered with bright-green arboreal lichens, noticeable decay of cambium layer at base of tree, and limited terminal leader growth in upper branches.	To provide future snag and coarse woody debris habitat.	Land Management Plan compliance
SI011	Felled trees may be left in place, lower limbs may be cut and scattered, or all or part of trees may be used for streambank or wetland restoration in order to provide surface roughness and bank stabilization or as necessary to protect riparian or wetland shrubs from grazing by livestock or wildlife (for example, jackstraw barriers)	To facilitate riparian restoration.	Specialist recommendation
SI012	On steep or south-facing slopes, where ground vegetation is sparse, leave enough course woody debris in sufficient quantities to promote reestablishment of vegetation and prevent erosion.	To provide soil resource protection in wetlands and riparian areas.	Specialist recommendation
SI013	If seeding is a part of the action, consider whether seeding would be most appropriate before or after juniper treatment.	To provide the most desirable vegetation response.	Specialist recommendation
SI014	Silviculturists, biologists, watershed specialist (specialist responsible for hydrologist or soil scientist duties), or their representatives shall be involved in designing riparian vegetation treatments.	To provide desired vegetation composition in riparian areas and wetlands.	Specialist recommendation
SI015	Prioritize the selection of genetically and ecologically appropriate native plant materials for revegetation activities.	To improve planting success.	Specialist recommendation
SI016	Tree and shrub species, willow cuttings, as well as sedge and rush mats to be used as transplant material, shall come from outside the bankfull width, typically in terraces (abandoned floodplains), or where such plants are abundant.	To provide desired vegetation composition in riparian areas.	Specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
SI017	Concentrate plantings above the bankfull elevation.	To provide desired vegetation composition in riparian areas.	Specialist recommendation
SI018	All known survey monuments, witness corners, reference monuments, and bearing trees will be protected against avoidable destruction, obliteration, or damage.	To ensure protection of land survey monuments.	Specialist recommendation and Forest Service requirement.
SI019	Coordinate with US Fish and Wildlife Service during planning and implementation of cable operations that occur in critical habitat and/or occupied habitat for federally listed species.	To avoid or minimize potential impacts to threatened species.	Specialist recommendation
SU001	Notify the affected landowners, permit holders, and Forest Service permit administrators whenever project activities are planned in areas having special use authorizations or non-National Forest System inholdings.	To ensure that landowners and permit holders are aware of planned activities well in advance, and to provide them opportunity to discuss concerns and potential mitigations to protect their sites.	Specialist recommendation
SU002	All National Forest System property boundary lines adjoining private, State, and public trust lands, such as Indian Reservations, shall be located, monumented, marked, and posted to prescribed Forest Service standards prior to undertaking land management activities that will occur near or adjacent to the property line.	To ensure that project activities occur only on National Forest System lands.	Complies with policy in FSM 7152.03
SU003	Evaluate potential haul routes that may be needed through non-Federal land and ensure easements, or road use agreements, are in place or obtained prior to use.	To prevent illegal trespass across lands with other ownership.	Specialist recommendation
SU004	Coordinate management activities with permit holders for any utility corridors (powerlines, pipelines, etc.) to determine how to protect facilities and improvements. Provide notification of activities during planning/layout and prior to implementation. Include pre-work safety meetings between utility holders and contractors.	To protect permit holders' facilities and improvements and ensure that management activities do not interfere with the operation of utility corridors.	Specialist recommendation
SU005	Place project-generated slash outside of permitted utility line and pipeline rights-of-way; do not interfere with utility corridor management.	Ensure that activities do not interfere with the operation of utility corridors.	Specialist recommendation
SU006	Vegetation treatments adjacent to power line corridors will be designed to reduce linear edges and create a more irregular natural appearance outside of the rights-of-way (ROW).	Maintain natural appearance of landscape.	Specialist recommendation
SU007	Prior to selecting sites to harvest, determine if any weather or stream course monitoring infrastructure exists within the project area and coordinate with the special use permit holder to determine if they would like treatments adjacent to their facilities.	To ensure that project activities do not interfere with meteorological data gathering.	Land Management Plan compliance and specialist recommendation
SU008	Protect highway ROW infrastructure from damage by management activities. Include facilities to be protected on contract area maps.	To ensure ROW infrastructure remains functional for its intended purposes.	Specialist recommendation
SU009	Coordinate planned activities with Arizona Department of Transportation (ADOT) and/or the appropriate county to ensure safe operation of roads and highways during project implementation.	To protect public safety on the affected roadways during operations.	Specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
SU010	Remove thinning slash from highway ROWs. If approved by the Forest Service, chipped slash may be left onsite at a maximum depth of two inches on average, otherwise excess chips must be removed completely. Any decking or tree processing within ROW needs prior approval. The maximum duration that logs and biomass can be left in the ROW is 30 days.	To ensure slash does not interfere with ROW access as potentially needed by ADOT or county.	Specialist recommendation
SU011	In-woods processing sites would be authorized under the terms of the timber contract or through a special use authorization depending on who would be the operator. Fees may be associated with special use authorizations. Before implementation, all sites would require interdisciplinary surveys and/or involvement.	Ensure proper authorization and permitting of in-woods processing sites.	Land Management Plan compliance
SU012	Through the Arizona Department of Environmental Quality (ADEQ), the operator of an in woods processing site would obtain coverage under a Multi-Sector General Permit (MSGP) for storm water discharges associated with non-mining industrial facilities such as timber products http://www.azdeq.gov/node/525 and http://www.azdeq.gov/permits-needed-timber-products-sector. Coverage under this permit would entail preparation and implementation of a storm water pollution prevention plan (SWPPP) as well as periodic inspections of the facility consistent with requirements of the permit.	Ensure proper authorization and permitting of in-woods processing sites.	Land Management Plan compliance
SU013	Support operations and facilities on in-woods processing sites that would be allowed include office trailers, sanitation facilities and fuel products storage containers or temporary structures. Fencing would be allowed to provide security for equipment and products. Camping or living trailers would not be allowed in the processing sites. Operators would provide their own water and water storage facilities and trash pickup. Connections to nearby powerlines and phones lines would be permitted. Operations on site would comply with fire restrictions and forest closures as applicable. Processing sites located in the interior of the project area would operate when the roads are open and passable and may be closed during the winter months if road and in-woods conditions are such that resource damage will occur, typically mid-December to April. Sites located near state highways or other paved roads may operate year-round.	Ensure proper design and construction of in-woods processing sites.	Land Management Plan compliance and specialist recommendation
SU014	The design, construction and operation of in-woods processing sites shall utilize practicable procedures for control of surface water runoff from facilities.	Ensure proper design and construction of in-woods processing sites.	Land Management Plan compliance
SU015	The contractor or permittee operating the in-woods processing site shall maintain the authorized facility and site in good condition and in accordance with approved contract or operating plans and specifications. When the contractor or permittee completes the authorized activity, they must rehabilitate by removing all facilities and structures, removing all wastes with disposal at an approved facility, restoring the pre-disturbance site gradient, preparing the site for reseeding by scarifying the site, and application of a native seed mix as specified and approved by the Forest Service.	Ensure proper reclamation and rehabilitation of in-woods processing sites.	Land Management Plan compliance

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
SW001	All waterbodies, including reservoirs, lakes, streams, and water dependent features including groundwater dependent ecosystems such as springs, seeps, fens, and other wetland features such as wet meadows would be protected with AMZs (referred to as Riparian Management Zones on the Tonto National Forest), measured as the slope distance from the edge of each side the stream and or riparian areas (wet meadows, springs, wetlands etc.). AMZ widths should be based on Land Management Plan direction or other guidance documents. Where AMZ widths are not customized to site conditions or species (see AQ021, AQ0040), the default minimum width for ground-based mechanical and prescribed burning treatments for perennial, intermittent, and ephemeral streams are 150, 75, and 50 feet, respectively. AMZ widths for all other features are 150 feet. Features to be protected with an AMZ will be shown on the project task order, contract or agreement maps, or burn plan maps. AMZ widths will be clearly labeled or described. Project specific design features such as Best Management Practices for water quality protection within AMZs will be implemented prior to construction when specified. (See SW003 for acceptable activities within AMZ's).	To ensure adequate protection of surface water quality during ground-based mechanical vegetation treatments and to provide consistency in how AMZ widths are measured and identified on the ground.	Specialist recommendation
SW002	Unless prescribed by Land Management Plan direction, AMZs can be increased by an interdisciplinary team (IDT) of qualified specialists prior to project implementation based on desired conditions along the stream reach and the nature of resource values at risk (such as the presence of aquatic Endangered Species Act species or its potential introduction), special concerns for water quality degradation, erosion hazard, existing vegetative ground cover conditions, stream bank and riparian conditions, natural geologic features, and flow regime. The IDT will determine appropriate AMZ widths and treatment limitations within these zones. These changes should be reflected in the plan-in-hand documents and included in the task order or contract maps.	To allow the greatest flexibility in designing AMZ prescription to meet resource benefits while protecting the values at risk.	Specialist recommendation
SW003	Accepted activities within AMZs include mechanical and hand tree felling, yarding, limited skidding, backing fire, and stream and springs restoration projects. When completing mechanical vegetation treatments within an AMZ, minimize the area of equipment usage in the AMZ. Vehicular operations including skidding should not occur longitudinally through AMZs. Turning machines and skidding within an AMZ should be minimized to the greatest extent possible. Landings, decking areas, machine or hand piles will occur outside of AMZs unless otherwise specified. Skidding across stream channels is covered in SW029 and SW031. Minimize disturbance and removal of riparian vegetation within AMZ's.	To avoid, improve, or minimize effects to soils, water quality, and aquatic species and habitat.	Land Management Plan compliance and specialist recommendation
SW004	Mechanical vegetation treatments within AMZs will minimize the amount of thinning debris deposited in stream channels and remove excess debris by hand or end-lining with one end suspension except where coarse woody debris is needed for stream health as identified by fisheries or watershed specialist (a specialist responsible for hydrologist or soil scientist duties). Remove thinning debris less than six inches in diameter and less than six feet long and place it above the ordinary high-water mark.	To minimize the potential for stream or culvert blockage.	Specialist recommendation
SW005	Mechanical vegetation treatments within AMZs will fell trees outside the stream channel unless otherwise specified as a stream treatment.	To minimize disturbance to stream morphology as much as possible and reduce the amount of fine woody debris entering the stream system.	Specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
SW006	If completing mechanical vegetation treatments within an AMZ, do not designate trees for removal where the root system is important in maintaining channel morphology without first consulting with a watershed specialist (a specialist responsible for hydrologist or soil scientist duties).	To provide for bank stability and minimize erosion and bank instability to streams or other aquatic habitats.	Land Management Plan compliance and specialist recommendation
SW007	Burn plans which allow fire to enter AMZs will be driven by the need to maintain or improve riparian and stream habitat (with the exception of WUI areas, see SW010 below). Consult with a watershed specialist (specialist responsible for hydrologist or soil scientist duties) and biologist if within threatened and endangered habitat where treatment in the AMZ is proposed.	Proper maintenance of prescribed burning activities adjacent to and/or within AMZs should help maintain the sediment filtering capacity of drainage way and reduce potential erosion in these locations.	Specialist recommendation
SW008	Fire control lines shall only be constructed within AMZs if mutually agreed upon by the authorized Forest Service officer, fuels specialist, watershed specialist (specialist responsible for hydrologist or soil scientist duties), and biologist. When constructing firelines, only the following are allowed in AMZs: Raking, brushing (less than 3 feet wide), leaf-blower, or other techniques that limit disturbance to soils. Any fireline in AMZ's need to be rehabilitated by removing any berms and raking removed material back across the fireline as soon as possible to prevent sediment movement.	To minimize the disturbance of riparian vegetation and minimize sediment.	Specialist recommendation
SW009	The following direction should be incorporated in developing the burn plan and project implementation: High soil burn severity should not occur on greater than 5 percent areal extent of the uplands or an AMZ in each burn unit unless to meet specific IDT treatment objectives. High-severity should be patchy rather than concentrated. No more than 5 percent mortality should occur in the mature desired riparian canopy along a streamside in each burn unit, with this mortality occurring as discontinuous patches. Variance in these parameters would need to be approved by appropriate specialist(s).	Maintaining low / moderate burn intensities and limiting the areal extent of high intensity burning will reduce the potential for severe soil burning which ultimately helps retain long-term soil stability/productivity and minimizes detrimental effects to soil, aquatic species, aquatic habitat, and desirable riparian species (flora and fauna) in AMZs.	Land Management Plan compliance and specialist recommendation
SW010	Apply the following direction if AMZ is within ½ mile of private land boundary or designated WUI: Treatment measures necessary to reduce the risk of wildfire encroachment on adjacent private lands may take priority over other considerations in these AMZs. Entry and treatments in these reaches will be considered on a case-by-case basis by IDTs.	To ensure that the fire management objectives and water quality objectives for these reaches are appropriately balanced.	Specialist recommendation
SW011	As part of seeding or other revegetation activities, do not apply surface fertilizer within an AMZ.	To protect water quality.	Land Management Plan compliance and specialist recommendation
SW012	Domestic livestock grazing within an AMZ affected by prescribed fire may be deferred until ground cover is adequately re-established as per guidance outlined in RM004.	Promote recovery and establishment of riparian species, protect floodplain function, and provide for resilient stream systems.	Specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
SW013	During project implementation use existing system travel courses and stream crossings whenever possible unless new construction would result in less resource disturbance. Minimize the number of temporary access roads and operational travel courses to lessen soil disturbance, compaction, and impacts to vegetation. Temporary roads will not be constructed on slopes where grade, soil, or other features suggest a likelihood of excessive erosion or failure. Temporary road construction is not allowed within AMZs. Temporary roads areas will be restored to natural, preconstruction conditions as much as possible in accordance with TR008.	To minimize soil disturbance and reduce sedimentation and erosion in aquatic habitats.	Land Management Plan compliance and specialist recommendation
SW014	When altering spring developments or splitting flow, place troughs far enough away from groundwater-dependent ecosystems), wetlands, and other sensitive or unique habitats to prevent erosion, compaction, or degradation to sensitive soils and vegetation due to livestock or wildlife congregations.	To maintain or improve the integrity of springs and other groundwater-dependent ecosystems and minimize effects on these sensitive systems.	Specialist recommendation
SW015	During implementation, vehicle staging, fueling of vehicles, and storage of petroleum products would be done on a designated protected upland outside of AMZs. Equipment operators shall maximize the recovery and proper disposal of all fuels, fluids, lubricants, empty containers, and replacement parts. If more than 1,320 of gallons of petroleum products are to be stored onsite above ground or if a single container exceeds 660 gallons, then a SPCC would be prepared as per 40 CFR 112. All herbicide and pesticide servicing and storage will be on designated, approved, upland sites.	To protect soil/water resources and aquatic species from petroleum, herbicide and pesticide contamination.	Land Management Plan compliance and specialist recommendation
SW016	Contractor shall take all reasonable precautions to prevent pollution of air, soil, and water by Contractor's Operations. If facilities for employees are established on a project area, they shall be operated in a sanitary manner. In the event that Contractor's Operations or servicing of equipment result in pollution to soil or water, the contractor shall conduct cleanup and restoration of the polluted site to the satisfaction of Forest Service and state regulations. Contractor shall maintain all equipment operating within the project area in good repair and free of abnormal leakage of lubricants, fuel, coolants, and hydraulic fluid. Contractor shall not service tractors, trucks, or other equipment on National Forest System lands where servicing is likely to result in pollution to soil or water. Contractor shall furnish oil-absorbing mats for use under all stationary equipment or equipment being serviced to prevent leaking or spilled petroleum-based products from contaminating soil and water resources. Contractor shall remove from National Forest System lands all contaminated soil, vegetation, debris, vehicle oil filters (drained of free-flowing oil), batteries, oily rags, and waste oil resulting from use, servicing, repair, or abandonment of equipment.	To protect soil/water resources and aquatic species from petroleum contamination.	Land Management Plan compliance
SW017	Dry meadow and grassland locations will be identified during the layout phase of a project sale and will be clearly labeled on contract maps for protection. In meadow and grassland restoration sites where, encroaching trees are being removed, designate skid trails in order to limit disturbance. Where material is not being removed, lop and scatter or manually remove slash from meadow are the preferred methods of treating slash. Do not machine pile within meadows or grasslands. Temporary roads, storage areas, camp sites, landings, machine piles and/or skidding should not occur on dry meadows in a project area.	To minimize impacts to meadow systems and improve implementation.	Specialist recommendation
SW018	At spring development restoration sites, place watering troughs far enough from a steam or surround with a protective surface to prevent sediment delivery to the stream. Avoid steep slopes and areas where compaction or damage could occur to sensitive soils, slopes or vegetation due to congregating livestock or wildlife.	To reduce sediment delivery to aquatic habitats.	Specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
SW019	Spring developments should not disturb the spring orifice (point where water emerges). Spring head boxes should be places in a location that will cause the least amount of disturbance to the soils and vegetation of the groundwater-dependent ecosystem. Preferable locations for spring head boxes should be in an established channel downstream from the orifice or a locations where flowing water becomes subsurface.	To maintain or improve the integrity of springs and other groundwater-dependent ecosystems and minimize effects on these sensitive systems.	Specialist recommendation
SW020	Formerly used skid trails should be utilized where they do not impair soil or other watershed resource conditions. The designation of new skid trails should be oriented to the contour of the slope as much as operationally feasible. Skid trail design should minimize concentrated runoff and sediment delivery by avoiding long, straight skid trails and providing breaks in grade. Designated skid trails and log landings would be required within the tree removal contracts (BMP 24.18 in FSH 2509.22) on all cutting units. Location of new skid trails and overall skid trail placement should be designed to minimize the overall disturbance footprint across the treatment unit while still meeting the objectives of the stand treatment.	Utilization of existing skid trails, designation of new skid trails, and proper skidding design should reduce the overall heavy disturbance footprint across the treatment unit. Skid trail placement that follows the contour of the slope as much as operationally feasible will help lessen the potential for accelerated erosion downslope.	Specialist recommendation
SW021	Closed skid trails and roads must have adequate runoff and erosion control features to minimize excess erosion and sedimentation. Slash is the preferred method for diverting water if of sufficient quantity and size is available to maintain complete contact with the ground. Otherwise, construct water bars and lead out ditches. Waterbars should not be constructed more than 2 feet high. Lead-out ditches or water bars shall be constructed to hydrologically disconnect travel route surface runoff from stream channels. All berms and depressions (such as ruts) created along the skid trail or road will be filled in to restore the natural grade of the slope as much as possible.	Minimize the concentration of run-off and sediment delivery into stream channels.	Land Management Plan compliance and specialist recommendation
SW022	Erosion control structures and measure must be in place prior to an erosive event. The timber sale and/or stewardship contract, and or agreement outlines the timing and application of erosion control methods to minimize soil loss and sedimentation of stream courses.	Minimize the concentration of run-off and sediment delivery into stream channels.	Land Management Plan compliance and specialist recommendation
SW023	Scarification or shallow ripping of landings should be conducted in a manner as not to mix the surface soil and subsoils to the point where subsoil becomes inverted and exposed at the surface.	Mixing of surface soil and subsoil is generally not conducive to obtaining desirable herbaceous revegetation.	Specialist recommendation
SW024	During machine piling of slash, rough piling is encouraged. This involves piling only large concentrations of slash, leaving areas of low concentration undisturbed. Also, where feasible, use a brush rake to minimize disturbance to the soil surface.	Rough piling minimizes disturbance to existing ground cover and the surface soil.	Specialist recommendation
SW025	Slash can be placed on skid trails and travel corridors to a maximum depth of 18 inches to drive on to reduce rutting and soil disturbance from mechanized equipment.	To reduce potential for rutting and compaction along mechanical equipment travel courses.	Land Management Plan compliance and specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
SW026	Seed mixes for erosion control on disturbed locations should be certified weed-free native species at a minimum of 5 pounds per acre pure live seed. Potential vegetation for individual sites should utilize the Apache-Sitgreaves, Coconino, and Tonto National Forests' Terrestrial Ecosystem Surveys (TES) to identify species to be utilized. Where appropriate and feasible, protect site with a variety of methods (for example, ungulate proof fencing, spreading slash etc.).	Minimize soil loss and sedimentation of stream courses from skidding operations. Minimize noxious weed spread and reestablish native vegetation. Minimize effects on severe erosion soils.	Land Management Plan compliance
SW027	Mechanical crushing or placement of lopped slash for the purposes of promoting long-term soil productivity or maintaining soil stability is appropriate in accordance with SW025.	Incorporate slash into the soil to promote long term soil productivity.	Land Management Plan compliance
SW028	Slash and/or chips can be scattered on landings to help minimize the formation of rills and gullies.	Minimize the concentration of run-off and sediment delivery into stream channels.	Specialist recommendation
SW029	Skid trail stream crossings on intermittent and perennial streams must be pre-approved by the authorized Forest Service officer in consultation with a watershed specialist (a specialist responsible for hydrologist or soil scientist duties) or another qualified specialist. Ephemeral stream skid trail crossings will be authorized in locations to minimize soil and channel disturbance by the authorized Forest Service officer. The number of designated crossings should be minimized.	A qualified person should designate stream crossings in order to protect stream banks and stream morphology.	Specialist recommendation
SW030	Felling to the lead would be required within the timber sale and/or stewardship contract, and or agreement to minimize ground disturbance from skidding operations.	Felling of timber should be done to minimize ground disturbance from skidding operations and to minimize effects on severe erosion soils.	Land Management Plan compliance
SW031	Culverts, temporary bridges, low-water crossings, log-fords, or other types of acceptable features will be required on all reopened and utilized Maintenance Level 1 systems roads, and skid crossings on all streams that will have flowing water during the life of the temporary crossing. All constructed features and fill material will be removed from these stream crossings and the channel and stream banks restored to a pre-project condition, unless otherwise approved by the sale administrator or COR after coordination with a hydrologist, soils specialist, and biologist, and the authorized Forest Service officer.	Protect stream morphology from damage from crossings while avoid damming or impounding free-flowing waters to provide streamflows needed for aquatic and riparian-dependent species.	Land Management Plan compliance and specialist recommendation
SW032	During thinning, operators shall avoid excavating skid trails whenever practical, locate skid trails where the need for sidecasting is minimized, and avoid adverse skidding to the greatest extent possible. If specialized equipment is available, utilize equipment designed to minimize ground disturbance when operating on sensitive soils and adverse slopes.	To prevent soil displacement.	Specialist recommendation
SW033	Slash should be distributed throughout skid trails, forwarder trails and cable corridors wherever mineral soils are exposed.	To provide surface roughness and prevent concentrated runoff that could cause accelerated erosion.	Specialist recommendation
SW034	During cable thinning operations, operators shall limit cable thinning to uphill yarding whenever practical. When downhill cable yarding is necessary, operators shall layout the cutting system in a manner which minimizes soil displacement. The numbers and widths of yarding corridors shall be minimized.	To prevent soil displacement from cable yarding operations.	Specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
SW035	Operators shall minimize the yarding of logs across streams or wetlands. Yarding across ephemeral streams shall be performed in ways that minimize soil and bank disturbances. Where it is necessary to yard across intermittent or perennial streams or wetlands, it shall be done by swinging the yarded material free from the ground to the greatest extent practicable (such as full suspension).	To prevent adverse effects to water quality.	Specialist recommendation
SW036	During cable thinning operations, operators shall install effective cross ditches that drain onto undisturbed forest floor or spread slash on all skid trails and cable corridors located on steep or erosion-prone slopes	To prevent erosion and sediment delivery to stream courses and other waterbodies.	Specialist recommendation
SW037	Landings and decks should be clearly designated on the timber sale project plan.	To aid in implementation of project.	Specialist recommendation
SW038	Sizing, spacing, and placement of landings should be designed to minimize the overall ground disturbance footprint across the treatment unit while still meeting the objectives of the stand treatment.	Limit the overall amount and extent of heavy ground disturbance that implicates soil stability/ productivity as well as the filtering capacity of upland areas.	Land Management Plan compliance and specialist recommendation
SW039	Heavy ground disturbance activity areas (landings, major skid trails, unsurfaced haul roads, etc.) and excessive ground disturbance in any location (such as exceeding the rutting guidelines) should aim to not exceed 15 percent -areal extent of a treatment unit within a timber sale area.	To meet soil condition thresholds for management concern and to reduce the overall heavy ground disturbance footprint across a treatment unit.	Land Management Plan compliance and specialist recommendation
SW040	Skid trails, landings, and temporary roads are to be closed and have erosion control measures implemented as outlined in SW021 and TR008. Post-treatment and landings are to be scarified and seeded with a certified weed-free mix of primarily native, perennial grasses. The Coconino National Forest does not require scarification unless compaction is present.	Scarification and seeding of heavily disturbed areas will help break up soil compaction and reintroduction of native, perennial grass species will aid in mitigating the over-establishment of exotic or noxious weeds. Water-barring, restoring the natural grade or the slope, and utilizing slash for additional erosion control mitigation will dissipate the run-off energy, reducing sediment delivery, as well as aiding in long-term site stability/productivity.	Land Management Plan compliance and specialist recommendation
SW041	When thinning trees, no skidding is allowed across wetlands or springs and their outflows. This restriction needs to be displayed on contract or agreement area maps.	To minimize impacts to streams and soils in meadows from tree thinning operations.	Land Management Plan compliance

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
SW042	Prior to the closure of the project contract, the authorized Forest Service contract team member or the sale administrator, in consultation with a watershed specialist (a specialist responsible for hydrologist or soil scientist duties) or other applicable specialist, will verify that the contractor has properly implemented the project watershed BMPs and erosion control measures. In evaluating acceptance, the following definition will be used by the Forest Service: "Acceptable" erosion control means only minor deviation from the established standards and guidelines, providing no major or lasting impact is caused to soil and water resources. Include biology staff where units are adjacent to federally listed and sensitive aquatic species habitat. Certified timber sales administrators or contracting officer representatives (CORs) would not accept erosion control measures that fail to meet these criteria.	It is necessary to have a watershed specialist present during closeout to ensure that project watershed BMPs were implemented correctly as they were the original designer of the conservation practice. To minimize sediment delivery to threatened and endangered and sensitive species aquatic habitat	Specialist recommendation
SW043	Meadow vegetation treatments will be conducted in a site-specific manner to be determined by a watershed specialist (specialist responsible for hydrologist or soil scientist duties) and a silviculturist.	Dry meadow soil types have low soil weight-bearing strength due to seasonally high moisture contents and inherent soil characteristics which make them highly prone to detrimental soil compaction and topsoil displacement.	Specialist recommendation
SW044	Whether identified pre-implementation and on a task order/contract area map or during the implementation phase, locations above 25 percent slope gradient on sensitive soil types (for example, cinder cones) will include a "protected area" designation that is clearly marked to exclude the use of mechanized thinning equipment. Hand-felling methods only will be permitted in these locations, unless use of specialized equipment may allow operations on steeper slopes. Viability and authorization of specialized equipment use above these slope gradients will be determined during the layout phase of a sale by the pre-sale forester and a watershed specialist (specialist responsible for hydrologist or soil scientist duties). This specification of desired equipment must be specified in the contract.	To protect highly erodible/sensitive soils on steep slopes by preventing traffic by heavy machinery on soils that are susceptible to destabilization and erosion.	Specialist recommendation
SW045	All ground-disturbing activities using heavy equipment must be done under conditions which maintain soil condition (such as avoiding excess rutting, compaction, and displacement).	Ensure that mechanical operations do not take place when ground conditions are such that detrimental soil compaction and topsoil displacement can occur.	Specialist recommendation

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SW046	Skid Trails: Allow up 6 inches of rutting over no more than 15 percent areal extent along a skid trail (two or more drags being considered a skid trail). Depth of rut is a measurement from the bottom to the top of a berm.	Excessive ground disturbance and rutting causes detrimental soil compaction and topsoil displacement. Compaction effects to the surface soil and inverted, exposed subsoil is not conducive to obtaining desirable long-term herbaceous revegetation. Excessive ground disturbance hinders long-term soil stability and productivity through increased erosion and establishment of exotic or invasive species that out-compete native, perennial grasses and forbs.	Land Management Plan compliance and specialist recommendation
SW047	At landings and within 75 feet of landings, rutting depths greater than 10 inches will not be allowed. Landings on slopes greater than 20 percent will be minimized to the greatest extent practicable and soil and watershed mitigation measures will be applied on a case by case basis to ensure that unacceptable soil loss does not occur.	Prevents detrimental soil disturbance to depths that are difficult to adequately ameliorate and that could lead to broken tree roots resulting in drought stress of remaining trees.	Land Management Plan compliance and specialist recommendation
SW048	Rutting on an unsurfaced road (generally Maintenance Level 1, 2 and temporary roads) will not exceed 8 inches depth for more than 75 linear feet or 10% of road length, whichever is shorter. Rutting in excess of 3 inches depth will not be permitted on surfaced collector or arterial roads (generally some maintenance level 2 and all maintenance level 3 and 4 roads).	Prevents rutting of the road traveled way that could lead to concentrated runoff, erosion and adverse effects to surface water quality.	Land Management Plan compliance and specialist recommendation
SW049	For any other locations (for example, interior locations other than skid trails) within a sale area, if wheel tracks or depressions consistently exceed 2 inches then conditions are too wet to operate in these areas.	To prevent detrimental soil disturbance and compaction that would make it difficult for vegetation to become reestablished.	Land Management Plan compliance and specialist recommendation
SW050	No prescribed fire control lines should be constructed using mechanized equipment on slopes greater than 40 percent or greater than 25 percent on identified fragile or sensitive soil types.	Restriction of fire control line construction and burning activities to these slope breaks will help mitigate accelerated overland flow and erosion typically associated with these settings.	Specialist recommendation
SW051	If fire control lines are constructed, rehabilitate lines after use by either rolling berm back over the entire fire line, spreading slash across the fire line, or water barring the fire line. If water barring only, vary spacing dependent on slope and disguise the first 300 feet of line to discourage use as a trail.	To prevent erosion and sediment delivery from firelines to stream courses. Also prevents firelines from being used as trails, thereby hastening recovery.	Specialist recommendation

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SW052	Coarse woody debris will be managed to achieve Land Management Plan direction and specialist recommendations. These recommended levels may be lower in WUI areas. Ponderosa Pine Forest: 3 to 10 tons per acre (For Tonto National Forest: Refer to Land Management Plan). Dry Mixed Conifer: 5 to 15 tons per acre (For Tonto National Forest: Refer to Land Management Plan). For facilitative operations or other activities that may occur in non-target vegetation types (for example, Pinyon-Juniper, Wet Mixed Conifer), refer to the applicable Land Management Plan to find appropriate fuel loading levels.	Maintain long term soil productivity. To provide levels of surface fuels (fine and coarse woody debris) to address the need for habitat (cover), soils (organic material and limited areas of high burn severity), and fire (to limit areas of high burn severity and a high resistance to control).	Land Management Plan compliance and specialist recommendation
SW053	Burn plans will be designed to promote resource benefits to riparian and wetland areas. Minimize fire severity in areas where degradation to riparian or wetland existing condition is a concern.	These systems may lack the vegetation to adequately dissipate energy and protect stream banks, therefore retaining the vegetative cover is necessary.	Specialist recommendation
SW054	At some stage prior to mechanical treatment and prescribed burning implementation include a watershed specialist (specialist responsible for hydrologist or soil scientist duties) or other relevant specialist to determine whether treatment extent or severity is appropriate for a subwatershed (HUC12). As a default, limit the areal extent of mechanical treatment which may occur in a subwatershed to 25% in a given year and 40% over 5 years of that subwatershed. For prescribed burning the percentages can be doubled. This is for subwatersheds that have not experienced a relatively recent largescale disturbance such as a fire and/or in a nonfunctioning condition. If exceeding these percentages by either treatment type or in combination, perform a more detailed watershed evaluation/analysis using a procedure such as the Equivalent Disturbed Area Analysis or other appropriate methodology. If it is determined that potential cumulative effects may be adverse to watershed function and condition, treatments should be spread out spatially and temporally.	Reduce potential cumulative effects which may adversely affect subwatershed scale (HUC12) condition or function.	Specialist recommendation
SW055	When restoring floodplains, mimic to the extent possible, the elevation, width, gradient, length, and roughness that would occur naturally for that stream reach and associated valley type.	To improve hydrologic function and connectivity and reduce detrimental effects to channel morphology and aquatic habitat. Reconnecting floodplains to their historic stream channels will improve soil hydrologic function, increase wetted area, and provide for improved stream morphology.	Specialist recommendation
SW056	Open system road and temporary road erosion control features, such as lead-out ditches or cross drains, shall be constructed and maintained as needed to hydrologically disconnect road surface runoff from stream channels.	Minimize the concentration of run-off and sediment delivery into stream channels.	Specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
SW057	Road drainage is controlled by a variety of methods including rolling the grade, insloping, outsloping, crowning, water spreading ditches, and contour trenching. Sediment loads at drainage structures can be reduced by installing sediment filters, rock and vegetative energy dissipaters, and settling ponds. Design of roads is included in the transportation plan of the forest product removal contract or agreement and T- specs. Road maintenance through the integrated resource service contract forest product removal contracts/agreements should require pre-haul and post-haul maintenance on all roads to be used for haul.	Minimize soil movement, maintain water quality, and minimize effects on severe erosion soils.	Land Management Plan compliance and specialist recommendation
SW058	Prioritize relocation of trails or roads in locations that benefit multiple resource areas. Relocated trails or roads will be constructed in a manner that does not hydrologically connect them to stream courses to the extent practical. Relocated roads and trails will have sufficient drainage features to maintain the integrity of the traveled way. New cross drains or lead-out ditches shall discharge to stable areas where the outflow will quickly infiltrate the soil and not develop an erosional feature such as a gully.	To provide for stable and serviceable roads and trails that do not adversely affect soils, surface water quality or aquatic habitats.	Specialist recommendation
SW059	Site rehabilitation on riparian sites for stream channel and road reconstruction projects where ground disturbance occurs: seed at 5 pounds per acre or other appropriate rate with certified weed-free native seed mix to rehabilitate the site and minimize effects of noxious weeds.	To comply with State and Federal water quality standards by minimizing soil erosion through the stabilizing influence of vegetation ground cover.	Land Management Plan compliance and specialist recommendation
SW060	Site rehabilitation on disturbed sites and stream channel shaping on decommissioned roads consists of several revegetation methods, such as, but not limited to: (1) Storing sod removed from the initial ground disturbance and replace the sod from the top of the bank on the disturbed site; (2) Use appropriate mix of species that will achieve vegetation establishment and erosion control objectives at the site. (3) Protect site with slash spread across the disturbed area to create microclimates and protect from grazing ungulates. Slash placement should be limited to the upper two-thirds of the bank to limit transport downstream of woody material;(4) Consider the use of mycorrhizal inoculum on severely disturbed sites where no topsoil is left; and (5) install erosion mat.(6) Protect site with herptile-friendly barriers until the site has reestablished (see AQ016). Temporary erosion control should be installed before land or channel disturbing activities commence and will be inspected for adequacy/effectiveness at sufficient intervals to minimize adverse effects to soils or surface water quality.	Comply with State and Federal water quality standards by minimizing soil erosion through the stabilizing influence of vegetation ground cover. To rehabilitate all disturbed areas from aquatic and watershed restoration treatments, minimize erosion and sedimentation to aquatic habitats and potential effects to species.	Specialist recommendation
SW061	All potential seeding areas as part of restoration treatment to re-establish native, perennial grass abundance and vigor will be evaluated on a site-specific, case-by-case basis by the project IDT. Seeding product for potential treatment areas will contain a mixture of certified weed-free native grasses which will contain a composition and ratio to be determined by the IDT.	For locations that do not have a viable enough seed bank to be propagated by prescribed fire activities alone, seeding may be necessary to help sites rejuvenate a more abundant and diverse herbaceous cover component that is aligned with the natural vegetative potential of the site.	Specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
SW062	De-compact soil by scarifying the soil surface of roads and paths, stream crossings, staging, and stockpile areas so that seeds and plantings can root. (See SW040)	To rehabilitate all disturbed areas from aquatic and watershed restoration treatments, minimize erosion and sedimentation to aquatic habitats and potential effects on species.	Land Management Plan compliance
SW063	For road, trail, aquatic, and watershed treatments: dispose of slide and waste material in stable sites out of the flood-prone area. Use native materials to restore natural or near-natural contours.	To protect water quality and aquatic habitat.	Specialist recommendation
SW064	If soil compaction occurs during implementation, mitigate through ripping, seeding with native weed-free seed, and covering compacted areas with slash or other certified weed free mulch material.	Minimize soil compaction, soil detachment, and sediment transport. To maintain long term soil productivity.	Specialist recommendation
SW065	Erosion control measures for roads, skid trails, landings, fire control lines, in woods processing sites, rock pits, and restoration and construction activities will be implemented in a timely manner to prevent excessive erosion and sedimentation from precipitation events or other disturbances. If implementation timing is not specified in a contract consult with a watershed specialist (specialist responsible for hydrologist or soil scientist duties) for clarification if needed.	To minimize ground disturbance in aquatic and associated habitats during site preparation and sedimentation to aquatic habitats.	Specialist recommendation
SW066	Minimize clearing and grubbing activities when preparing staging, project, and or stockpile areas. Any large wood, topsoil, and native channel material displaced by construction will be stockpiled for use during restoration if applicable. Materials used for implementation of aquatic and watershed restoration categories (for example, large wood, boulders, fencing material) should be staged out of the 100-year floodplain.	To minimize ground disturbance in aquatic and associated habitats during site preparation and sedimentation to aquatic habitats.	Specialist recommendation
SW067	Minimize time in which heavy equipment is in stream channels, riparian areas, and wetlands. Complete earthwork as quickly as possible when ground conditions are driest. During excavation, stockpile native streambed materials above the bankfull elevation, where it cannot reenter the stream, for later use.	To minimize ground disturbance in aquatic and associated habitats during site preparation and sedimentation to aquatic habitats.	Land Management Plan compliance and specialist recommendation
SW068	Disturbance to streambank vegetation should be minimized in all project activities.	To protect riparian vegetation and stream channel stability.	Specialist recommendation
SW069	Do not borrow road fill or embankment materials from the stream channel or meadow surface on road maintenance projects. End-load all material hauled onsite and compact fill.	Minimize disturbance in drainage systems and minimize sediment production within channel.	Specialist recommendation
SW070	Heavy equipment will be commensurate with the project and operated in a manner that minimizes adverse effects to the environment (for example, minimally sized, low pressure tires, minimal hard turn paths for tracked vehicle, temporary mats or plates within wet areas or sensitive soils).	To minimize impacts to streams and wetlands as well as aquatic habitats from heavy equipment use to implement restoration treatments.	Land Management Plan compliance and specialist recommendation
SW071	Placement piles for burning will occur outside of fragile or sensitive soil types.	Minimize disturbance of sensitive soil.	Specialist recommendation
SW072	Project implementation activities will be completed as to not negatively impact existing water rights as recognized and being consistent with Arizona Department of Water Resources and applicable regulations.	To protect existing water rights.	Land Management Plan compliance

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
SW073	All erosion control work to be constructed related to ground disturbing activities would be in place or maintained prior to potential damaging runoff events.	To avoid and minimize impacts to water quality and watershed integrity.	Land Management Plan compliance and specialist recommendation
SW074	One 50-gallon spill kit (or two 30-gallon spill kits) must be located on-site during use of all heavy equipment.	To avoid impacts to water quality and wildlife.	Specialist recommendation
SW075	No permanent structures would be constructed as part of any rock pit; although at least one self-contained portable toilet is required to be on-site during all operations.	To protect water quality and prevent unnecessary impacts to vegetation and wildlife.	Specialist recommendation
SW076	In rock pit areas, minimize soil and vegetation disturbance to the extent practical outside of the area needed for extraction of material from the pit.	Prevents impacts to soil, vegetation, and wildlife.	Specialist recommendation
SW077	If possible, stockpile rock-pit soil for reclamation that is first removed to access the aggregate material source. Soil would be stockpiled instratum and replaced so that the “A” horizon is back on the surface. Replace soil, revegetate, and reclaim mined areas pit as soon as possible once pit use is discontinued.	To facilitate reclamation efforts.	Specialist recommendation
SW078	In rock pits, stockpiled material should be placed and shaped to prevent water from ponding and to direct water to a drainage system. Mine pit areas would be designed to be internally draining, keeping sediment on-site of rock pits using settling ponds, check dams, or sediment barriers; and monitor and inspect the site frequently and correct problems promptly. Ponds should be cleaned out before they are more than 1/3 full of sediment.	To protect water quality.	Specialist recommendation
SW079	Slash piles should not be placed within 300 feet of perennial or intermittent streams or within 100 feet of ephemeral streams unless local conditions suggest otherwise.	To minimize impacts to streams and wetlands as well as aquatic habitats.	Land Management Plan Conformance
SW080	Surveys would be conducted within the modeled habitat identified in the soil specialist report (USDA FS 2021) for biological soil crusts prior to implementation using the Field Guide to Biological Soil Crusts of Western US Drylands (Rosentreter, 2007). Where feasible, flag and avoid areas with confirmed biological soil crusts categories 4-6 (Rosentreter 2007) for mechanical treatments and temporary road building.	To minimize impacts to biological soil crusts.	Specialist recommendation
TR001	Avoid locating temporary roads on soils with severe erosion hazard.	The completion of a total maximum daily load assessment may result in developing additional water quality improvement strategies and mitigation of effects within associated watersheds.	Specialist recommendation
TR002	On areas to be prescribed burned, if decommissioned roads are used as fire lines, return decommissioned roads to their pre-burn condition. Rehabilitation of the surface should refer to the soil and water BMPs for rehabilitation of fire lines and disturbed areas.	Discourage use on previously decommissioned roads and maintain a safe and economic road system.	Specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
TR003	Where temporary road construction is unavoidable, provide soil protection through implementation of any of the following methods to control sediment and protect water quality. Methods may include but are not limited to properly locating the temporary road in an upland position, road drainage (waterbars/rolling dips), and outsloped roads. For activities adjacent to the road to control runoff, include tactics such as wattling, hydro-mulching, straw or wood-shred mulching, spread slash, erosion mats, terraces, blankets, mats, silt fences, riprapping, tackifiers, soil seals, seeding and side drains.	To protect long-term soil productivity.	Specialist recommendation
TR004	Utilize road safety signage with any project road activities that are related to project implementation.	Provide for user safety.	Specialist recommendation
TR005	Utilize the closest material source that has the specified material type for all road maintenance/reconstruction/relocation projects.	Minimize energy use for road maintenance/reconstruction/relocation activities.	Specialist recommendation
TR006	The timber contract or stewardship contract should require pre-haul and post-haul maintenance on all roads to be used for haul.	Provide for a safe travel surface and provide for access to the project area.	Specialist recommendation
TR007	Decommissioned roads should have the roadbed removed and natural contours and gradients restored as much as possible. Slash or other suitable erosion material (mats, wattles, jute, silt fence, etc.) should be used where necessary and disturbed areas should be seeded with a suitable erosion control see mix consisting primarily of native grass species. Roads that are in closed status should be either lightly scarified and seeded or stabilized with erosion control features (for example, rolling the grade, waterbars, etc.). Road entrances should be blocked to prevent access and signed as closed. Camouflaging of road entrances with large rocks and woody debris may prevent unauthorized access and improve stability. Road drainage features such as lead-out ditches or waterbars should not be hydrologically connected to stream channels on active or closed roads.	To protect long-term soil stability/productivity and water quality by reducing overland flow and sediment delivery originating from these locations.	Specialist recommendation
TR008	As a condition of approval for use of a temporary road under any contract involving mechanical thinning, temporary roads would be decommissioned, using any one or combination of appropriate methods (FSM 7734.1, , also see TR007), by the purchaser/contractor immediately after mechanical treatments and restoration work are completed.	To protect long-term soil productivity and water quality and ensure that temp roads do not become de facto new roads.	Specialist recommendation
TR009	Roads causing damage to hydrological resources, cultural resources or threatened endangered, and sensitive species habitat are a priority for decommissioning.	To reduce effects to aquatic habitats from roads.	Specialist recommendation
TR010	Where feasible, relocate roads out of drainage bottoms to an upland location. If this is not feasible, rock armor outfall of drainage features as an energy dissipater.	To minimize sediment delivery into and disturbance to drainage systems, and minimize sediment production within channels.	Specialist recommendation
TR011	Avoid road rehabilitation and maintenance during periods of sustained or heavy rainfall.	To minimize erosion and negative effects from sediment and other contaminants on water bodies and aquatic and associated habitats and cave/karst systems.	Specialist recommendation

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TR012	When deemed necessary to prevent potential damage to buried utilities, the Forest Service will coordinate any hauling activity which will cross buried utilities with the owner of the line. Care shall be taken to prevent damage to buried utilities which may include mitigation measures such as gravel padding or other suitable measures.	Prevent damage to water pipelines.	Specialist recommendation
TR013	While a rock pit is in operation, appropriate dust abatement measures will be taken on roads and pit areas where trucks are operating if necessary.	Reduce dust and minimize visibility issues on roads.	Specialist recommendation
WL001	In Mexican spotted owl Recovery Foraging non-breeding habitat strive to maintain all trees more than 24 inches d.b.h. except in overriding management situations such as for human safety. Consult Appendix F – Mexican spotted owl Recovery Plan Framework for further guidance.	To minimize adverse effects on Mexican spotted owls while restoring Mexican spotted owl habitat, contribute toward the recovery of the owl, and to comply with Endangered Species Act and direction in the 2012 Mexican Spotted Owl (Mexican spotted owl) Recovery Plan, pp. 268-269.	Land Management Plan compliance and specialist recommendation
WL002	Mexican spotted owl PACs and recovery nest/roost habitat will be managed to meet basal area, trees per acre, and canopy cover requirements as specified in the most current Mexican spotted owl Recovery Plan. In Mexican spotted owl PACs and Nest/Roost Recovery Habitat strive to maintain all trees 18 inches d.b.h. except in overriding management situations such as for human safety. Consult Appendix F – Mexican spotted owl Recovery Plan Framework for further guidance. Also see SI019.	To minimize adverse effects on Mexican spotted owls while restoring Mexican spotted owl habitat, contribute toward the recovery of the owl, and to comply with Endangered Species Act and direction in the 2012 Mexican spotted owl Recovery Plan, tables C.1, C.2, and C.3.	Land Management Plan compliance and specialist recommendation
WL003	Coordinate and implement management activities within Mexican spotted owl PACs to reduce potential disturbance and minimize the frequency and duration of operations within and immediately adjacent to these areas.	To minimize adverse effects on Mexican spotted owls while restoring Mexican spotted owl habitat, contribute toward the recovery of the owl, and to comply with the Endangered Species Act.	Land Management Plan compliance and specialist recommendation
WL004	In Mexican spotted owl recovery foraging/non-breeding habitat, follow the most current Mexican spotted owl Recovery Plan and incorporate the following guidelines: • Crown spacing between tree groups (interspace) would average 25 to 60 feet distance, providing for forest health, prey habitat development, and to move toward or facilitate stand conditions more conducive to low-severity fire. • Tree thinning in pine-oak would target 40 to 110 BA; thinning in mixed conifer would target 40 to 135 BA. The goal is manage for a sustainable range of density and structural characteristics. • No trees greater than 24 inches in diameter would be cut and trees greater than 18 inches would be retained, unless overriding management situations require their removal.	To minimize adverse effects to Mexican spotted owls and contribute toward the recovery of the owl while restoring Mexican spotted owl habitat.	Land Management Plan compliance and specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
WL005	In Mexican spotted owl PACs, springs, riparian and stream restoration, obliteration, relocation, and maintenance, would not occur during the breeding season (March 1 to August 31). Timing restrictions may be waived on a case by case basis if protocol level surveys confirm non-nesting or an active nest is more than 0.25 mile from project work. Timing restrictions may also be waived if the district biologist, in coordination with USFWS determines actions within 0.25 mile will not disturb nesting birds.	To minimize adverse effects on Mexican spotted owls while restoring Mexican spotted owl habitat, contribute toward the recovery of the owl, and to comply with the Endangered Species Act.	Land Management Plan compliance and specialist recommendation
WL006	In Mexican spotted owl PACs, no mechanical or prescribed fire treatments or road or trail maintenance would occur during the breeding season (March 1 to August 31). Timing restrictions may be waived if protocol surveys indicate non-breeding or infer absence. Timing restrictions may also be waived if the district biologist, in coordination with USFWS determines actions within 0.25 mile will not disturb breeding birds.	To minimize adverse effects to Mexican spotted owls and comply with the Endangered Species Act and the 2012 Mexican spotted owl Recovery Plan, table C.1 while restoring Mexican spotted owl.	Land Management Plan compliance and specialist recommendation
WL007	Thinning equipment would remain greater than or equal to 0.25 mile from Mexican spotted owl PAC boundaries during breeding season unless topographic features would minimize noise such that breeding owls would not be disturbed.	To minimize effects on Mexican spotted owls while restoring Mexican spotted owl habitat, contribute toward the recovery of the owl, and to comply with the Endangered Species Act	Land Management Plan compliance and specialist recommendation
WL008	• Hauling would generally avoid Mexican spotted owl PACs during the breeding season (March 1 to August 31) unless specific analysis has documented that this would not lead to adverse effects or protocol surveys indicate non-breeding or infer absence. Timing restrictions may also be waived if the district biologist, in coordination with USFWS, determines actions within 0.25 mile will not disturb breeding owls. • Trucks would drive less than or equal to 25 miles per hour in PACs during breeding season.	To minimize adverse effects on Mexican spotted owls while restoring Mexican spotted owl habitat, contribute toward the recovery of the owl, and to comply with the Endangered Species Act.	Land Management Plan compliance and specialist recommendation
WL009	In Mexican spotted owl PACs, no new wire fencing would be constructed to minimize the risk of owls colliding with new fences. Other alternatives would be used for aspen, sensitive plants, springs, and ephemeral channel restoration exclosures.	To minimize adverse effects to Mexican spotted owls and contribute toward the recovery of the owl while restoring Mexican spotted owl habitat.	Specialist recommendation
WL010	In Mexican spotted owl PACs, road maintenance would not occur during the breeding season (effective March 1 to August 31). Timing restrictions may be waived if protocol surveys indicate non-breeding or infer absence. Timing restrictions may also be waived if the district biologist, in coordination with USFWS determines actions within 0.25 mile will not disturb nesting birds.	To minimize disturbance effects on Mexican spotted owls while restoring Mexican spotted owl habitat, contribute toward the recovery of the owl, and comply with the Endangered Species Act.	Land Management Plan compliance and specialist recommendation
WL011	All stands included in the proposed mechanical treatments for Mexican spotted owl PACs would be hand-marked for thinning, and prescriptions and marking would be coordinated with the U.S. Fish and Wildlife Service.	To improve site specificity of treatments to retain trees with the greatest habitat value and continue coordination with the U.S. Fish and Wildlife Service during implementation.	Specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
WL012	Fireline associated with prescribed burning would not be constructed during the breeding season in Mexican spotted owl PACs and/or core areas. Timing restrictions may be waived if protocol surveys indicate non-breeding or infer absence. Timing restrictions may also be waived if the district biologist, in coordination with USFWS determines actions within 0.25 mile will not disturb breeding owls.	To minimize adverse effects to Mexican spotted owls while restoring Mexican spotted owl habitat, contribute toward the recovery of the owl, and comply with the Endangered Species Act.	Land Management Plan compliance and specialist recommendation
WL013	In Mexican spotted owl PACs, nest trees would be protected in the design and implementation of prescribed fires.	To minimize adverse effects to Mexican spotted owls while restoring Mexican spotted owl habitat, contribute toward the recovery of the owl, and comply with the Endangered Species Act.	Land Management Plan compliance and specialist recommendation
WL014	Survey all potential Mexican spotted owl areas including protected and recovery nest/roost, within the implementation area plus the area 0.5 mile to all habitat up to 0.5 mile beyond the perimeter of the proposed treatment area. Surveys should be conducted for two years, with the second-year survey either the year before or the year of (but prior to) project implementation. If more than five years have elapsed between the last survey year and the initiation of the proposed action, then one additional year of survey will be conducted prior to project implementation.	To minimize adverse effects to Mexican spotted owls while restoring Mexican spotted owl habitat, contribute toward the recovery of the owl, and comply with the Endangered Species Act.	Land Management Plan compliance and specialist recommendation
WL015	Coordinate burning spatially and temporally to limit smoke effects on nesting Mexican spotted owls, particularly for PACs in low-lying areas (March 1 to August 31).	To minimize the effects to Mexican spotted owls and comply with the Endangered Species Act.	Land Management Plan compliance and specialist recommendation
WL016	No cable operations or temporary road construction will be conducted in Mexican spotted owl PACs.	To minimize adverse effects to Mexican spotted owls and comply with the Endangered Species Act.	Specialist recommendation
WL017	Unless subsequent finalized revised Land Management Plan Species of Conservation Concern determinations do not include northern goshawk, in northern goshawk nest stands, burn plans covering areas with nesting northern goshawks and/or known nest trees would include mitigations to minimize smoke effects on nesting birds and nest trees would be protected.	To minimize disturbance to northern goshawks while restoring northern goshawk habitat.	Land Management Plan compliance and specialist recommendation
WL018	Unless subsequent finalized revised Land Management Plan Species of Conservation Concern determinations do not include northern goshawk, fuels in northern goshawk nesting areas would be evaluated and, if necessary, would be manipulated outside of the breeding period (March 1 to September 30) to ensure low-severity fire effects from prescribed fire.	To minimize disturbance to goshawks while restoring goshawk habitat.	Land Management Plan compliance and specialist recommendation
WL019	Unless subsequent finalized revised Land Management Plan Species of Conservation Concern determinations do not include northern goshawk, in northern goshawk post-fledging family areas (PFAs), thinning activities would not occur in occupied PFAs during the breeding season (March 1 September 30) unless the protocol surveys indicate non-nest or infer absence. Timing restrictions may also be waived if the district biologist, determines actions within 0.25 mile will not disturb nesting birds.	To minimize disturbance to goshawks while restoring goshawk habitat.	Specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
WL020	Unless subsequent finalized revised Land Management Plan Species of Conservation Concern determinations do not include northern goshawk, hauling will not occur within northern goshawk PFAs during the breeding season (March 1 through September 30) unless surveys determine the PFA is not nesting, or the nest is 1/4 mile away, topographically isolated, or as determined by a wildlife biologist.	To minimize disturbance to northern goshawks.	Specialist recommendation
WL021	Unless subsequent finalized revised Land Management Plan Species of Conservation Concern determinations do not include northern goshawk, in northern goshawk PFAs, spring, riparian and stream restoration projects would not occur during the breeding season (March 1 to September 30) if occupied. However, work could potentially occur on an individual basis through coordination with the district biologist.	To minimize disturbance to northern goshawks while restoring northern goshawk habitat.	Land Management Plan compliance and specialist recommendation
WL022	Unless subsequent finalized revised Land Management Plan Species of Conservation Concern determinations do not include northern goshawk, in northern goshawk PFAs road construction, obliteration, relocation, and maintenance would not occur during the breeding season (March 1 to September 30). Timing restrictions may be waived if protocol surveys indicate non-breeding or infer absence. Timing restrictions may also be waived if the district biologist, determines actions within 0.25 mile will not disturb nesting birds.	To minimize disturbance to northern goshawks while restoring northern goshawk habitat.	Land Management Plan compliance and specialist recommendation
WL023	--During project implementation, the Forest Service will not remove or degrade bald and golden eagle nest trees and treatments will reduce the risk of high-intensity fire affecting nest sites. • The Forest Service will coordinate with AGFD and FWS prior to planning treatments within bald or golden eagle breeding areas. • In bald and golden eagle breeding areas, mechanical treatments within 500-1,000 feet of bald or golden eagle nest trees or nest sites would only occur outside of the breeding season (January 1 to August 31), unless the nest is determined to be inactive by the District Biologist in coordination with AGFD and FWS.	To minimize disturbance to eagles while restoring forest habitat.	Specialist recommendation
WL024	In bald and golden eagle nest sites, fire staff will coordinate burn plans with the district wildlife biologist to ensure smoke will not nesting adversely affect nesting eagles.	To minimize disturbance to eagles while restoring forest habitat.	Specialist recommendation
WL025	• Restrict project activities within 500 feet of known bald eagle winter roost sites from October 15 - April 15, unless, in coordination with AGFD and FWS, it is determined eagles are not using the winter roost at that time. • If the Forest Service determines that thinning or temporary road construction must occur within 300 feet of a known bald or golden eagle winter roost, the Forest Service will coordinate with AGFD and FWS during project layout to ensure roost habitat is maintained.	To minimize disturbance to eagles while restoring forest habitat.	Specialist recommendation
WL026	If new Mexican spotted owl PACs are established in areas with planned or ongoing 4FRI activities, then existing design features related to Mexican spotted owl protection would apply to management activities. New PACs would be drawn in coordination with FWS.	To minimize adverse effects to Mexican spotted owls while restoring Mexican spotted owl habitat.	Land Management Plan compliance and specialist recommendation
WL027	In turkey foraging and roosting cover, mechanical thinning will retain mostly medium, with some areas of high canopy cover in ponderosa pine stringers in the pinyon-juniper transition zone. Thinning activities would emphasize retaining large and old trees in accordance with the OTIP and LTIP.	To minimize disturbance to turkeys while restoring forest habitat.	Land Management Plan compliance and specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
WL028	Manage prescribed fire to retain ponderosa pine and roosting cover for turkeys.	To minimize disturbance to turkeys while restoring forest habitat.	Land Management Plan compliance and specialist recommendation
WL029	No mechanical treatment would occur within 900 feet of an active great blue heron rookery between April 1 and June 30. Burn plan development would include consultation with the local biologist as well as the implementation of prescribed fire to minimize adverse impacts of smoke on nesting herons.	To minimize disturbance to rookeries while restoring forest habitat.	Specialist recommendation
WL030	Emphasize retainment of dominant or co-dominant trees in great blue heron rookeries. Nest trees would be prepped prior to implementing prescribed fire and ignition mitigations would apply. Timing would avoid mechanical thinning while birds are in the nest. Activities would be coordinated with the local biologist.	To minimize disturbance to rookeries while restoring forest habitat.	Specialist recommendation
WL031	Protect active raptor nest sites from disturbance by project-related activities by restricting activities during nesting season as specified in the applicable Land Management Plan, or as determined by a local wildlife biologist. Known nest trees for any raptor species will be prepped, as needed, to avoid negative impacts to survival or successful reproduction, prior to implementing management activities, including prescribed fire.	To minimize disturbance to raptors while restoring forest habitat.	Land Management Plan compliance and specialist recommendation
WL032	All personnel involved in thinning and prescribed burning activities, transportation of equipment and forest products, research, or restoration activities would be briefed on the Mexican spotted owl, know to report sightings and to whom, avoid harassment of the owl, and are informed as to whom to contact (FWS) and what to do if an owl is incidentally injured, killed, or found injured or dead.	To minimize adverse effects to Mexican spotted owls while restoring Mexican spotted owl habitat, contribute toward the recovery of the owl, and comply with the Endangered Species Act.	Specialist recommendation
WL033	A 300-foot buffer for mechanical treatment with heavy equipment should be designated around known bat colonies (use AGFD Heritage Data Management System (HDMS) database). For treatments around cave entrances, sink hole rims and other karst features that are to occur during the maternity season (April 15-August 31) or during monsoon season, coordination should occur with a wildlife biologist regardless of whether HDMS data indicates the occurrence of bat colonies or not.	To minimize disturbance to bats and their habitat, including detrimental effects to the cave/karst microclimate and hydrology, and to prevent collapse and sedimentation.	Specialist recommendation
WL034	Where cover exists near dependable waters, consult with a wildlife biologist to determine where and if hiding areas, openings, and interspaces should be created.	Maintain hiding cover where wildlife congregates while restoring forest structure.	Specialist recommendation
WL035	Snags and Logs: Protect snags and logs wherever possible by placing landings in existing openings or in areas where snags and/or logs, and old trees would be minimally affected in accordance with OTIP and LTIP.	Maintain key but limited wildlife habitat components while restoring forest structure.	Land Management Plan compliance

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
WL036	Snags and Logs: In ponderosa pine, protect/provide snags and logs wherever possible through site prep, implementation planning, green tree selection, and ignition techniques to retain 1-2 snags per acre greater than or equal to 18 inches in diameter, and greater than or equal to 3 logs greater than or equal to 8 feet long and greater than or equal to 12 inches mid-point diameter, and 3-10 tons of coarse woody debris (greater than 3 inches in diameter) per acre in pine and pine-oak habitat. In dry mixed conifer, protect/provide snags and logs wherever possible through site prep, implementation planning, green tree selection, and ignition techniques to retain 3 snags per acre greater than or equal to 18 inches in diameter, and greater than or equal to 3 logs greater than or equal to 8 feet long and greater than or equal to 12 inches mid-point diameter, and 5-15 tons of coarse woody debris (greater than 3 inches in diameter) per acre.	Maintain key but limited wildlife habitat components while restoring forest structure.	Land Management Plan compliance
WL037	Snags: Retain trees greater than or equal to 18 inches in diameter with dead tops, cavities, and lightning strikes wherever possible to provide cavity nesting/foraging habitat (such as the living dead) in ponderosa pine habitat.	Maintain key but limited wildlife habitat components while restoring forest structure.	Specialist recommendation
WL038	In pinyon-juniper cover type, snags 8 inches and greater in diameter at root collar would be managed for an average of 5 per acre, while snags 18 inches and greater in diameter would be managed for 1 per acre, and coarse woody debris would be managed for a post-treatment average of 2-5 tons per acre.	Maintain key wildlife habitat components while restoring forest structure.	Land Management Plan compliance and specialist recommendation
WL039	Emphasize retention of snags exhibiting loose bark to provide habitat for roosting bats and retain large-diameter, tall, early-decay-stage trees, as well as snags, especially those with natural cavities or sloughing bark to provide habitat for roosting bats.	Maintain key but limited wildlife habitat components while restoring forest structure.	Land Management Plan compliance and specialist recommendation
WL040	Gambel oak, juniper and pinyon species greater than 5-inch diameter at the root collar (diameter root collar) may be considered as residual trees in the target group spacing and stocking. Manage for large Gambel oaks (10 inch diameter at the root collar or larger) by removing ponderosa pine up to 18 inches in diameter that do not meet the “old tree” definition and do not have interlocking crown with oaks and occur within 30 feet of base of oak 10 inches in diameter at the root collar or larger.	Maintain a range of structure conditions (such as wildlife habitat heterogeneity) while restoring forest conditions.	Specialist recommendation
WL041	Burn plans will develop prescriptions that will maintain coarse woody debris levels that align with Land Management Plan direction.	Maintain a range of structure conditions (such as wildlife habitat heterogeneity) while restoring forest conditions.	Specialist recommendation
WL042	Burn Plans: Ensure that the potential cumulative effects of multiple fires burning in a given area do not produce negative effects to local wildlife; coordinate burning between administrative units and between wildlife and fire management to minimize potential disturbance.	Minimize disturbance to wildlife while conducting restoration activities.	Specialist recommendation
WL043	Defer thinning in a ¼ mile radius around documented black bear den sites from April 15 to June 30; maps would be provided to those implementing the activities.	Minimize potential for disturbance.	Specialist recommendation

DF/BMP/M&CM Number	Description	Primary Purpose	Basis
WL044	Temporarily restrict human access and disturbance-causing land-use activities within a 1-mile radius around active Mexican wolf dens between April 1 and July 31, and around active rendezvous sites between June 1 and September 30. Exceptions include any authorized specific land use that was active and ongoing at the time Mexican wolves chose to locate a den or rendezvous site nearby. Coordinate with the Interagency Field Team \to determine current denning/rendezvous site locations.	To avoid adverse effects to reproductive success, natural behavior, or persistence of Mexican wolves. To prevent loss of Interagency Field Team equipment (cameras, etc.) on Forest.	Land Management Plan compliance and specialist recommendation
WL045	Rock pits within ½ mile of Mexican spotted owl recovery and protected habitat would be surveyed to protocol to determine occupancy status of recovery habitat or breeding status of owls in PACs before operations are initiated, unless a wildlife biologist determines this restriction is unnecessary.	To avoid or minimize potential impacts to Mexican spotted owls.	Land Management Plan compliance and specialist recommendation
WL046	No ground disturbance from rock pit development or operation and in-woods processing sites would occur in known Mexican spotted owl PACs, or within 1/4 mile of nests and roosts during the breeding season, unless a wildlife biologist determines this restriction is unnecessary.	To avoid or minimize potential impacts to Mexican spotted owls.	Land Management Plan compliance and specialist recommendation
WL047	Material hauling from rock pits in or within ¼ miles of occupied Mexican spotted owl PACs would occur outside of the Mexican spotted owl breeding season unless a wildlife biologist determines this restriction is unnecessary.	To avoid or minimize potential impacts to Mexican spotted owls.	Land Management Plan compliance and specialist recommendation
WL048	Unless subsequent finalized revised Land Management Plan Species of Conservation Concern determinations do not include northern goshawk, pit development and operation within occupied northern goshawk PFAs may occur when surveys have indicated there are no active nests. If surveys identified an occupied nest, all operational activities and hauling would be avoided March 1 - September 30 unless a wildlife biologist determines this restriction is unnecessary.	To minimize impacts to northern goshawk.	Land Management Plan compliance and specialist recommendation
WL049	Unless subsequent finalized revised Land Management Plan Species of Conservation Concern determinations do not include northern goshawk, if a northern goshawk is detected at a rock pit location at any time, the local district biologist would be contacted prior to any additional activity to confirm northern goshawk activity in the area and determine additional mitigations, if necessary, to limit impacts to nesting northern goshawks.	To avoid or minimize potential impacts to nesting northern goshawk.	Specialist recommendation
WL050	No ground disturbance from in-woods processing site development or operation would occur within 1/4 mile of Mexican spotted owl PAC or northern goshawk PFAs, unless a district biologist, in coordination FWS (for MSO only), determines this restriction is unnecessary (unless subsequent finalized revised Land Management Plan Species of Conservation determinations do not include northern goshawk).	To avoid or minimize potential impacts to Mexican spotted owls and northern goshawk.	Specialist Recommendation
WL051	No mechanical thinning and prescribed burning in potential yellow-billed cuckoo habitat during the height of the breeding season (July 1 – September 30), but thinning and prescribed burning could occur from May 15 – July 1, when cuckoos may be present. The FS will coordinate with the state and federal YBCU species leads to determine when potential habitat polygons require timing restrictions. Field visits assessing habitat, stream gradient, vegetation, and floodplain width in coordination with FWS will determine if and where timing restrictions should occur.		

Appendix D – Implementation Plan for Alternatives 2 and 3

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

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

Description of Implementation Plan Components

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

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

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

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

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

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

Section G – Arizona GFD Aquatic Restoration Priority Treatment Table.

Section A – Implementation Plan Checklist

Table D-1. Implementation Plan Checklist

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

Line Officer Signature (required) Date

Section B – Old Tree Implementation Plan

Old Tree Descriptions and Illustrations

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

One example of a situation where the removal of an old tree is necessary in order to prevent additional habitat degradation is in the rare case of an old tree growing on the side of an existing curve in a road. Hauling equipment may require a wider turning radius. The options are to relocate the road or cut the old tree and widen the curve to accommodate the larger turning radius. Relocating the road to preserve the old tree would result in a larger area of the forest being permanently disturbed, versus the large tree and widening the curves radius. This is an example where cutting the old tree would result in less habitat degradation then relocating a road.

Threats to human health and safety would include hazard trees as defined by Forest Service Manual and Forest Service Handbook Direction (currently FSM 2332.1, FSM 2332.11, and FSH 7709.59). A hazard tree is defined as a tree that has both a structural defect that increases the chance of a tree or its parts to fail and a target (people, buildings, cars, etc.) would be hit when the tree fails.

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

Age – Approximately 150 years and older.

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

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

Tops – Ranging from pyramidal or rounded (occasionally pointed) to flat (making no further height growth).

Branching – Ranging from upturned in upper third of the crown, horizontal in the middle third, and drooping in the lower third of the crown to mostly large, drooping, gnarled, or crooked. Branch whorls range from incomplete and indistinct except at the top to completely indistinct and incomplete.

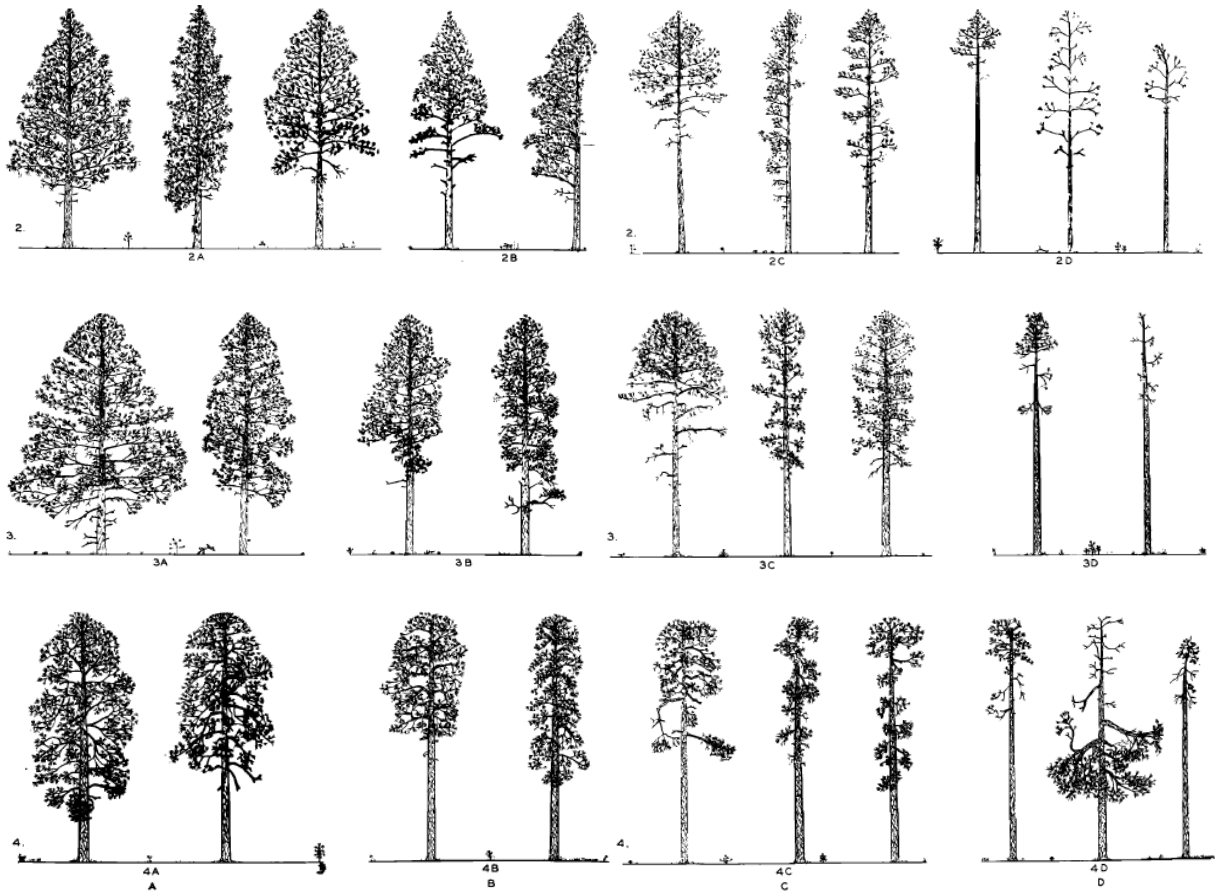


Figure D-1. Illustrations of age classes 2, 3 and 4 from Thomson (1940). Trees with physical characteristics of age classes 3 and 4 may be considered as old trees

Ponderosa Pine Age Class Descriptions

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

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

Photo Guide for Identification of Old Ponderosa Pine Trees



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



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

Section C – Large Tree Implementation Plan

The large tree implementation plan is designed to inform implementation. The plan's ecological objectives are consistent with the desired conditions found in the three Rim Country land management plans as well as the enacting language of the Collaborative Forest Landscape Restoration Program "maximizing the retention of large trees, as appropriate for the forest type, to the extent that the trees promote fire-resilient stands" (Omnibus Public Land Management Act of 2009).

For the purpose of this document, large post-settlement trees, as defined by the socio-political process, are those that are 16-inch diameter at breast height (d.b.h.) or larger. Groups of trees greater than or equal to 18-inch d.b.h. represent the largest and (sometimes) oldest trees. These size classes best correspond with the successional stage classification system that was developed to address the forest dynamics of southwestern ponderosa pine.

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

Seeps and Springs

Seeps are locations where surface-emergent groundwater causes ephemeral or perennial moist soil or bedrock. Standing or running water is infrequent or absent. Vegetation and other biological diversity are adapted to mesic habitat with moist, adequate soil moisture. Springs are small areas where surface-emergent groundwater causes ephemeral or perennial standing or running water and wet or moist soils. Vegetation and other biological diversity are adapted to mesic habitat or aquatic environments (Feth and Hem 1963).

Seeps and springs exhibit unique, often isolated biophysical conditions that can sustain unique, mesic-adapted biological diversity, and can facilitate endemism and speciation. Springs also provide water and other habitat to terrestrial wildlife. In the late 1800s, unsustainable livestock grazing practices significantly reduced herbaceous cover, reducing competition pressure on conifer seedlings. Coupled with the onset of fire suppression in the early 1900s, conifer trees rapidly encroached and recruited into native grasslands (for example, Moore and Huffman 2004, Coop and Givnish 2007). This cause and effect relationship allowed for an increase in conifer tree development. Due to the absence of frequent fires and the presence of livestock grazing, the establishment of large post-settlement trees may reduce available soil moisture (Simonin et al. 2007) and block the sunlight necessary to support the unique biophysical conditions associated with seeps and springs.

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

Ecological Objectives

The biophysical conditions in seeps and springs upon which terrestrial, mesic-adapted, and aquatic native biological diversity depend are conserved and restored.

The integrity of the spring's unique biophysical attributes is not compromised by tree rooting and shading.

Mesic habitats associated with a seep or spring are not encroached upon by conifers.

If treatment occurs, an equivalent number of large replacement trees remain where there is evidence that pre-settlement trees have grown in similar root and crown proximity to a particular seep or spring in the past.

Riparian

Riparian areas occur along ephemeral to perennial streams or are located downgradient of seeps or springs. These areas exhibit riparian vegetation, mesic soils, and/or aquatic environments.

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

Ecological Objectives

The biophysical conditions in riparian habitat upon which terrestrial and aquatic native biological diversity depends are conserved and restored.

The use of soil and water best management practices (BMPs) minimize the impacts of removing trees within riparian areas.

Removal of trees constitutes a relatively small part of an overall riparian area restoration effort, when compared to the fundamental causes of overall degradation. Riparian areas are fully restored by using an array of tools that address all sources of degradation.

Available soil moisture or light that support that area's unique biophysical conditions is not compromised by growing (rooted) trees.

If treatment occurs, an equivalent number of large replacement trees remain where there is evidence that pre-settlement trees have grown in similar root and crown proximity to a particular seep or spring in the past.

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

Wet Meadows

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

Wet meadows may be referred to as riparian meadows, montane (or high elevation) riparian meadows, sedge meadows, or simply as wet meadows. Wet meadows are usually located in valleys or swales, but may occasionally be found in isolated depressions, such as along the fringes of ponds and lakes with no outlets. Where wet meadows have not been excessively altered, sedges (*Carex spp.*), rushes (*Juncus spp.*), and spikerush (*Eleocharis spp*.) are common species (Patton and Judd 1970, Hendrickson and Minckley 1984, Muldavin et al. 2000). Willow (Salix) and alder (*Alnus spp.*) often occur in or adjacent to these meadows (Long 2000, Long 2002, Maschinski 2001, Medina and Steed 2002). High elevation wet

meadows frequently occur along a gradient that includes aquatic vegetation at the lower end and mesic meadows, dry meadows, and ponderosa pine or mixed conifer forest at the upper end. These vegetation gradients are closely associated with differences in flooding, depth to water table, and soil characteristics (Judd 1972, Castelli et al. 2000, Dwire et al. 2006). While relatively rare, wet meadows are believed to be of disproportionate value because of their use by wildlife and the range of other ecosystem services they provide. Wet meadows perform many of the same ecosystem functions associated with other wetland types, such as water quality improvement, reduction of flood peaks, and carbon sequestration.

Wet meadows are one of the most heavily altered ecosystems. They have been used extensively for grazing livestock, have become the site of many small dams and stock tanks, have had roads built through them, and have experienced other types of hydrologic alterations. Most notably, the lowering of their water tables due to stream down cutting, surface water diversions, or groundwater withdrawal (Neary and Medina 1996) has occurred. Due to the presence of livestock grazing and hydrologic changes, large post-settlement trees may have established and grown within wet meadows such that they compromise available soil moisture or light creating unique biophysical conditions.

Ecological Objectives

The biophysical conditions of wet meadows upon which terrestrial native biological diversity depend are conserved and restored.

Wet meadow function is not impaired by growing (rooted) trees.

If treatment occurs, an equivalent number of large replacement trees remain where there is evidence that pre-settlement trees have grown in similar root and crown proximity to a particular seep or spring in the past.

Removal of large trees constitutes a relatively small part of an overall riparian area restoration effort, when compared to the fundamental causes of overall degradation. Wet meadows are fully restored by using an array of tools that address all sources of degradation.

Encroached Grasslands

Encroached grasslands are herbaceous ecosystems that have infrequent to no evidence of conifer trees growing prior to settlement. The two prevalent grassland categories in the 4FRI landscape are montane (includes subalpine) grasslands and Colorado Plateau (a subset of Great Basin) grasslands, with montane grasslands being most common (Finch 2004). A key indicator of grasslands is the presence of mollisol soils. Mollisol soils are typically deeper with higher rates of accumulation and decomposition of soil organic matter relative to soils in the surrounding landscape. Grasslands in this region evolved during the Miocene and Pliocene periods, and the dark, rich soils observed in grasslands today have taken more than 3 million years to produce. In addition to their association with mollic soils, grasslands in this region are maintained by a combination of climate, fire, wind desiccation, and, to a lesser extent, by animal herbivory (Finch 2004).

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

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

Prior to European settlement, conifer trees were rarely established in grasslands because they were either suppressed by production of cool-season grasses or killed by frequent fire (Finch 2004). In the late 1800s, unsustainable livestock grazing practices significantly reduced herbaceous cover, reducing competition pressure on conifer seedlings. Coupled with the onset of fire suppression in the early 1900s, conifer trees rapidly encroached and recruited into native grasslands (Moore and Huffman 2004, Coop and Givnish 2007). Plant diversity is particularly important in grassland ecosystems. Grassland plots with greater species diversity have been found to be more resistant to drought and to recover more quickly than less diverse plots (Tilman and Downing 1994). This resilience will become even more important in a warming climate. Conifer tree removal, restoration of fire, and appropriate livestock numbers are all necessary to restore structure and function of native grasslands.

Ecological Objectives

Grasslands are enhanced, maintained, and function with potential natural vegetation (as defined by vegetative mapping units).

Grasslands function with a natural fire regime.

Existing grasslands are not encroached upon by conifers.

If treatment occurs, an equivalent number of large replacement trees remain where there is evidence that pre-settlement trees have grown in similar root and crown proximity to a particular seep or spring in the past.

Aspen Stands and Patches

Quaking aspen (*Populus tremuloides*) generally occurs within mixed conifer forests. It is ecologically important due to the high concentration of biodiversity that depends on aspen for habitat (Tew 1970, DeByle 1985, Finch and Reynolds 1987, Griffis-Kyle and Beier 2003). Aspen is currently declining at an alarming rate (Fairweather et al. 2008).

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

The lack of fire as a natural disturbance regime in southwestern frequent-fire forests since European settlement has caused much of the aspen dominated lands to cede to conifers (Bartos 2001). Other factors contributing to gradual aspen decline over the past 140 years include reduced regeneration from browsing ungulates (Pearson 1914, Larson 1959, Martin 1965, Jones 1975, Shepperd and Fairweather 1994, Martin 2007). More recently, aerial and ground surveys indicate more rapid decline of aspen, with very high mortality occurring in low and mid-elevation aspen sites. Major factors thought to be causing this rapid decline of aspen include frost events, severe drought, and a host of insects and pathogens (Fairweather et al. 2008) that have served as the “final straws” for already compromised stands.

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

Ecological Objectives

Aspen stands and patches are conserved and restored to their appropriate fire regime.

Aspen is effectively being regenerated or maintained, and regeneration, saplings, and juvenile trees are protected from browsing.

There is decreased competition from conifers. Post-settlement conifer tree numbers do not exceed residual targets that have been identified using pre-settlement conifer tree evidences, site visitations, and collected data.

Removal of large trees constitutes a relatively small part of the aspen restoration effort, when compared to the fundamental causes of overall degradation. Aspen forests and woodlands are fully restored by using an array of tools that address all sources of degradation.

Ponderosa Pine/Gambel Oak Forest (Pine-Oak)

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

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

Gambel oak provides high quality wildlife habitat in its various growth forms and is a desirable component of ponderosa pine forests (Neff et al. 1979, Kruse 1992, Bernardos et al. 2004).

Gambel oak enhances soils (Klemmedson 1987), wildlife habitat (Kruse 1992, Rosenstock 1998, USDI 1995, Bernardos et al. 2004), and understory community composition (Abella and Springer 2008). Large oak trees are particularly valuable because they typically provide more natural cavities and pockets of decay that allow excavation and use by cavity nesters than conifers. In addition to its important ecological role, Gambel oak has high value to humans as it is a popular firewood that possesses superior heat-producing qualities compared to other tree species (Wagstaff 1984).

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

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

oak diameter growth tended to be greater in areas where pine was thinned relative to burn only treatments and controls. Thinning of competing pine trees may promote large oaks with vigorous crowns and enhanced acorn production (Abella 2008b), and may increase oak seedling establishment (Ffolliott and Gottfried 1991).

Ecological Objectives

All Gambel Oak

Small oak trees develop into larger size classes.

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

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

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

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

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

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

In Mexican Spotted Owl Recovery Habitat

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

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

Outside Mexican Spotted Owl Recovery Habitat

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

Within-stand Openings (Interspaces)

Within-stand openings are small openings (generally 0.05 to 1.0 acres) that were occupied by grasses and wildflowers before settlement (Pearson 1942, White 1985, Covington and Sackett 1992, Sánchez Meador et al. 2009). For the purposes of this strategy, within-stand openings are equivalent to interspaces.

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

Within-stand openings appear to have been self-perpetuating before overgrazing and fire exclusion (Pearson 1942, Sánchez Meador et al. 2009). Fully occupied by the roots of grasses and wildflowers as

well as those of neighboring groups of trees, these openings had low water and nutrient availability because of intense root competition (Kaye et al. 1999). Heavy surface fuel loads insured that tree seedlings were killed by frequent surface fires, reinforcing the competitive exclusion of tree seedlings (Fulé et al. 1997).

These natural openings appear to have been very important for some species of butterflies, birds, and mammals (Waltz and Covington 2004). Often the largest post-settlement trees, typically a single tree, became established in these natural within-stand openings as soon as herbaceous vegetation was removed by overgrazing (Sánchez Meador et al. 2009). Contemporary within- stand openings or areas dominated by smaller post-settlement trees should be the starting point for restoring more natural within-stand heterogeneity.

Ecological Objectives

The pattern of openings within stands that provide natural spatial heterogeneity for biological diversity are conserved, created, or enhanced.

Openings break up fuel continuity to reduce the probability of torching and crowning and restore natural heterogeneity within stands.

Openings promote snowpack accumulation and retention which benefits groundwater recharge and watershed processes at the fine (1 to 10 acres) scale.

The presence of large trees does not prevent the reestablishment of sufficient within- stand openings to emulate natural vegetation patterns based on current stand conditions, pre-settlement evidences, desired conditions, or other restoration objectives.

Groups of trees typically range in size from 0.1 acre to 1 acre. Canopy gaps and interspaces between tree groups or individuals are based on site productivity and soil type and range from 10 percent on highly productive sites to as high as 90 percent on those soil types that have an open reference condition.

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

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

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

Ecological Objectives

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

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

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

Decreased shading and interception from the canopy fuels allow the growth of continuous herbaceous surface fuels to carry surface fire.

Reduced horizontal and vertical canopy fuels reduce the potential for crown fire.

Fire may be used with other methods to maintain/develop desired forest structure over time.

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

Section D – Rim Country Condition-based Management Approach

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

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

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

Changes in Treatment Intensity

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

Rim Country EIS Tracking Process

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

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

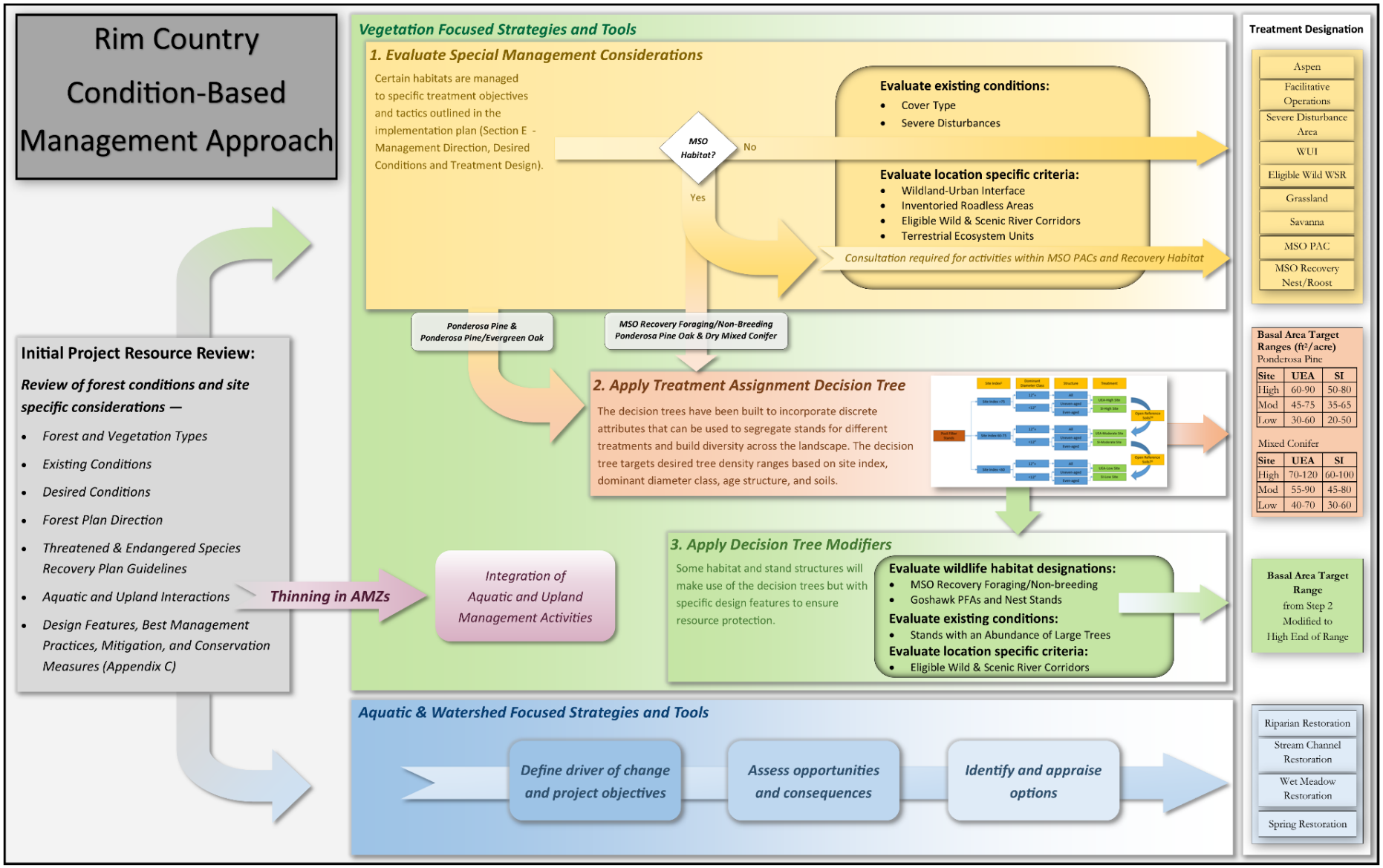


Figure D-4. Condition-based management approach for Rim Country

Initial Project Resource Review

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

Integration of Aquatic and Upland Management Activities

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Condition-based Management Approach for Vegetation-focused Restoration Treatments

Evaluate Special Management Considerations

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

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

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

Aspen

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

Facilitative Operations

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

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

Severe Disturbance Areas

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

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

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

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

Stands or parts of stands within these buffers that are identified as special management considerations or decision tree modifiers (as described in this condition-based management approach) will not be considered for these types of increased-intensity treatments, but will be considered for the appropriate treatments per their descriptions in this condition-based management approach.

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

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

The current condition of each of these areas will be field-reviewed prior to implementation by an interdisciplinary team of resource specialists, to determine what type and level of mechanical treatment is needed to protect the values at risk.

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

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

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

Grassland

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

Savanna

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

Treatment Assignment Decision Tree

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

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

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

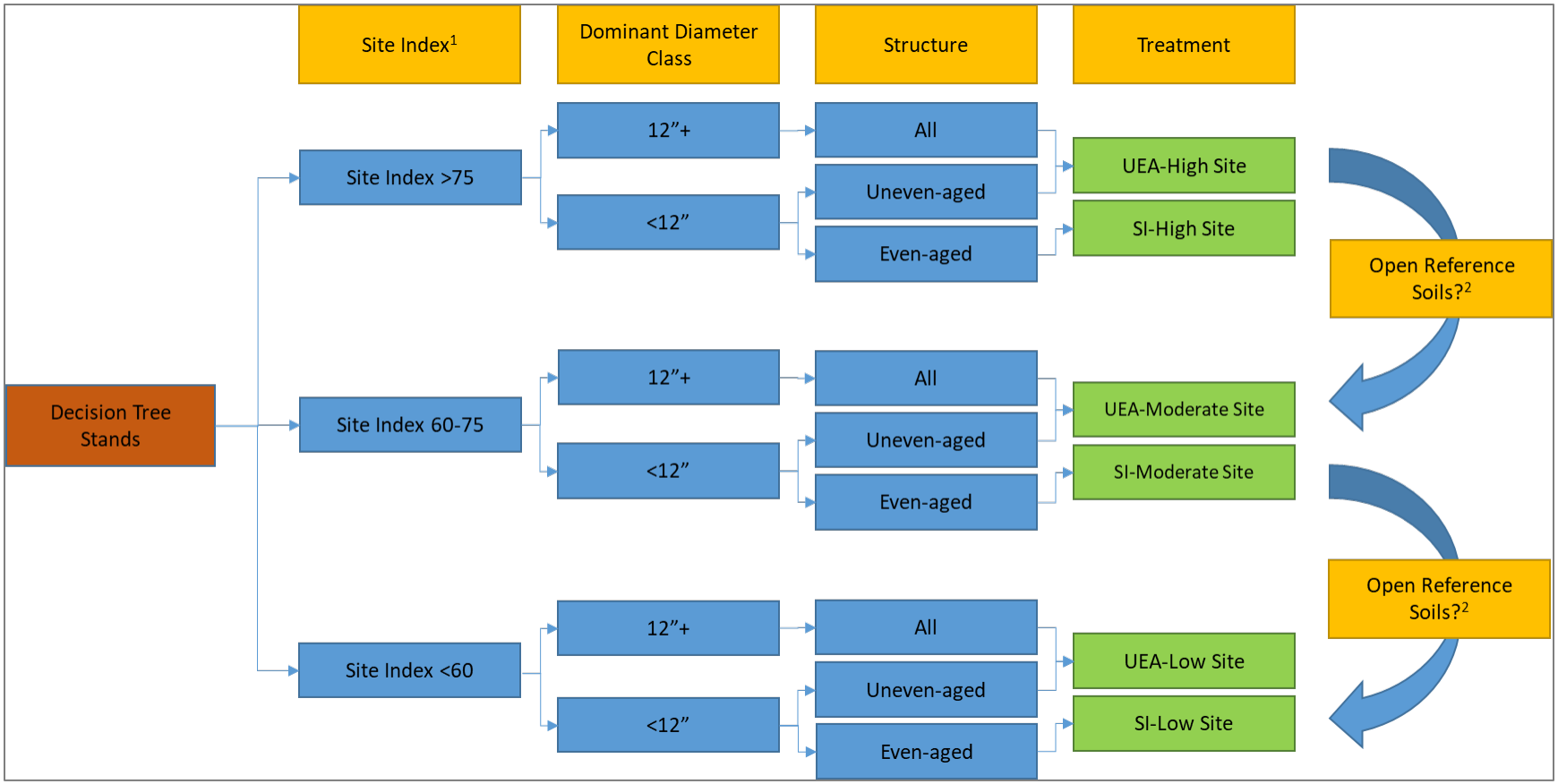


Figure D-5. Decision tree for the Rim Country condition-based management approach

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

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

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

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

Decision Tree Modifiers

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

Mexican Spotted Owl Foraging/Non-breeding Recovery Habitat

Achieving management objectives within Mexican spotted owl recovery habitat can be addressed with this Condition-based Management Approach. Stands in recovery habitat would be assigned a treatment using the decision tree, however, additional management direction would be applied such as maintaining increased basal area (40-110 BA for pine-oak and 40-135 BA for mixed conifer).

NOGO Nest Stands

Achieving management objectives for northern goshawk nest stands can be addressed with the condition-based management approach. NOGO nest stands would be assigned a treatment using the decision tree. However, additional direction, such as promoting multi-aged stands and stands dominated by large trees with relatively denser canopies (with basal areas generally 10 to 20 percent greater than surrounding areas) is necessary to maintain or improve habitat and ensure land management plan compliance.

NOGO Post-Fledging Areas (PFAs)

Management objectives in NOGO PFAs are like those in NOGO nest stands and can be addressed with the condition-based management approach. NOGO PFA stands would be assigned a treatment using the decision tree; however, additional direction comes from Land Management Plans (with basal areas

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

Stands with an Abundance of Large Trees (SALT)

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

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

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

Eligible Wild and Scenic River Corridors

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

geomorphic and ecological processes and the specific outstandingly remarkable values (ORVs) of the river (such as fish and wildlife habitat).

Stands Infected with Dwarf Mistletoe

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

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

In severely infected stands (80 percent or more infected), the forest health objective must also be weighed against other resource objectives. Generally, these stands would be assigned a similar treatment type to stands without a severe dwarf mistletoe infection, however, mechanical deferral may also be an option. Because of the patchy nature of dwarf mistletoe infections, it is recommended that the district silviculturist consider re-delineating a stand with high mistletoe infection and treating the healthy and infected portions with separate prescriptions or even deferring stands from mechanical treatment where a mechanical approach would not lower the level of dwarf mistletoe infection.

Inventoried Roadless Areas

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

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

Special Designations

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

Mechanical Treatment Condition-based Management Approach Summary

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

Condition-based Management Approach for Aquatics and Watershed Restoration Treatments

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

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

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

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

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

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

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

Salt River

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

Little Colorado River

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

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

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

Aquatics and Watershed Restoration Condition-based Management

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

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

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

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

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

Introduce Evaluation Methods

Aquatic Restoration Review Team

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

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

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

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

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

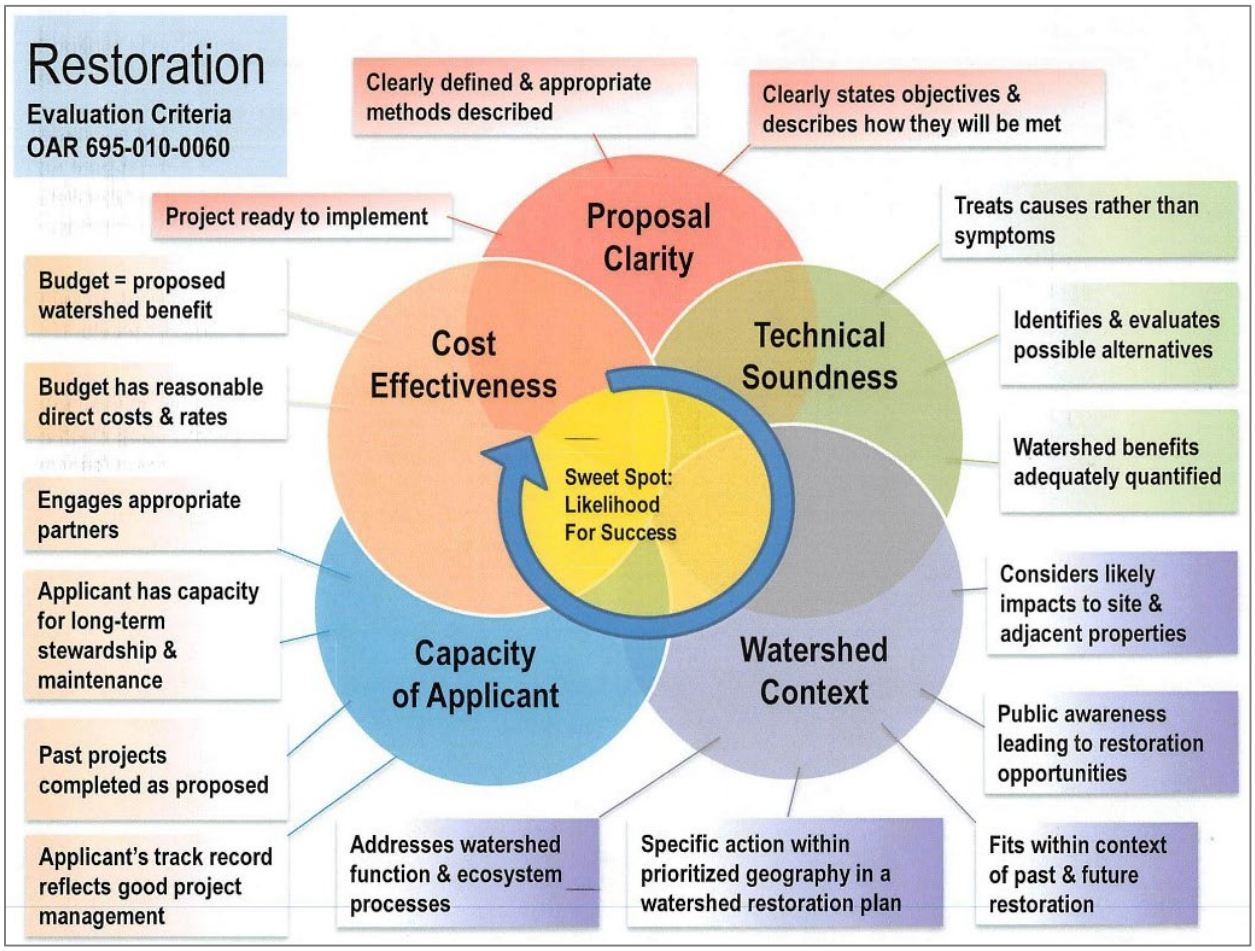


Figure D-6. Oregon Administrative Rule bubble diagram of review criteria

Project Screening and Decision Matrix

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

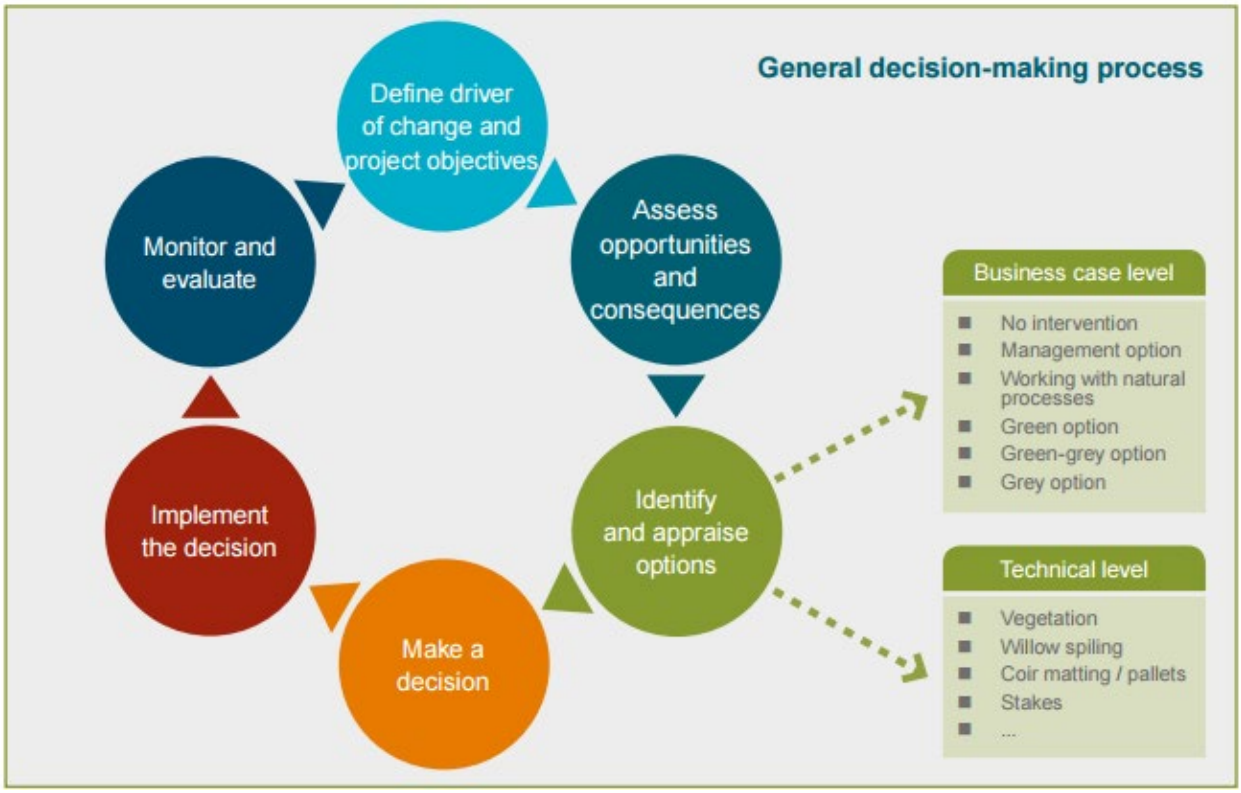


Figure D-7. Guidance for decision-making process (Roca et al. 2017)

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

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

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

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

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

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

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

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

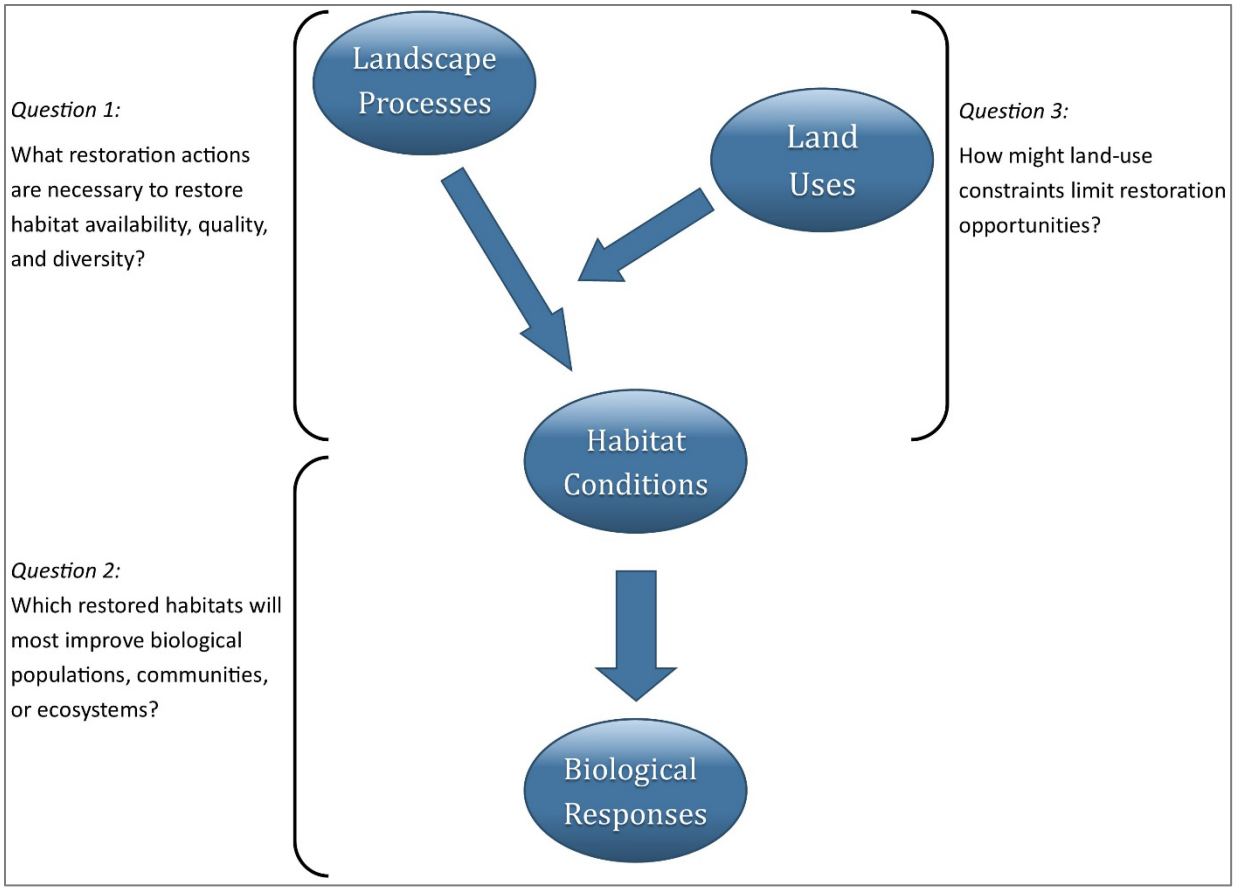


Figure D-8. Diagram of conceptual linkages and questions to be addressed in assessments used to identify and prioritize restoration actions (Beechie et al. 2008)

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

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

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

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

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

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

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

Prioritization

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

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

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

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

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

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

Project Checklist and ARRT Review

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

Implementation of Restoration Projects

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

Validation and Collaboration Period

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

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

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

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

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

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

Restoration Assessment Framework

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

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

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

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

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

Springs

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

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

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

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

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

Montane Meadows

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

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

Unneeded Roads and Unauthorized Routes and Trails

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

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

Road and Stream or Wetland Crossings

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

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

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

Streams (Channels, Floodplains and Riparian)

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

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

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

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

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

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

Table D-11. Methods for improving spring outflows

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

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

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

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

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

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

Circumstances Tables

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

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

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

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

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

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

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

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

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

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

Table D-15. Seasonal restrictions for wildlife species

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

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

Mexican Spotted Owl Habitat

Protected Activity Center (PAC)

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

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

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

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

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

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

PAC Mechanical Thin and Burn Treatment Design

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

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

Prescribed Burning Objectives and Tactics

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

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

Mechanical Thinning Objectives and Tactics

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

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

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

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

Recovery Nesting/Roosting Habitat

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

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

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

Recovery Nesting/Roosting Habitat Mechanical Thin and Burn Treatment Design

Prescribed Burning Objectives and Tactics:

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

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

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

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

Prescribed burning includes following concurrence and consultation advice from FWS.

Mechanical Thinning Objectives and Tactics:

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

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

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

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

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

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

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

Recovery Foraging/Non-breeding Habitat

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

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

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

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

Prescribed Burning Objectives and Tactics:

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

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

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

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

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

Mechanical Thinning Objectives and Tactics:

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

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

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

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

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

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

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

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

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

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

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

Northern Goshawk Habitat

Post-Fledging Family Area (PFA)

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

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

Desired Conditions: northern goshawk post-fledging family areas may contain 10 to 20 percent higher basal area in mid-aged to old tree groups or random tree spacing than northern goshawk foraging areas and the surrounding forest. Northern goshawk nest areas have forest conditions that are multi-aged and dominated by large trees with relatively denser canopies than the surrounding forest.

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

Prescribed Burning Objectives and Tactics:

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

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

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

Mechanical Thinning Objectives and Tactics:

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

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

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

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

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

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

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

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

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

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

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

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

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

Northern Goshawk Post Fledging Family Area Mechanical Thin Silviculture Prescription

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

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

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

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

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

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

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

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

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

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

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

Ponderosa Pine Forests

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

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

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

Desired Conditions

Landscape-Scale

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

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

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

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

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

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

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

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

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

Mid-scale

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

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

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

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

Fine scale

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

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

Trees within groups are of similar or variable ages and may contain species other than ponderosa pine. Tree groups are typically less than 1 acre and average ½ acre. Mid- to old-aged tree groups consist of approximately 2 to 40 trees with interlocking canopies.

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

Ponderosa Pine Forest Mechanical Thin and Burn Treatment Design

Prescribed Burning Objectives and Tactics:

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

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

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

Mechanical Thinning Objectives and Tactics:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Ponderosa Pine Forest Mechanical Thin Silviculture Prescription

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

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

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

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

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

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

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

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

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

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

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

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

Dry Mixed Conifer Forests

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

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

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

Desired Conditions

Landscape-Scale

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

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

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

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

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

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

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

Mid-scale

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

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

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

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

Northern goshawk post-fledging family areas (PFAs) may contain 10 to 20 percent higher basal area in mid-aged to old tree groups than northern goshawk foraging areas and the surrounding forest.

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

Fine scale

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

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

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

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

Dry Mixed Conifer Forest Mechanical Thin and Burn Treatment Design

Prescribed Burning Objectives and Tactics:

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

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

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

Mechanical Thinning Objectives and Tactics:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Dry Mixed Conifer Forest Mechanical Thin Silviculture Prescription

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

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

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

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

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

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

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

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

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

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

Aspen Stands or Inclusions in Mixed Conifer Forests

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

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

Landscape-Scale

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

Mid-scale

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

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

Aspen Mechanical Thin and Burn Treatment Design

Inclusions of aspen remnants within portions of other forested areas would be regenerated by removing all post-settlement conifers from within 100 feet of the aspen clone. Some removal of aspen within the clone as well as ground-disturbing activity or burning may occur to stimulate suckering.

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

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

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

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

Piñon-juniper Woodlands

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

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

Landscape-Scale

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

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

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

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

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

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

Mid-scale

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

Piñon-juniper Woodland Mechanical Thin and Burn Treatment Design

Prescribed Burning Objectives and Tactics:

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

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

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

Mechanical Thinning Objectives and Tactics:

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

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

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

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

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

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

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

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

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

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

Grasslands

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

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

Landscape

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

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

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

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

Mid-scale

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

Prescribed Burning Objectives and Tactics:

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

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

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

Mechanical Thinning Objectives and Tactics:

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

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

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

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

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

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

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

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

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

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

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

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

Group	Group Basal Area																													
QMD	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195
8	158	172	186	200	215	229	243	258	272	286	301	315	329	344	358														
9	125	136	147	158	169	181	192	204	215	226	238	249	260	272	283	294													
10	101	110	119	128	138	147	156	165	174	183	193	202	211	220	229	238	248	257											
11	83	91	99	106	114	121	129	136	144	152	159	167	174	182	189	197	204	212	220										
12	70	76	83	89	96	102	108	115	121	127	134	140	146	153	159	166	172	178	185	191									
13	60	65	71	76	81	87	92	98	103	109	114	119	125	130	136	141	147	152	157	163	168								
14	51	56	61	66	70	75	80	84	89	94	98	103	108	112	117	122	126	131	136	140	145	150							
15	45	49	53	57	61	65	69	73	77	81	86	90	94	98	102	106	110	114	118	122	236	130							
16	39	43	47	50	54	57	61	65	68	72	75	79	82	86	90	93	97	100	104	107	111	115	118						
17	35	38	41	44	48	51	54	57	60	63	67	70	73	76	79	83	86	89	92	95	98	102	105	108					
18	31	34	37	40	42	45	48	51	54	57	59	62	65	68	71	74	76	79	82	85	88	91	93	96	99				
19	28	31	33	36	38	41	43	46	48	51	53	56	58	61	63	66	69	71	74	76	79	81	84	86	89	91			
20	25	28	30	32	34	37	39	41	43	46	48	50	53	55	57	60	62	64	67	69	71	73	76	78	80	83			
21	23	25	27	29	31	33	35	37	40	42	44	46	48	50	52	54	56	58	60	62	64	67	69	71	73	75	77		
22	21	23	25	27	28	30	32	34	36	38	40	42	44	46	47	49	51	53	55	57	59	61	63	64	66	68	70	72	
23	19	21	23	34	26	28	30	31	33	35	36	38	40	42	43	45	47	49	50	52	54	56	57	59	61	62	64	66	
24	18	19	21	22	24	26	27	29	30	32	33	35	37	38	40	41	43	45	46	48	49	51	53	54	56	57	59	61	62

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

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

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

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

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

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

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

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