USDA

United States Department of Agriculture

Final Environmental Impact Statement for the Four-Forest Restoration Initiative

Volume 1

Coconino and Kaibab National Forests
Coconino County, Arizona

Forest Service Southwestern Region MB-R3-04-23 November 2014

Printed on recycled paper – November 2014

Final Environmental Impact Statement for the Four-Forest Restoration Initiative

Coconino and Kaibab National Forests
Coconino County, Arizona

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Abstract: This final environmental impact statement (FEIS) documents the analysis of five alternatives (including a "no action" alternative) that was developed for the Four-Forest Restoration Initiative on the Coconino and Kaibab National Forests (NFs). Alternative C is the preferred alternative. The project proposes to conduct restoration activities over a 10-year period. Alternatives B through E would mechanically treat up to 431,049 acres of vegetation and treat up to 586,110 acres with prescribed fire. Alternatives B through D propose nonsignificant forest plan amendments that would amend the 1987 Coconino National Forest Plan. Alternative E, which does not propose forest plan amendments, was developed in response to public comments on the DEIS.

This final EIS and the draft record of decision are subject to objection pursuant to 36 CFR 218.8, Subparts A and B. For more information on how to comment/file objections see the project website at: http://www.fs.usda.gov/main/4fri/planning or contact Annette Fredette, project team leader at 928-226-4684.

List of Acronyms

4FRI	Four-Forest Restoration Initiative
ACHP	Advisory Council on Historic Preservation
ADEQ	Arizona Department of Environmental Quality
AGFD	Arizona Game and Fish Department
AUM	Animal Unit Month
BA	Basal area
BAER	Burned Area Emergency Response
BCC	Birds of Conservation Concern
BCR	Bird Conservation Region
BE	Biological evaluation
BMP	Best management practice
CCF	Hundred cubic feet
CEQ	Council on Environmental Quality
CFLR	Collaborative Forest Landscape Restoration
CFLRP	Collaborative Forest Landscape Restoration Program
CFR	Code of Federal Regulations
CHU	Critical habitat unit
CNF	Coconino National Forest
CO	Carbon monoxide
CWD	Coarse woody debris
d.b.h.	Diameter at breast height
DEIS	Draft environmental impact statement
dPFA	Dispersal post-fledging area
d.r.c.	diameter at root collar
EIS	Environmental impact statement
EMA	Ecosystem management area
EPA	Environmental Protection Agency
EIS	Environmental impact statement
FEIS	Final Environmental Impact Statement
FLEA	Flagstaff/Lake Mary Ecosystem Analysis
FRCC	Fire regime condition class
FSH	Forest Service Handbook
FSM	Forest Service Manual
FVS	Forest Vegetation Simulator
FWS	United States Fish and Wildlife Service
GIS	Geographic information system
HUC	Hydrologic unit code
IBA	Important bird area
IMPLAN	Impact Analysis for Planning
IT	Intermediate thin
KNF	Kaibab National Forest
LANL	Los Alamos National Laboratory
LOPFA	Landscapes outside post-fledging family area
LTIP	Large tree implementation plan
LTRS	Large tree retention strategy
MA	Management area
MAUM	Thousand animal unit month
MIS	Management indicator species
ML	Maintenance level
MRNG	Management Recommendations for the Northern Goshawk in the Southwestern United States
MSO	Mexican spotted owl
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NF	National Forest
NFMA	National Forest Management Act
NHPA	National Historic Preservation Act
NMED	New Mexico Environment Department
NRV	Natural Range of Variability
PAC	Protected activity center
PFA	Northern goshawk post-fledging family area
PJ	Pinyon-juniper
PM	Particulate matter
PNVT	Potential natural vegetation type
ROS	Recreation opportunity spectrum
ROW	Right-of-way
RU	Restoration unit
SDI	Stand density index
SHPO	State Historic Preservation Office
SI	Stand improvement
SIO	Scenery integrity objectives
SWCP	Soil and water conservation practice
TAP	Travel analysis process
TCP	Traditional cultural properties
TES	Threatened, endangered and sensitive
TMR	Travel Management Rule
TPA	Trees per acre
UEA	Uneven-aged
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
VMS	Visual Management System
VSS	Vegetation structural stages
WEPP	Water Erosion Prediction Project
WFLC	Western Forest Leadership Coalition
WUI	Wildland-urban interface

Summary

The Four-Forest Restoration Initiative (4FRI) is a planning effort designed to restore ponderosa pine forest resiliency and function across four national forests in Arizona including the Coconino, Kaibab, Apache-Sitgreaves, and Tonto National Forests. The EIS project area is approximately 988,764 acres (figure 1) and includes the Coconino National Forest (hereafter referred to as Coconino NF) and Kaibab National Forest (hereafter referred to as Kaibab NF). This analysis is independent of any preceding or subsequent environmental analysis that may occur across northern Arizona.

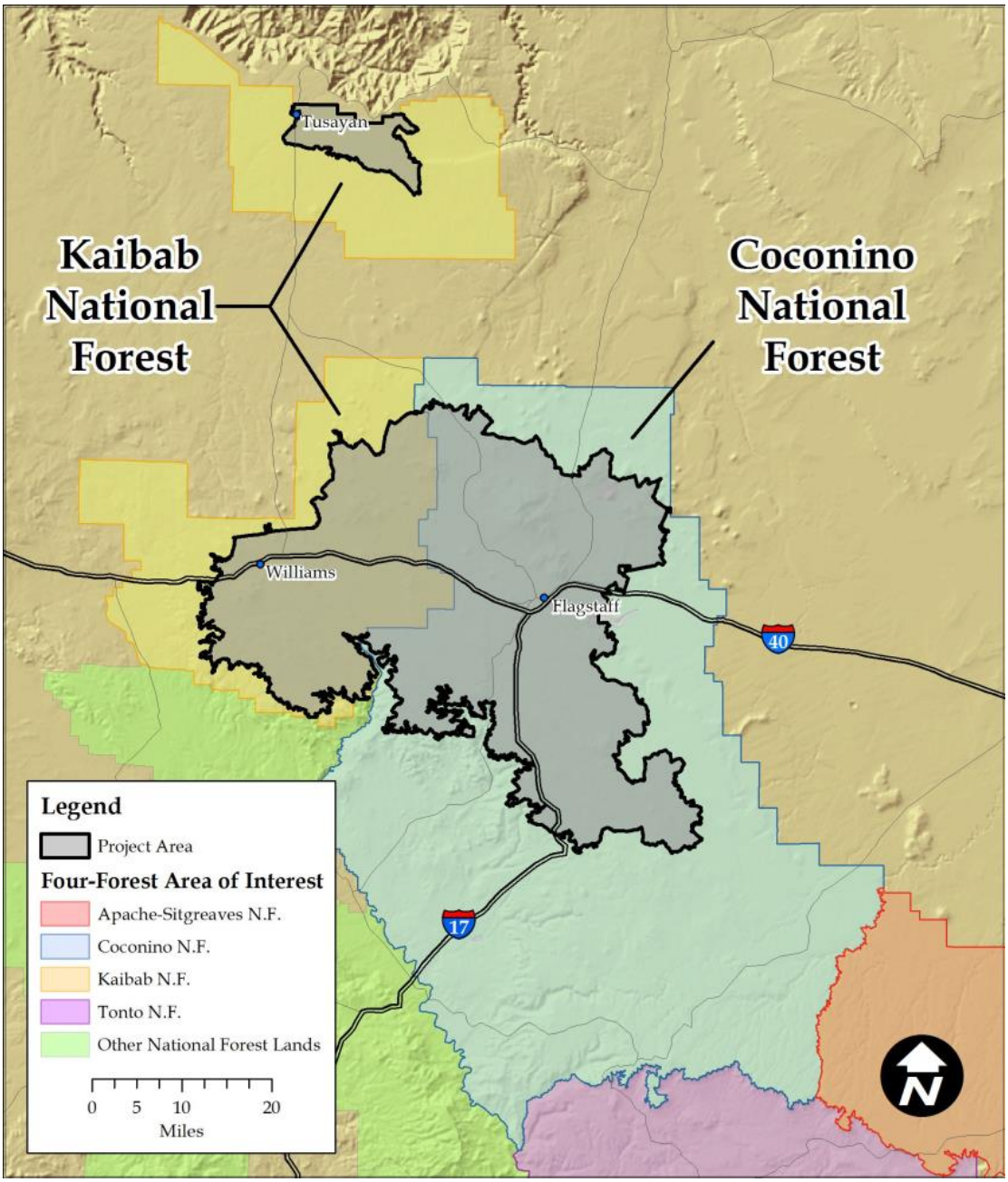

Figure 1. Four-Forest Restoration Initiative (4FRI) project area

This proposal is a result of several years of planning and collaboration among interested parties, groups and organizations, and Federal, State and local government agencies. The focus has been to restore forest landscapes and reduce the potential for severe fire effects in a manner that benefits the local economy. This proposal was selected to receive Collaborative Forest Landscape Restoration Act (CFLRA) funding. CFLRA supports landscape restoration on National Forest System lands.

In 2010, stakeholders developed a comprehensive landscape restoration strategy for the Coconino and Kaibab NFs, which documented existing conditions, potential treatment areas, and desired post-treatment conditions. The stakeholders also developed other products including the Large Tree Retention and Old Growth Protection Strategy. The Forest Service used the stakeholder's Landscape Restoration Strategy for the first analysis area (4FRI Stakeholders 2010) to inform the purpose and need and proposed action for this project. The large tree and old growth strategy was used to inform alternatives and the implementation plan.

In response to the purpose and need for action, the Coconino and Kaibab National Forests are proposing to conduct a suite of restoration activities on approximately 586,110 acres over a period of 10 years. The area affected by the proposal includes approximately 355,708 acres on the Flagstaff, Mogollon, and Red Rock Ranger Districts of the Coconino NF and 230,402 acres on the Williams and Tusayan Ranger Districts of the Kaibab NF.

The purpose of this project is to reestablish and restore forest structure and pattern, forest health, and vegetation composition and diversity. There is a need to increase forest resiliency and sustainability, protect soil productivity, and improve soil and watershed function. Resiliency increases the ability of the ponderosa pine forest to survive natural disturbances such as fire, insect and disease, and climate change (FSM 2020.5). This action is needed because:

- Over 50 percent of the ponderosa pine is even-aged and lacks age-class diversity. The single-age forest structure has reduced the health of the ponderosa pine forest. Large, old ponderosa pine trees are rare across the landscape. The remaining old pines are at risk of dying from the increased overcrowding of trees (stand density-related mortality) and the potential for severe fire effects.
- In contrast to having a ponderosa pine ecosystem consisting of groups of trees mixed with interspaces, approximately 74 percent of the ponderosa pine forest type within the project area is departed from desired conditions. Non-forested openings have been invaded by ponderosa pine since fire exclusion and this has changed the natural (and desired) spatial pattern.
- The dense, single-age forest structure combined with the lack of nonforested openings has affected function related to the presence of grass, forbs, and shrubs (vegetation composition and diversity). There is reduced understory productivity and function throughout the forest and within grasslands and meadows where trees have grown in. Ephemeral stream function has been affected by reduced ground cover, the presence of noxious weeds, increased numbers of trees, and the lack of fire. Spring function has been affected by drought, the lack of fire, and closed forest canopies, which increase evapotranspiration.
- The existing forest structure is in poor forest health. This has affected resiliency, or the ability of ponderosa pine to withstand natural disturbances including fire, insects and disease, and changing climatic conditions, such as drought. About 191,000 acres (38 percent) are at risk from crown fire. Additional acres, primarily within or next to Mexican spotted owl habitat are at risk from high-intensity surface fire that can result in high-severity effects.

- Approximately 72 percent of the ponderosa pine in the project area has a high hazard rating for bark beetle. About 34 percent of the ponderosa pine is moderately to heavily infected with dwarf mistletoe (see silviculture report). The current deficiency in resiliency is attributed to closed forest conditions and the associated buildup of forest fuels.

The 4FRI Project has been published in the Coconino and Kaibab NFs' Schedule of Proposed Actions since January of 2011. The notice of intent to prepare an environmental impact statement was published in the Federal Register on January 25, 2011 (76 FR 4279–4281). A draft proposed action was sent to the project mailing list (paper copies and electronic mail), consisting of 1,331 individuals, local governments, State governments, Federal and State agencies, and organizations that encompassed both national forests. Fifty-four (54) scoping responses (emails and letters) were received through May 5, 2011. A scoping report that included a summary of the scoping process was posted on the 4FRI website on June 29, 2011. On March 11, 2011, the Arizona Game and Fish Department (AGFD) was designated a cooperating agency. The agency provided a habitat specialist to serve as an interdisciplinary team member and assist with the wildlife analysis.

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

Four issues including prescribed fire emissions, conservation of large trees, post-treatment canopy cover and landscape openness and increased research and restoration focused the analysis or contributed to alternative development. See chapter 1 for information on how other public concerns and recommendations were addressed.

On February 26, 2013, a preview of the draft environmental impact statement (DEIS) was posted on the project's website at http://www.fs.usda.gov/main/4fri/planning, and interested parties were notified via email or phone call. On March 29, 2013 a notice of availability was published in the Federal Register (78 FR 19261). The notice of availability began a 60-day public comment period.

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

Approximately 213 letters and emails were received on the DEIS. About 1,000 individual comments were received. The Forest Service analyzed comments to identify issues that required further or updated analysis and to identify analyses that required further clarification. See chapter 1 for further information on how comments were categorized and addressed. Appendix I (volume 2) of this FEIS contains responses to comments received on the DEIS.

Changes from the DEIS to the FEIS

Since the publication of the DEIS, the Forest Service:

(1) addressed two procedural concerns raised by the public;

(2) added language to the purpose and need and implementation plan to clarify the need to conserve large trees;

(3) developed a new alternative (alternative E) that proposes no forest plan amendments;

(4) considered but eliminated an evidence-based full restoration alternative;

(5) revised treatment acres for all "action" alternatives (alternatives B through E) based on monitoring results that identified new Mexican spotted owl protected activity centers (PACs), modified existing PAC boundaries, and identified new northern goshawk post-fledging family areas (PFAs);

(6) removed treatment acres which overlapped with other ongoing National Environmental Protection Act (NEPA) analyses (such as the Flagstaff Watershed Protection Project);

(7) corrected technical errors;

(8) clarified methodology; updated environmental consequences (including cumulative effects);

(9) revised, further developed, and analyzed or corrected appendix sections B through G;

(10) conducted additional analyses (as appropriate) based on public comments on the DEIS in the preparation of this FEIS;

(11) removed all forest plan amendments on the Kaibab NF and updated forest plan direction as a result of having a revised forest plan (see chapter 2; forest plan consistency section);

(12) completed the monitoring and adaptive management plan, including the incorporation of U.S. Fish and Wildlife Service (FWS) mitigation and monitoring items for Mexican spotted owl;

(13) addressed changed conditions from a 2014 wildland fire on the Coconino NF; and

(14) modified how canopy cover would be measured on about 38,256 acres in alternatives C and E in response to comments.

The incremental changes to the proposed action and alternatives is documented in the project record and incorporated by reference in accordance with 40 CFR 1502.21 (36 CFR 220.5(e)(1)).

Issues

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

Two procedural concerns related to the range of alternatives and plan amendments were added to chapter 1 to highlight concerns raised by the public. Public concerns that are routine disclosures (see chapter 3) were not considered to be issues. For example, consultation with the U.S. Fish and Wildlife Service on endangered species is a requirement. Therefore, comments that stated consultation needed to occur were not considered a key issue. Appendix I of this FEIS provides a summary of comments as well as individual responses to comments received on the DEIS. Many

public comments submitted during the scoping period suggested alternatives that were either considered in detail or eliminated from detailed analysis (see chapter 2).

Issue 1: Prescribed Fire Emissions

This issue relates to the emissions from prescribed fire activities and the impact on air and water quality, public health, quality of life, and the economy of northern Arizona. In response to comments on the DEIS, emissions include, but are not limited to, radionuclide particles and mercury.

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

Issue 2: Conservation of Large Trees

This issue focuses on the conservation of large trees and the inclusion into the action alternatives of a strategy produced by the 4FRI stakeholders, the "Old Growth Protection and Large Tree Retention Strategy"[1] (also referred to as the "Large Tree Retention Strategy" or the "Old Tree Retention Strategy"). Large post-settlement trees, as defined by a socio-political process, are those greater than 16 inches d.b.h.

Commenters stated alternatives B (proposed action alternative) and D do not incorporate the Large Tree Retention Strategy. Alternative C and E respond to this issue by incorporating key components of the strategy and focusing on ecological desired conditions. In response, an implementation plan that is integral to all action alternatives was developed. The plan identifies ecological conditions where large, post-settlement trees may be removed to move toward or meet desired conditions. The intent of the Large Tree Retention Strategy has been incorporated into alternative C and E's design criteria, the monitoring and adaptive management plan, and the project implementation plan. All resource reports have analyzed and disclosed how the modified Large Tree Retention Strategy (the Large Tree Implementation Plan) has been addressed in the environmental consequences section of this FEIS.

Issue 3: Post-treatment Canopy Cover and Landscape Openness

This issue focuses on retaining closed canopy conditions for species including, but not limited to, goshawk and Mexican spotted owl. Commenters stated measuring canopy cover in goshawk habitat at the group level would not meet forest plan stand-scale canopy requirements. Commenters stated a reduction in canopy and large tree densities have never been analyzed under the National Environmental Policy Act and National Forest Management Act and could have deleterious effects to goshawk, its prey species, and those wildlife species that are dependent on that cover. Because natural openings would no longer be included within the vegetation structural stage (VSS) classification, it would result in significantly more lands being in an open condition

[1] 4FRI Stakeholders 2010

or outside of the VSS 4 to 6 classifications. This could substantially increase the logging of mature and old trees and negatively affect wildlife, including goshawk and its prey species.

Alternatives B through E are designed to provide closed canopy conditions and comply with the forest plans. The vegetation analysis addresses the interrelationship between canopy cover and old and large trees. To address post-treatment openness and canopy cover, a nonsignificant forest plan amendment for the Coconino NF was developed for alternatives B, C, and D. Alternative E does not propose a forest plan amendment.

Issue 4: Increased Restoration and Research

This issue focuses on recommendations to increase the acres and type of restoration treatments. Commenters recommended including additional acres of grassland restoration. The U.S. Fish and Wildlife Service recommended increasing prescribed fire and mechanical treatments within Mexican spotted owl habitat (to improve the quality of the habitat and be in alignment with the revised Mexican Spotted Owl Recovery Plan (USDI FWS 2012)). Commenters recommended including a paired watershed study and small mammal research to evaluate the impact of landscape-scale restoration. Alternative C was developed to respond to this issue.

Procedural Concerns

Range of Alternatives and Comparison of Alternatives

This procedural concern was raised in comments to the DEIS. There is a concern that the action alternatives proposed in the DEIS were virtually identical except for the variation in acreages. Some commenters stated there is no (action) alternative where a plan amendment would not take place. Commenters stated it is not possible to understand the environmental effects and tradeoffs for resources that result from the amendments themselves.

Alternative E may address this concern. In alternative E, no forest plan amendment would occur and treatments would comply with the current Coconino NF forest plan. In summary, the FEIS includes 11 alternatives including no action, 4 action alternatives and 6 alternatives that were considered but eliminated from detailed study.

Significant Forest Plan Amendments

This procedural concern is based on comments on the DEIS. Commenters stated the plan amendments are significant because they may bring about changes that may have an important effect on the entire land management plan (or affect land and resources throughout a large portion of the planning area) see FSM 1926.52 (Jan. 31, 2006). Some commenters stated the plan amendments are significant because the two national forests are including identical plan amendments in similar projects.

In the FEIS, the analysis has been updated to clarify methodology and data used for the significance evaluation. Alternative E, which proposes no forest plan amendments, provides a point of comparison to alternatives B, C and D which do include plan amendments. In the FEIS, no plan amendment is proposed for the Kaibab NF in alternatives B, C and D because the treatments are in alignment with the plan's objectives, desired conditions, and standards and guidelines (see chapter 2, "Forest Plan Consistency" section). Also see appendix I, "DEIS Response to Comments."

Summary of Alternatives

This FEIS documents the analysis of five alternatives, including no action (alternative A), the final proposed action (alternative B), and three additional alternatives (alternatives C, D and E). Alternatives C and D respond to recommendations and issues raised by the public during the extended scoping period. These issues were addressed in the DEIS. Alternative E was developed in response to comments on the DEIS. A brief summary of the alternatives is provided below.

- **Alternative A** is the no action alternative as required by 40 CFR 1502.14(c).[2] There would be no changes in current management and the forest plans would continue to be implemented. Approximately 166,897 acres of current and ongoing vegetation treatments and 195,076 acres of prescribed fire projects would continue to be implemented within and next to the project area. Approximately 43,041 acres of vegetation treatments and 58,714 acres of prescribed fire and maintenance burning would be implemented next to the project area by the Coconino and Kaibab NFs in the foreseeable future (within 5 years). Activities such as road maintenance, recreation, firewood gathering and authorized livestock grazing would continue. Activities that have been authorized in separate decisions such as the control of non-native invasive plants and implementation of travel management would continue. Alternative A is the point of reference for assessing alternatives B through E.
- **Alternative B** is the proposed action. This alternative would mechanically treat 384,966 acres of vegetation and use prescribed fire on 583,330 acres. It incorporates comments and recommendations received during eight months of collaboration with individuals, agencies, and organizations. It proposes mechanically treating trees up to 16 inches in diameter (d.b.h.) in 18 Mexican spotted owl protected activity centers and includes low-severity prescribed fire within 70 Mexican spotted owl protected activity centers, excluding 54 core areas. Three nonsignificant forest plan amendments on the Coconino NF would be required (see table 2). No forest plan amendments are proposed on the Kaibab NF.
- **Alternative C is the preferred alternative.** This alternative would mechanically treat 431,049 acres of vegetation and use prescribed fire on 586,110 acres. It responds to **Issue 2** (conservation of large trees), and **Issue 4** (increased restoration and research). It adds acres of grassland treatments on the Kaibab NF, incorporates wildlife and paired watershed research on both national forests, and mechanically treats trees and uses prescribed fire within the proposed Garland Prairie management area on the Kaibab NF. It proposes to mechanically treat trees up to 17.9 inches d.b.h. in 18 Mexican spotted owl protected activity centers and includes low-severity prescribed fire within 70 Mexican spotted owl protected activity centers, including 54 core areas. Key components of the stakeholder-created Large Tree Retention Strategy are incorporated into the alternative's implementation plan. Three nonsignificant forest plan amendments on the Coconino NF would be required (see table 2). No forest plan amendments are proposed on the Kaibab NF.
- **Alternative D** would mechanically treat 384,966 acres of vegetation and use prescribed fire on 178,441 acres. This alternative was developed in response to **Issue 1** (prescribed fire emissions). It decreases the acres that would receive prescribed fire by 69 percent (when compared to alternative B, the proposed action). This equates to removing fire on about 404,889 acres. It proposes mechanically treating trees up to 16 inches d.b.h. in 18 Mexican spotted owl protected activity centers, but the protected activity centers would not be treated with prescribed fire. Three nonsignificant forest plan amendments on the Coconino NF would be required (see table 2). No forest plan amendments are proposed on the Kaibab NF.

[2] http://www.nepa.gov/nepa/regs/ceq/1502.htm#1502.14

- **Alternative E** was developed in response to comments on the DEIS. This alternative would mechanically treat 403,218 acres of vegetation and use prescribed fire on 581,020 acres. Alternative E responds to **Issue 3** (post-treatment landscape openness and canopy cover), and may resolve concerns the public had related to the range of alternatives and forest plan amendments. It is similar to alternative C in that it adds acres of grassland treatments on the Kaibab NF and incorporates a paired watershed study and small mammal research. It proposes to mechanically treat trees up to 9 inches d.b.h. in 18 Mexican spotted owl protected activity centers and includes low-severity prescribed fire within 70 Mexican spotted owl protected activity centers, excluding 54 core areas. Key components of the stakeholder-created Large Tree Retention Strategy are incorporated into the alternative's implementation plan. No forest plan amendments are proposed on either forest.

Actions Common to Alternatives B, C, D, and E

- Alternatives B through E propose additional actions including restoring springs and ephemeral channels, constructing protective fencing in select aspen stands, constructing (and decommissioning) temporary roads, reconstructing and improving roads, relocating a minimal number of road miles, and decommissioning existing roads and unauthorized routes (table 2).
- On those acres proposed for prescribed fire, two fires would be conducted over the 10-year period.
- Design features, best management practices (BMPs), and mitigation to be used as part of alternatives B through E are located in volume 2, appendix C.
- All action alternatives include adaptive management actions that would be taken as needed to restore springs, ephemeral channels, and naturalize decommissioned and unauthorized roads (table 22). Temporary roads will be decommissioned by the purchaser/contractor immediately after use using adaptive management actions (FEIS, chapter 2) and BMPs for the rehabilitation of ground disturbed sites (FEIS, appendix C).

All action alternatives incorporate into each alternative's design features key components of the Old Tree Retention Strategy (volume 2, appendix C), the implementation plan (volume 2, appendix D), and the adaptive management, biophysical and socioeconomic monitoring plan (volume 2, appendix E). The Forest Service worked collaboratively with stakeholders to develop the final monitoring and adaptive management and implementation plan. Appendix E also includes the Mexican spotted owl and Arizona bugbane monitoring plan as approved (through formal consultation) by the U.S. Fish and Wildlife Service.

Table 1. FEIS summary of alternatives analyzed in detail

Proposed Activity	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C (Preferred)	Alternative D	Alternative E
Vegetation Mechanical Treatment (acres)	Under forest plan implementation	384,966	431,049	384,966	403,218
Prescribed Fire (acres)*	Under forest plan implementation	583,330	586,110	178,441	581,020
MSO PAC Habitat Treatments	Under forest plan implementation	Mechanically treat up to 16 inches d.b.h. in 18 PACs (excluding core areas). Use prescribed fire in 70 MSO PACs (excluding core areas).	Mechanically treat up to 17.9 inches d.b.h. in 18 PACs and manage these PACs for a minimum of 110 BA. Use prescribed fire in 54 MSO PACs (including core areas). Use prescribed fire in 16 MSO PACs (excluding core areas).	Mechanically treat up to 16 inches d.b.h. in 18 PACs (excluding core areas).	Mechanically treat up to 9 inches d.b.h. in 18 PACs (excluding core areas). Use prescribed fire in 70 MSO PACs (excluding core areas).
Springs Restored (number)	Under forest plan implementation	74	Same as alternative B		
Springs Protective Fence Construction (miles)	Under forest plan implementation	Up to 4	Same as alternative B		
Aspen Protective Fencing (miles)	Under forest plan implementation	Up to 82	Same as alternative B		
Ephemeral Stream Restoration (miles)	Under forest plan implementation	39	Same as alternative B		
Temporary Road Construction and Decommission (miles)	Under forest plan implementation	Up to 520	Same as alternative B		
Road Reconstruction/ Improvement (miles)	Under forest plan implementation	Up to 30	Same as alternative B		
Road Relocation (miles)	Under forest plan implementation	Up to 10	Same as alternative B		
Existing Road Decommission (miles)	Under forest plan implementation	726	Same as alternative B		
Unauthorized Route Decommission (miles)	Under forest plan implementation	134	Same as alternative B		

*On those acres proposed for prescribed fire, two fires would be conducted over the 10- year period.

MSO PAC = Mexican spotted owl protected activity center; BA = basal area

Table 2. Summary of forest plan amendments by alternative and theme for the Coconino NF

Alternative	Mechanical Treatments in PACs	Treatments in PAC Core Areas	Restricted Habitat Management	Basal Area in Restricted Target and Threshold Habitat	Population and Habitat Monitoring	Habitat Treatment in Incremental Percentages
Forest Plan Amendment 1: Theme - Management in Mexican Spotted Owl Habitat on the Coconino NF						
A, E	N/A					
B	Amendment 1: Allows mechanical treatment up to 16 inches d.b.h. in 18 PACs	N/A: No PAC core area treatments	Amendment 1: Adds definitions for target and threshold habitat	N/A—basal area in restricted target and threshold habitat remains 150 on both forests	Amendment 1: Defers monitoring to the project's U.S. Fish and Wildlife Service (FWS) biological opinion	Amendment 1: Defers treatment design to the project's FWS biological opinion
C	Amendment 1: Allows mechanical treatment up to 17.9 inches d.b.h. in 18 PACs and decreases the minimal basal area from 150 to 110 in the 18 PACs	Amendment 1: Allows prescribed fire in 54 core areas	Amendment 1: Adds definitions for target and threshold habitat	Amendment 1:Allows for managing 6,299 acres of restricted target and threshold habitat for a minimum range of 110 to 150 basal area	Amendment 1: Defers monitoring to the project's FWS biological opinion	Amendment 1: Defers treatment design to the project's FWS biological opinion
D	Amendment 1: Allows mechanical treatment up to 16 inches d.b.h. in 18 PACs	N/A: No PAC core area treatments	Amendment 1: Adds definitions for target and threshold habitat	N/A—basal area in restricted target and threshold habitat remains 150	Amendment 1: Defers MSO monitoring to the project's FWS biological opinion	Amendment 1: Defers treatment design to the project's FWS biological opinion
Forest Plan Amendment 2: Theme - Management of Canopy Cover and Ponderosa Pine with an Open Reference Condition within Goshawk Habitat on the Coconino NF						
A	N/A					
B-D	Amendment 2: (1) adds the desired percentage of interspaces within uneven-aged stands to facilitate restoration, (2) adds the interspaces distance between tree groups, (3) adds language clarifying where canopy cover is and is not measured, (4) allows 28,952 acres (alternatives B and D) and 28,653 (alternative C only) to be managed for an open reference condition (up to 90 percent open with less than 3 to 5 reserve trees), and (5) adds a definition to the forest plan glossary for the terms: interspaces, open reference condition, and stands.					
E	N/A: No desired percentage of interspaces would be added. No language clarifying where canopy cover is and is not measured would be added. Zero acres would be managed for up to 90 percent open with less than 3 to 5 reserve trees. No definition of interspace and stands would be added.					
Forest Plan Amendment 3: Theme - Effect Determination for Cultural Resources on the Coconino NF						
A	N/A					
B-D	Amendment 3: The amendment deletes the standard that would require achieving a "no effect" determination and adds the words "or no adverse effect" to the remaining standard. In effect, management strives to achieve a "no effect" or "no adverse effect" determination.					
E	N/A: Forest plan standard that would require achieving a "no effect" determination would remain in place.					

Alternatives Considered but Eliminated from Detailed Study

The DEIS included five alternatives considered but eliminated from detailed study. Public comments suggested five alternative methods for achieving the purpose and need, including an alternative that would: (1) use mechanical treatments limited to trees no larger than 8 inches d.b.h., (2) use prescribed fire as the sole treatment method, (3) eliminate the use of prescribed fire, (4) use the original Large Tree Retention Strategy, and (5) limit mechanical treatments to 16 inches d.b.h. In response to comments on the DEIS, a sixth alternative (evidence-based full restoration) was considered but eliminated from detailed study.

Design Features, Best Management Practices and Mitigation

Project design features, best management practices and mitigation measures that are designed to minimize or avoid impacts of the proposed actions have been included in the analysis of this FEIS (see appendix C). Some mitigation measures have been refined or added since the release of the DEIS. Chapter 3 of this FEIS summarizes, by resource, changes to design features and mitigation measures (with rationale) as appropriate.

Implementation Plan

The implementation plan (appendix D) is designed to be integral to the selected alternative and record of decision. It must be considered in conjunction with appendix C, which provides the design criteria, best management practices, and mitigation measures. The implementation plan provides direction that would be used by personnel to ensure that implementation meets the purpose and need and forest plan standards and guidelines. It is the foundation for the formal silvicultural prescriptions. The silvicultural prescriptions would document the desired conditions presented in the analysis, incorporate design features and mitigation (appendix C), and provide the course of action needed to move toward those desired conditions. In response to comments on the DEIS, the implementation plan has been corrected and revised.

Monitoring and Adaptive Management

Appendix E includes the adaptive management, biophysical and socioeconomic monitoring plan. This plan is designed to be integral to the selected alternative and record of decision. The monitoring and adaptive management plan details the framework and process for monitoring selected actions. The 4FRI stakeholders and the Forest Service coordinated on the design of the monitoring and adaptive management plan. In response to comments on the DEIS, the plan has been corrected and revised. Appendix E also includes the Mexican spotted owl and Arizona bugbane monitoring plan as approved (through formal consultation) by the FWS.

Forest Plan Consistency

The 4FRI Project was reviewed for consistency with the direction in the current “Coconino National Forest Plan” (forest plan), as amended (USDA FS 1987), the “Land and Resource Management Plan for the Kaibab National Forest, as revised” (USDA FS 2014). Consistency evaluations can be found by resource in chapter 3 of this FEIS, in each specialist report, and the project record. Appendix D (implementation plan) documents how treatment design meets Coconino NF and Kaibab NF forest plan direction and desired conditions.

Coconino NF: Three nonsignificant amendments for the Coconino NF were evaluated in the FEIS. The amendments are authorized via 36 CFR 219, the Forest Service Planning Rule. Section 219.17(b)(3) of the Rule provides the transition language that allows this project to propose

amendments to the Coconino NF forest plan using the provisions of the 1982 Planning Rule. The purpose of amendment 1 is to bring the selected alternative in alignment with the revised Mexican Spotted Owl Recovery Plan and defer monitoring to the FWS biological opinion that is specific to this project. Amendment 2 clarifies existing direction related to managing canopy cover and interspace in the forest plan. The purpose of amendment 2 is to bring the project into alignment with the best available science (Reynolds et al. 2013) that provides desired conditions for restoring fire-adapted ponderosa pine in the Southwest. Amendment 3 resolves a forest plan error related to the management of heritage resources and is specific to this project. The detailed significance analysis for each amendment is located in appendix B of this FEIS.

The significance of each amendment was evaluated in accordance with Forest Service Handbook (FSM) 1926.51 and FSM 1926.52. No amendment alters multiple use forest plan goals and objectives, adjusts management area boundaries or management prescriptions. The changes in standards and guidelines are considered to be minor because they reflect the latest, best available science (Reynolds et al. 2013). The amendments bring the alternatives into alignment with the revised Mexican Spotted Owl Recovery Plan, although the degree of alignment varies by alternative. No amendment would alter the long-term relationship between levels of multiple-use goods and services originally projected for the Coconino NF. These outputs were specific to a planning period ranging from 10 to 15 years (as identified in 1987).

With the proposed nonsignificant forest plan amendments (see appendix B) alternatives B, C, and D are consistent with the current 1987 Coconino NF forest plan direction. Alternative E is consistent with the current forest plan with one exception. Attaining no effect for heritage resources would not be possible unless 100 percent of the project area was surveyed and avoided.

Kaibab NF: The revised forest plan for the Kaibab NF became effective in April of 2014. All forest plan amendments for the Kaibab NF were removed from the FEIS because the alternatives are consistent with the revised Kaibab NF forest plan. The project's desired conditions for ponderosa pine were based on the best available science for the restoration of southwestern fire-adapted ecosystems (Reynolds et al. 2013). These desired conditions informed the Kaibab NF's plan revision process. The amendments for Mexican spotted owl were removed because the project is consistent with the forest plan in that a guideline for threatened, endangered and sensitive species directs projects to integrate management objectives and protection measures from approved recovery plans (Kaibab NF forest plan, p. 51).With design features and mitigation, alternatives B through E are consistent with forest plan objectives, desired conditions, standards and guidelines, although movement toward desired conditions varies by alternative. Kaibab NF forest plan consistency evaluations are located in each resource report. A consolidated evaluation is in the project record (see chapter 2 for additional details).

Major Conclusions

In response to public comments received on the DEIS, the FEIS presents additional information to display a sharper contrast and comparison of effects between the alternatives (table 35). See chapter 3 for the complete effects analysis.

Prescribed Fire Emissions (Issue 1)

Emissions would be highest in alternative A, approaching 80,000 pounds per acre. After treatment, there would be the least emissions potential from alternatives B and C with emissions projected at about 31,000 pounds per acre. Alternative E would be the next lowest amount of emissions, and would be closer to alternatives B and C than to D. Alternative D would have the

highest potential emissions of all the action alternatives because of the lack of treatment of surface fuels, and the slight increase in surface fuels that comes from thinning. Once treatments are complete, the emissions from wildfire are projected to be slightly greater than 50,000 pounds per acre. Compared to alternative A, there would be a reduction in emissions from approximately 80,000 pounds per acre to approximately 31,000 pounds per acre.

From a quality of life perspective, smoke emissions would be inevitable under all alternatives, whether from prescribed burns or wildfire. However, the intensity and duration of emissions would be variable. With prescribed burns, burn plans would be developed to minimize adverse effects to quality of life in nearby communities. The Forest Service would work with the Arizona Department of Environmental Quality to ensure that smoke impacts to human health are avoided or minimized. This issue remains unresolved and controversial with those members of the public who oppose any use of prescribed fire.

Large and Old Trees (Issue 2, Purpose and Need)

The conservation of large trees was identified as issue 2. The need to retain large trees was identified in the purpose and need. In alternative A, the sustainability of the large and old tree component across the landscape may be impaired by density related mortality and forest health issues. When compared to alternative A, the sustainability of the large and old tree component across the landscape would be improved (see “Forest Health” later in this section).

The goshawk analysis indicates the mature and old forest structural stages would be underrepresented in the post-fledging area (PFA) habitat and lands outside post-fledging area (LOPFA) even-aged stands. Projections show a trend toward improved representation in all habitats. In 2050, all restoration units (RUs) are very close to or exceed desired conditions for the number of trees per acre larger than 18 inches with the exception of RU 6.

In alternative D, the reductions in prescribed fire mortality results in denser conditions that affect the VSS distribution trend by slowing stand development and growth. This results in more of the landscape being maintained in the young forest stage and impeding development of the mature and old forest stages. Also see the “Mexican Spotted Owl Habitat” large and old tree discussion. In response to feedback and comments received on treating less aggressively and leaving more large trees, canopy cover would be measured at the stand level on about 38,256 acres of goshawk habitat where there is a preponderance of VSS 4, 5 and 6. However, this issue likely remains unresolved and controversial with those members of the public who oppose cutting any tree larger than 16 inches d.b.h.

Mexican Spotted Owl Habitat (Issue 3, Purpose and Need)

How treatments could potentially affect Mexican spotted owls and their habitat is part of Issue 3. The need to improve the quality of Mexican spotted owl habitat is part of the purpose and need for the project.

Although the modified large tree retention strategy applies only to alternatives C and E, the silvicultural analysis for Mexican spotted owl indicates good representation in the 18- to 24-inch size classes in all habitats in alternatives B, C, and E. Alternative D resembles the no action alternative with the least movement made toward desired conditions. Stocking in the 24-inch and larger size class has good representation in the restricted other habitat and is underrepresented in the target/threshold habitat. Reducing abundant quantities of mid-sized trees and increasing areas dominated by large trees should improve Mexican spotted owl nesting and roosting habitat (USDI FWS 1995, May and Gutierrez 2002, May et al. 2004, Blakesley et al. 2005).

The FWS biological opinion for Mexican spotted owl found the preferred alternative (alternative C) "may effect and is likely to adversely affect Mexican spotted owls and their habitat, including critical habitat." There is potential for short-term adverse effects to owls and their habitat from project activity disturbance outside of the nesting season (USDI FWS 2014). Potential impacts to Mexican spotted owl likely remain controversial with those members of the public who oppose any mechanical or prescribed fire treatments within Mexican spotted owl habitat. Also see the uncertainty and risk discussion in the "Mexican Spotted Owl" analysis in the "Wildlife" section of chapter 3.

Northern Goshawk Habitat (Issue 3, Purpose and Need)

How treatments could potentially affect northern goshawk habitat is part of issue 3. The need to improve the quality of goshawk habitat is part of the purpose and need for the project.

In alternatives B through E, primary benefits from these changes in forest structure are that the risks of large-scale loss of habitat from disturbances such as uncharacteristic fire, bark beetles, and density-related mortality would be reduced. In alternative A, the potential for large-scale loss of habitat from disturbances would persist and increase.

Substantial increases in the average pounds per acre of understory biomass in all action alternatives would improve cover and food for birds and mammals preyed upon by goshawks as well as the invertebrates that are an important food source for goshawk prey. Alternatives B and C would have the most improvement followed by alternatives E, then D.

In alternatives B through E, treatments in goshawk habitat would be implemented using tree stocking guidelines that would maintain interlocking or nearly interlocking tree crowns. Tree group density would meet and exceed the canopy cover requirements (Coconino NF only) and desired conditions (Kaibab NF). In response to feedback and comments received on treating less aggressively and leaving more large trees, canopy cover will be measured at the stand level on about 38,256 acres of goshawk habitat where there is a preponderance of VSS 4, 5, and 6. Although canopy cover desired conditions and requirements would be met, the retention of adequate canopy cover or closed canopies likely remains controversial with those members of the public who believe the post-treatment condition will be too open.

Soil Productivity and Watershed Function (Issue 4, Purpose and Need)

The topic of increased restoration and research and how landscape restoration affects water yield and watershed function is part of issue 4. The potential impact of treatments on soil productivity and watershed function is part of the purpose and need.

In alternatives B through E, water yield would be expected to increase only slightly in areas where vegetation treatments remove 25 to 50 percent of the overall tree canopy cover within a given watershed. Water yield in alternative C would be expected to be slightly higher than alternatives B, D, and E.

Short-term impacts from soil disturbances would range from a watershed average of 2.9 percent (lowest in alternative D) to 3.4 percent (highest in alternative C). In alternatives B through E, no watershed would have soil disturbance above 11 percent (4 percent below the 15 percent threshold).

Soil disturbance includes temporary road construction and decommissioning. Disturbance to soils from about 520 miles of road construction and decommissioning would occur on about 1,645

acres. Disturbance would be short term. Most road construction and decommission actions would be located on soils with slight or moderate erosion hazard. About 22 miles of road (about 40 acres) occur on severe erosion hazard soils. Temporary roads would be decommissioned by the purchaser/contractor immediately after use using adaptive management actions (FEIS, chapter 2) and BMPs for the rehabilitation of ground-disturbed sites (FEIS, appendix C).

The project would remove approximately 860 miles of roads, or about 1,645 acres of road from future disturbance in the long-term. About 38 miles (roughly 70 acres) are on severe erosion hazard soils. BMPs, including SW BMP 38 (see appendix C), are designed to minimize impacts from decommissioning efforts. After decommissioning, there would be reduction of roads on severe erosion hazard soil type. Soil productivity and watershed function should be maintained.

On untreated slopes over 15 percent, up to 33 percent is likely to have high burn severity in alternative A. The potential for high burn severity could occur across more acres in alternative D because of the continuing accumulation of surface fuels.

In alternatives B, C and E, watershed condition would be improved on 23 percent at risk and 42 percent impaired watersheds. This would be reduced in alternative D with 18 percent improvement in at-risk watersheds and 23 percent improvement in impaired watersheds. This occurs because alternative D does not use enough prescribed fire that is necessary to maintain soil productivity and watershed function. With implementation of identified soil and water BMPs, ADEQ water quality standards would be met.

Although soil productivity and watershed function would be maintained, disturbance related to the development and decommissioning of temporary roads is likely to be remain controversial with some members of the public.

Forest Health (Purpose and Need)

In alternative A, the percent of the project area with a high bark beetle hazard rating would increase from 84 percent in the short term (2020) to 92 percent in the long term (2050). Alternatives B and C reduce this the most to 22 percent by 2020, best meeting the desired condition of having no high hazard ratings in the project area. In the long term, all action alternatives would result in increases of the high rating as regrowth occurs. The high hazard rating would range from 52 (alternative B) to 69 (alternative D).

When compared to no action (alternative A), alternatives B through E reduce dwarf mistletoe infection in the “none/low” condition primarily as a result of being able to selectively remove lightly infected trees.

In alternative A, an increase in stand density-related mortality would be expected in much of the Mexican spotted owl habitats. Alternatives B through E would decrease SDI max[3] as a result of treatments. However, regardless of alternative (B through E), most Mexican spotted owl protected habitat would be within the “extremely high density” zone. Restricted other habitat would be on the high end of the desired range. This is largely due to the limited mechanical treatment in the protected habitat and the high oak stocking in the restricted habitat. All goshawk habitat is in the upper end of the “high density” zone and would continue approaching the threshold for the onset of density-related mortality.

[3] SDI max represent the maximum SDI varying by species. Percent SDI max expresses the actual density in a stand relative to a theoretical maximum density possible for trees of that diameter and species. Ponderosa pine uses a maximum SDI of 450 (i.e., a stand with SDI of 200 is (200/450)*100 = 44.4% of maximum SDI).

Vegetation Composition and Diversity (Purpose and Need)

In alternative A, the ponderosa pine tree canopy would continue to increase, shading out understory herbaceous vegetation, understory sage and further reducing forage production and species diversity. Alternatives B through E would result in vigorous aspen regeneration. Alternative D treats the least acres of aspen due to using less prescribed fire. Alternatives B, C, and D increase large oak in Mexican spotted owl habitat by 6 percent in the short term and 7 percent in the long term. Alternative D increases large oak the most in the long term (increase of 9 percent) as there are many acres where prescribed fire would not remove the smaller size classes of oak.

Alternatives B, D, and E would treat the most acres of grassland (see chapter 2, table 35), but alternative C would accomplish the most restoration. Alternative E would remove encroaching trees in existing grasslands and meadows, but does nothing to restore grasslands, savannas, and meadows that are currently functioning ecologically as forest. There is a strong link between raptors and their food, and restoring and enhancing prey habitat is expected to benefit Mexican spotted owls and their prey in the short and long terms (Kalies et al. 2012, Ganey et al. 2011). Grassland desired conditions for fire would be met in alternatives C and E and would not be met in alternatives B and D.

Forest Resiliency and Function – Fire (Purpose and Need)

At the landscape scale, the difference in modeled crown fire potential between alternatives B though E is minimal because the vertical and horizontal continuity of canopy fuels is broken up by mechanical treatments. Under alternative E there would likely be greater potential for crown fire than under alternative B because, without an amendment, the forest plan would require less interspace and result in more contiguous canopy fuels.

In alternative A there would be no movement toward the composition, pattern, and structure needed to support healthy ecological functions. Alternatives B through E would achieve desired conditions in the short term (2020) at a landscape scale for fire regime condition class, fire behavior, and canopy characteristics.

Forest Resiliency and Function – Vegetation Structure and Composition (Purpose and Need)

In terms of establishing and maintaining composition and structure of vegetation, alternative A moves the project area away from desired conditions. In alternative A, in ponderosa pine, all trees per acre greater than 5 inches d.b.h. and all basal area would continue to increase from the historic range. In most cases, the averages exceed the historic range by 2020 and 2050. This alternative represents an increase in tree density, the slowing of tree growth, and increased risks from fire, insects, and diseases.

Alternative D would move the project toward the desired condition but leaves treated areas at higher risks of high severity fire. Alternatives B and C move the project area closer to desired conditions in terms of: (1) increasing species composition, (2) increasing groups of trees, (3) maintaining scattered individual trees, (4) increasing grass-forb-shrub interspaces, (5) increasing snags, logs, and woody debris, (6) increasing variation in the arrangements of these elements in space and time, and (7) establishing ecosystem processes and functions. Vegetation would have improved ability to resist, and adapt to, future disturbances and climates. In alternatives B through E, forest attributes are within the natural range of variation, except for in protected activity centers, goshawk nest areas, and Mexican spotted owl target threshold habitats.

Forest Resiliency – Climate Change (Purpose and Need)

In alternative A, there would be increased risk of stand density and insect and disease-related mortality. The ponderosa pine forest would have limited resilience to survive and recover from potential large-scale impacts. Alternatives B, C, and E increase resiliency to natural disturbances on over 500,000 acres in both the short and long terms. In alternative D (long term) over 300,000 acres would return to pretreatment conditions and would be susceptible to high-severity surface fire effects resulting in reduced resiliency to natural disturbances.

In alternative A, carbon stocks would remain high. Large-scale fire events would release significant amounts of carbon into the atmosphere. In alternatives B through E, individual tree growth would improve, resulting in larger average tree size and increased stable carbon storage over time, offsetting short-term losses of carbon removed through mechanical treatments and prescribed fire.

Socio-economics (Topic of Public Interest)

No effects are presented under alternative A, as these reflect current conditions. The changes in employment and income under alternatives B through E reflect an increase in employment and income due to 4FRI harvesting and processing activities as well as the potential for a temporary reduction of 60 jobs and $2 million in labor income due to recreation displacement.

Over the 10-year treatment period, assuming a 4 percent discount rate, alternatives B through E would save between $156,000,000 and $232,000,000 of cost to the taxpayer as a result of using stewardship contracts. This figure can be viewed as a proxy for the economic value of 4FRI treatments.

Decision Framework

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

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