



United States
Department of
Agriculture

Forest
Service

Southwestern
Region

MB-R3-07-9

March 2009



Final Environmental Impact Statement for the Warm Fire Recovery Project

Kaibab National Forest Coconino County, Arizona



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Printed on recycled paper – March 2009

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Kaibab National Forest Coconino County, Arizona

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Abstract: This environmental impact statement documents the analysis of four alternatives for removal of fire-killed trees, reforestation, fuels reduction and associated road reconstruction of the wildland fire burn portion of the Warm Fire of 2006 on the Kaibab National Forest. Alternative 1 proposes no action and responds to issues related to salvage harvest being detrimental to burned areas. Alternative 2 represents the proposed action from scoping and includes removal of fire-killed trees, reforestation, fuels treatments, and road reconstruction activities. This alternative emphasizes breaking up the continuity of large fuel over the long term and reforestation to accelerate the development of desired forested conditions. Alternative 3 was developed in response to concerns related to impacts on burned area soils, and emphasizes reducing impacts on severely erosive soils through winter harvest. Alternative 4 emphasizes retaining all snags in designated Mexican spotted owl habitat. Alternatives 3 and 4 would harvest fire-killed trees in some areas to break up some of the continuity of large fuel over the long term and reforestation to accelerate the development of desired forested conditions. All action alternatives propose fuels treatments on harvest acres and road reconstruction activities commensurate with timber harvest activities. Alternative 2 was identified as the preferred alternative in the “Warm Fire Recovery Project Draft Environmental Impact Statement” (DEIS). Public and other agency comments on the DEIS are addressed in the “Warm Fire Recovery Project Final Environmental Impact Statement” (FEIS) in appendix D, including documentation of additional analysis in response to comments.

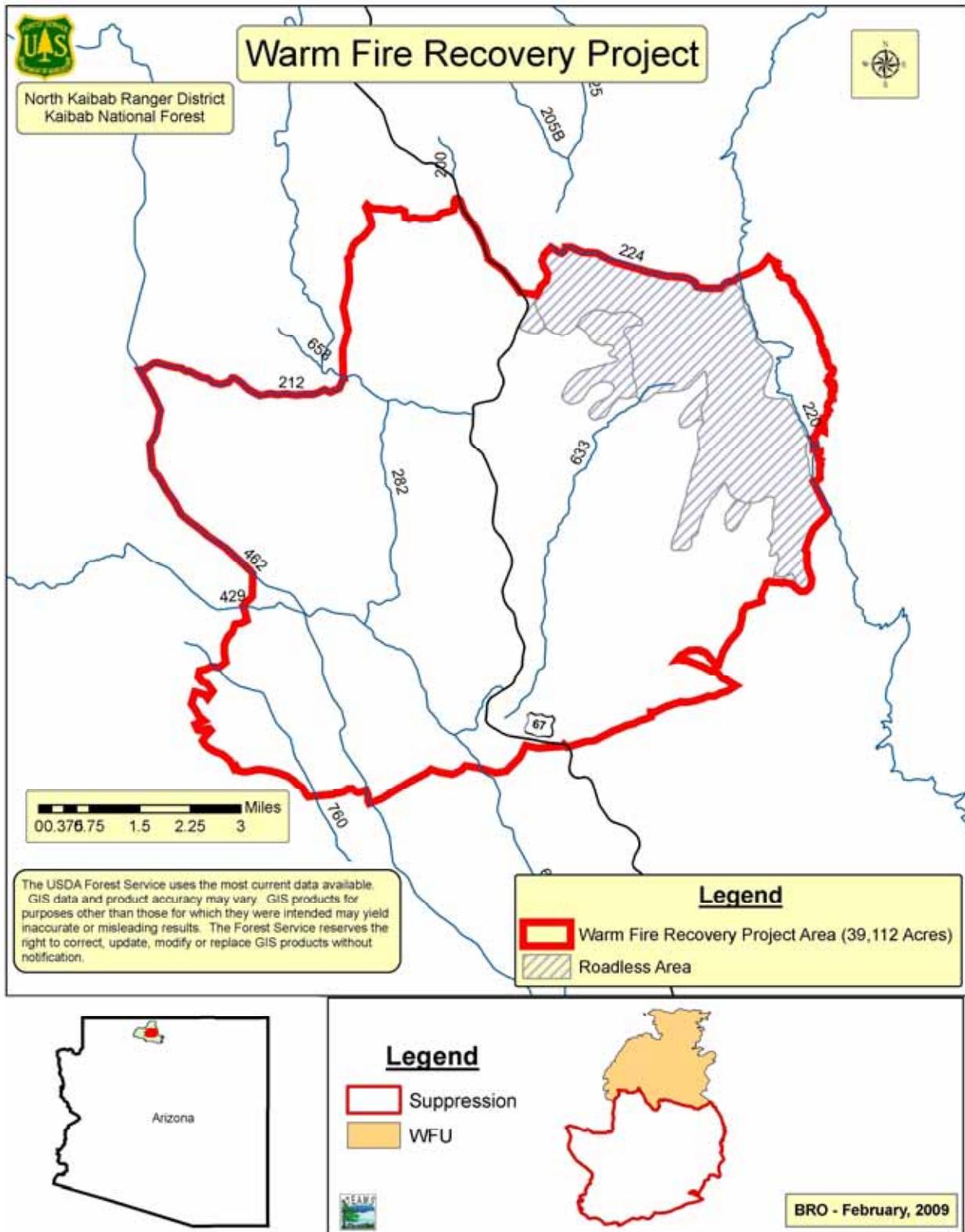


Figure 1. Vicinity map for the Warm Fire Recovery project

Summary

The Warm Fire Recovery project would address part of the overall restoration needs for the approximately 39,100 acres that burned in June through July 2006 in the fire suppression area of the Warm Fire.

The proposed project area includes the Warm Fire suppression area located 4 miles south of Jacob Lake and 14 miles north of the Grand Canyon National Park boundary on the North Kaibab Ranger District of the Kaibab National Forest, Coconino County, Arizona. The northern portion of the Warm Fire was managed under Fire Use and that portion of the Warm Fire is not included in this project area. The legal description for the Warm Fire Recovery project area is all or portions of Sections 28, 29, 31-36, T38N, R2E; Sections 31, 32 T38N, R3E; Sections 10-15, 23-25, 35, 36 T37N, R1E; Sections 1-36 T37N, R2E; Sections 5-9, 17-21, 29-31 T37N, R3E; Sections 1, 2, 11, 12 T36N, R1E; Sections 1-10 T36N, R2E; and Section 6 T36N, R3E; Gila and Salt River Meridian (see figure 1).

The “Kaibab National Forest Land Management Plan,” (hereafter referred to as the forest plan) as amended (USDA Forest Service 2004a), establishes multiple-use goals and objectives, and assigns a management area to each portion of the forest. A recent correction to the forest plan clarifies the geographic areas (GA) and ecosystem management areas (EMA) on the forest. The majority of the Warm Fire Recovery project area lies within Geographic Area (GA) 13 (36,041 acres; 92 percent) and GA 16 (3,069 acres; 8 percent). In addition, the project area lies within the Grand Canyon National Game Preserve and overlaps a portion of the Red Point Roadless Area (see figure 2). The Warm Fire Recovery project focuses on management actions within GA 13. A small portion of GA 16 and the roadless area have been identified for reforestation planting activities.

Background

The Warm Fire started by lightning and burned in June through July 2006. A Burned Area Emergency Response (BAER) team was assembled to conduct a soil and hydrologic assessment, and to initiate rehabilitation to minimize the loss of soil productivity, downstream water quality, and threats to human life and property. Rehabilitation of fire lines, repair of storm damaged roads, and seeding of portions of the moderate and high severity burned areas occurred on approximately 10,000 acres.

Between June 25 and July 4, while the fire was managed under a wildfire suppression strategy, approximately 39,110 acres burned. Much of this area burned at high intensity in the crowns as well as on the ground and resulted in severe fire effects (USDA Forest Service 2007c). Sites that were disturbed during fire suppression were rehabilitated immediately following fire containment. Both hand and dozer fire lines were water barred and seeded as part of this rehabilitation work. No other sites were mechanically disturbed during the fire suppression (such as constructing safety zones or staging areas).

On July 1, 2006, a Burned Area Emergency Response (BAER) team was assembled to conduct a soil and hydrologic assessment, and to initiate rehabilitation to minimize the loss of soil productivity, downstream water quality, and threats to human life and property.

Burn Severity

The Warm Fire post-fire assessment team classified the burn severity within the Warm Fire suppression area (USDA Forest Service 2007c). Burn severity is a term that describes the effects of heat on soil and watershed conditions that are important for their influence on soil productivity and the potential for destructive flooding.

Approximately 41 percent (16,026 acres) of the area was classified as low burn severity. Low burn severity is defined as “there is light ground char where the litter was scorched, charred, or partially consumed. The duff is largely intact, although it may be charred on the surface. Woody debris accumulations are partially scorched or charred. Vegetative ground cover remains intact and is adequate to protect soils from accelerated soil erosion” (USDA Forest Service 2007c). The moderate and high burn severity areas lost critical soil and hydrologic function. In some areas, natural soil recovery has already begun. Vegetative ground cover and coarse woody debris are necessary for the recovery of forest and grassland ecosystems. In forested ecosystems, a minimum of 10 to 15 tons per acre of down, coarse woody debris should be managed for in the moderate to high burn severity areas, and 5 to 10 tons per acre in the low burn severity areas. In woodland ecosystems (pinyon-juniper) a minimum of 5 tons per acre should be managed for (USDA Forest Service 2007c).

The majority of burned areas within the forested cover types resulted in high mortality (100 percent scorching of the subcanopy and upper canopy trees and 100 percent mortality of upper canopy trees) and mixed-high mortality (100 percent scorching of the subcanopy, 40 percent scorching of upper canopy trees and 70 percent mortality of upper canopy trees (see figure 6). The fire consumed the surface litter layer, and the duff layer was deeply charred. Some water repellency existed below the soil surface with strong water repellency in isolated areas.

The forest reviewed the management considerations identified in the post-fire assessment and developed an overall “Warm Fire Rehabilitation and Recovery Plan and Status Summary” to provide an overview of the rehabilitation and recovery needs for lands burned in the June 2006 Warm Fire and the current status of that work. This plan is periodically updated and posted on the Kaibab National Forest Web site to provide followup on the management actions recommended in the post-fire assessment. For more detailed information, please refer to http://www.fs.fed.us/r3/kai/projects/warm/documents/warmfire_recovery_plan_summary_Dec2008.pdf

Purpose and Need for Action

The difference between the desired conditions identified in the forest plan and the existing post-fire conditions were assessed by the interdisciplinary team. The responsible official identified three action items based on the recovery needs from the assessment that were most time sensitive to focus on for this effort. There is a need to:

1. Recover economic value from burned timber;
2. Reforest burned conifer stands to move toward desired conditions; and
3. Break up fuel continuity in the project area.

Proposed Action

In response to the previously described components of the purpose and need, the Forest Service proposes to salvage harvest fire-killed trees; conduct fuels reduction treatments, and plant conifer seedlings. The proposed salvage operations and related activities would occur within high and mixed-high fire mortality areas of the project area. Only trees without green needles will be salvaged. Salvage harvest activities would involve the following mechanized equipment:

Feller-buncher equipment (either rubber tired or tracked) cuts the trees and moves them from the stump to a designated skid trail, placing several trees in a “bunch” for transport to the landing.

Skidding equipment (typically rubber tired with a grapple) lifts one end of a bunch of trees and drags them along a skid trail to the landing. Skid trails are predesignated routes where multiple passes of skidding equipment occur.

Trees are delimbed, cut into log lengths, and skidded to a landing area where the unmerchantable tops would likely be cut and piled. Some trees may have tops cut where the tree is felled. The cut logs would be loaded onto trucks to be hauled away for forest product processing. Planting would entail site preparation by hand clearing a small area of competing vegetation, and then planting conifer seedlings also by hand. Certain existing closed roads would be temporarily opened to allow access for salvage activities and then closed again at the end of the project. Early comments and suggestions received from the public generated from the October 11, 2006, Warm Fire public meeting, and from the October 12, 2006, public stakeholder field trip were considered when determining where salvage logging may be appropriate.

The transportation system required to access salvage operations is in place. No new roads would be constructed with this project; however, approximately 95 miles of older, existing closed system roads would need to be temporarily opened for salvage activities, and then closed at completion of the project. Closure would be done through a timber sale contract clause (T811) and includes native grass seeding where mineral soil is exposed, ensuring proper drainage structures are in place along the length of the road, and scarification and placing slash on the road prism for the first 200 feet. Other open Forest System roads would be maintained as needed.

The majority of salvage activities would occur on areas previously dominated by ponderosa pine on slopes under 20 percent, with short spans (less than 100 feet) of activities on adjacent slopes over 20 percent where material could be directionally felled or endlined to restrict use of ground-based equipment to slopes below 20 percent.

The following criteria were used to determine whether an area would be appropriate for treatment:

- **Wildlife:** Ensure large blocks of snags and habitat corridors for certain birds and other wildlife species to provide snag habitat and connectivity. These areas were combined with 100-foot buffers along the ephemeral drainages identified in the USGS National Hydrography Dataset stream layer for soil and water resource protection, and would retain habitat with no ground disturbance or snag removal within the project area.
- **Economics:** Stands considered for salvage include those with at least 3 MBF of gross volume per acre in trees greater than 14 inches in diameter. Smaller diameter material is anticipated to lose value quickly, so areas with only smaller material were not proposed for salvage activities.

- **Soils:** Forest plan direction allows harvest on slopes under 40 percent. In order to protect soils in this project, skid trails will not exceed 20 percent slope for distances greater than 100 feet and will not occur at all on slopes greater than 30 percent. On treatment units with soil categorized as “severely erodible,” ground-based yarding and fuels treatment equipment would be restricted to slopes less than 20 percent. Reaching with feller-buncher type equipment or end lining (using cable to pull logs to the skidder) to access material within 100 feet of ground-based units would be allowed on slopes up to 30 percent.
- **Fire Severity:** Areas with mixed-high and high mortality were considered for salvage logging. Low severity burn areas stocked with green trees were removed from salvage consideration. Only conifer trees with no green needles are proposed to be salvaged. A frequent debate related to salvage harvest is “when does a fire-damaged tree become a fire-killed tree,” e.g. will a damaged tree be dead in 1 year, 2 years, 10 years, or longer? Trees will not be considered “fire-killed” if green needles remain. The result of this conservative clarification is that it maximizes the chance of retaining isolated seed sources across the mixed-high and high severity burn areas. In addition, future snags will be created as trees with green needles subsequently die. The remaining live trees, standing dead to meet forest plan direction, and logs on the ground, would be maintained to enrich the regenerated forest (Franklin and Agee 2003). Salvage will be concentrated in trees 14 inches d.b.h. and larger. Trees less than 14 inches d.b.h. will not be designated as timber in harvest contracts. These trees, along with larger snags retained for wildlife, and tops and limbs left onsite following harvest, would contribute to the amount of coarse woody debris (CWD) left onsite; the objective being to retain an average of at least 15 to 20 tons per acre of CWD on all salvage units. The Kaibab forest plan calls for retaining two or more snags per acre in ponderosa pine and greater than three snags per acre in mixed conifer forest types. Five to seven snags per acre would be retained within Warm Fire harvest units that were previously designated MSO critical habitat, and three to five snags per acre would be retained in stands that were previously ponderosa pine areas. Retained snags would target the largest diameter trees left in groups. The majority of salvage activities would occur on slopes under 20 percent, with short spans (less than 100 feet) of activities on slopes over 20 percent where material could be directionally felled or endlined to restrict use of ground-based yarding equipment to slopes below 20 percent.
- **Reforestation Needs:** Approximately 4,800 acres of previously conifer dominated forest types are determined to have enough aspen present to restock the stand through sprouting and would be managed for aspen. Areas with adequate aspen regeneration will provide for relatively fast tree canopy and restoration opportunities. Planting conifer seedlings was identified for areas with mixed-high and high mortality that do not have a significant aspen response, are lacking a seed source, and where suitable soil conditions exist to ensure a reasonable chance of reforestation success. All acres of MSO habitat were initially considered for planting. However, aspen is likely to become established on approximately 30 percent of the mixed-high and high mortality habitat (based on pre-fire aspen stocking) and it was decided not to plant those sites due to vegetative competition. Other considerations for planting included the probability of natural regeneration by assessing adjacency to live stands and seed sources. Probability of survival was considered for mixed conifer species that need moister microclimates and soils. Planting is proposed to establish mixed conifer species composition for some of the areas that are designated Mexican spotted owl habitat. Planting of approximately 240 acres in GA 16 is

proposed to occur on the cooler, moister aspects with deeper soils that were dominated by ponderosa prior to the fire.

- **Recreation/Roadless Area:** The Red Point Roadless Area was excluded from consideration for salvage activity to maintain roadless characteristics. However, hand planting conifers in the Red Point Roadless Area where seed sources were lost in the fire was included to help move this area toward desired forested conditions. Planting of approximately 1,095 acres in the Red Point Roadless Area is proposed to occur on the cooler, moister aspects with deeper soils that were dominated by ponderosa pine prior to the fire.

The activities in the proposed action developed to address the needs are as follows (see chapter 2 for more details):

- Ground-based salvage logging of fire-killed trees on approximately 9,114 acres removing approximately 73.4 million board feet (MMBF), gross volume, of timber material from the project area. However, it is expected that the timber has lost some economic value due to deterioration of the wood (e.g., insect holes and blue stain affecting the outer layers of each tree bole) and may result in approximately 35.7 MMBF of commercial volume.
- The transportation system required to access salvage operations is in place. No new roads would be constructed with this project; however, approximately 95 miles of existing closed spur roads would need to be re-opened for salvage activities, and then closed at completion of the project. Other open Forest System roads would be maintained as needed.
- Planting ponderosa pine on 7,625 acres and mixed conifers (ponderosa pine and Douglas-fir) on 2,353 acres within high and mixed-high fire mortality areas where limited and poorly distributed seed sources currently exist, and where there is a moderate to high potential for planting success. These areas include salvage units and other areas where the soil inventory indicates a moderate to high potential for planting success. Pre-planting surveys will occur at the stand level and a regeneration prescription will be developed based on current and desired stand conditions; including re-establishing mixed conifer habitat for Mexican spotted owls. Seedlings would be planted in groups with irregular spacing between each group with desired stocking levels ranging from 30 trees per acre to 160 trees per acre. Some sites may need to have more seedlings planted per acre initially, based on anticipated seedling survival rates. The reforestation effort within designated MSO stands will promote the establishment of Douglas-fir seedlings to the greatest extent possible based on current site conditions. The planting pattern would be based on the prefire stand structure with groups being concentrated adjacent to where legacy trees existed before the fire.
- Removing some of the large fuels via salvage harvest and followup slash treatments such as “lop and scatter to 18-inch depth” to break up fuel continuity would occur on all salvage logged areas. Additional fuels treatments would be conducted on approximately 283 acres of the salvaged logged areas along main roads where fuel loads are in excess of 15 to 20 tons per acre. These treatments may include a combination of lop and scatter of tops and limbs, chipping, mastication, and/or hand pile or jackpot burning of 50 percent of the 3- to 12-inch material. A minimum of 15 to 20 tons per acre will be retained onsite post harvest to address soil resource concerns. Treatments along Highway 67 are designed to meet scenic integrity objectives while other treatments along Forest System

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roads or trails (i.e. Forest Road 212 and Trail 101) are designed to meet recreation objectives.

Scope of the Project, Analysis, and Decision Framework

The scope of the project and the decision to be made are limited to salvage of fire-killed timber, reforestation, and hazardous fuel reduction work in portions of the 2006 Warm Fire suppression area.

Invasive plant prevention measures are included in the proposed project design, but direct control of invasive plants is not proposed in this project. Invasive plant control and management in the Warm Fire area is addressed by the Record of Decision and “Final Environmental Impact Statement for Integrated Treatment of Noxious and Invasive Weeds on the Coconino, Kaibab, and Prescott National Forests” (USDA Forest Service 2005).

The proposed action does not represent a comprehensive travel management plan. Certain closed roads would need to be opened for salvage operations and following use would be re-closed. A roads analysis for temporarily opening certain closed roads has been completed for this project. District-wide roads analysis, NEPA analysis and a decision that would designate routes for motorized access on the North Kaibab Ranger District (including the Warm Fire area), under the Travel Management Rule are currently scheduled for 2009 and 2010.

The responsible official for this proposal is the forest supervisor. Based on the analysis in the final EIS, the responsible official will make the following decisions and document them in a record of decision:

- Whether to salvage fire-killed timber from the Warm Fire suppression area as proposed, as described or modified in an alternative, or not at all.
- What level of reforestation planting, if any, should occur.
- What level of fuels reduction, if any, should occur.
- What project design features should be applied.

Public Involvement

The Forest Service hosted a public meeting on October 11, 2006, in Kanab, Utah, to discuss the Warm Fire Use event and the after action review. During that meeting, the public was invited to submit suggestions for future management of the area burned in the suppression portion (project area). The next day (October 12, 2006), a field trip to the burned area with local, State, and Federal agency personnel as well as other interested parties allowed discussion of future management considerations and recovery needs for the project area. Individuals continued to express concerns and suggestions for restoration actions, which the Forest Service considered when reviewing the existing conditions and formulating a proposed action to address the identified purpose and need.

In addition, as part of the public involvement process, meetings with individuals, open houses, mailing of information to interested and affected parties, and posting of project related information on the forest Web site occurred.

Issues

The forest received over 2,000 responses to scoping, mostly electronic form letters. The comments were reviewed and a list of comments and documentation explaining their categorization may be found in the project record. Some comments were outside the scope of the purpose and need for this project. Many commenters disagree with the stated purpose and needs identified for the project, wanting instead analysis of restoration management options without active management.

Using the comments from the public, tribes, and other agencies, individuals, and groups, the ID team developed a list of issues to address in this EIS. The ID team identified and separated the issues into two groups: significant and nonsignificant issues. Significant issues are defined as those directly or indirectly caused by implementing the proposed action. Nonsignificant issues were identified as those: (1) outside the scope of the proposed action; (2) already decided by law, regulation, forest plan, or other higher level decision; (3) irrelevant to the decision to be made; or (4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in Sec. 1501.7, "...identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)."

Some comments were considered for alternative development, but were eliminated from detailed analysis because the recommendations would not meet the identified purpose and need for the project. These are discussed further in chapter 2.

Using the external and internal comments and concerns, the following significant issues will be carried forward for analysis:

Effects on Soils and Water Quality: Concern that salvage logging, as proposed under this project, would adversely affect long-term soil productivity, damage soil structure, and increase erosion and sediment delivery. They also state that removing logs would permanently remove organic matter from the site. These commenters cited the Beschta Report (Beschta et al. 1995) and other literature in support of their arguments. Some commenters suggested that alternative technologies (helicopter) could be used to minimize ground disturbance. Others suggested that construction of new roads and landings should not occur to protect the fire impacted soils. Indicator values are: (1) acres of soil disturbance, and (2) percent of area with effective ground cover, including coarse woody debris levels retained (tons per acre). This issue was used to develop alternative 3, as described in chapter 2. The no action alternative is also responsive to this issue.

Effects to Wildlife and Wildlife Habitat: Concern that removal of dead trees would adversely impact habitat for Mexican spotted owl (MSO), management indicator species (MIS) including the northern goshawk, and certain bird species and other wildlife associated with snags. Concern was also expressed that the proposed action would be inconsistent with the intent of the Grand Canyon Game Preserve Act. Several commenters believe that the proposed action would not leave enough dead trees for some wildlife. Indicator values are: (1) number of snags per acre retained; (2) number of down logs per acre retained; and (3) years to regenerate forested areas. This issue was used to develop alternative 4, as described in chapter 2. The no action alternative is also responsive to this issue.

Spread of Nonnative Invasive Plants: Concern that mechanical disturbance would increase the spread of nonnative invasive plants; especially cheatgrass in the project area from seed

introduction potential and soil disturbance. Indicator values are acres of salvage disturbance. This issue was used to develop alternative 3, as described in chapter 2. The no action alternative is also responsive to this issue.

Fire Risk and Fuels Reduction: Concern was expressed regarding the need to reduce fuels. Some commenters believe that no fuels reduction is necessary and that the risk of future fires is low in severely burned areas. Other commenters believe that current standing dead trees could be fuel for a future fire once they fall to the ground. They state that fuels reduction should be a restoration goal to help prevent a future catastrophic fire. Still others felt that removal of large diameter trees would increase the risk of fire. Many expressed a desire to know what size and quantity of fuels would be left on treatment sites. Indicator values are tons per acre of residual fuels and resistance to control.

Alternatives

These issues led the Agency to develop alternatives to the proposed action. They are described in the following paragraphs.

Alternative 3 – Winter Logging for Increased Soil Protection

This alternative was developed in response to issues regarding salvage logging effects on soils and water quality. It was developed by modifying the proposed action to reduce salvage impacts on soils classified by the “Kaibab National Forest Terrestrial Ecosystem Survey” (TES) as having severe erosion hazard, and also reducing the total number of acres salvaged by dropping certain acres that are regenerating heavily to aspen. The activity units classified with severe erosion hazard would have skidding operations restricted to over snow or frozen conditions. Ground-based skidding on soils with low to moderate erosion hazard would be restricted to existing roads and designated skid trails, using existing skid trails where possible.

Size and location of salvage operations proposed were factored in with areas naturally regenerating to aspen to create strategic breaks in fuels. This approach is also responsive to issues regarding effects to soils and watershed conditions, since it results in fewer acres of salvage with correspondingly fewer impacts to soils and watersheds. Reforestation would be the same as described for the proposed action, and fuels treatments and road work would be commensurate with harvest treatments. See figures 7 and 9 for activities proposed.

The actions developed to meet the purpose and need for action while providing for increased soil protection are described below.

Recover Economic Value from Burned Timber

Ground-based salvage logging of fire-killed trees on approximately 5,756 acres resulting in removal of approximately 52.8 MMBF of gross timber volume. However, it is expected that the timber has lost some economic value due to deterioration of the wood and may result in approximately 26.8 MMBF of commercial volume. The removals will contribute to fuels reductions and forest recovery. The salvage operations would occur within high and mixed-high fire mortality areas of the project area. Only fire-killed trees would be salvaged. Salvage would be limited to trees 14 inches d.b.h. and larger. Within Warm Fire harvest units that were previously designated MSO critical habitat, five to seven snags per acre would be retained; in stands that were previously ponderosa pine areas, three to five snags per acre would be retained. Snags retained would target the largest diameters left in clusters. The majority of salvage

activities would occur on slopes under 20 percent, with short spans (less than 100 feet) of activities on slopes over 20 percent where material could be directionally felled or endlined to restrict use of ground-based equipment to slopes below 20 percent. The transportation system required to access salvage operations is in place. No new roads would be constructed with this project; however, approximately 65 miles of older, existing spur roads would need to be re-opened to access salvage operations, and then closed at completion of the project. Other open Forest System roads would be maintained as needed.

The operation of equipment on soils identified with severe erosion hazard would be restricted when soil conditions are such that accelerated soil erosion, excessive soil surface displacement, or excessive compaction would occur. Commonly used guidelines to achieve soil protection in activity units scheduled for winter ground-based harvesting are 4 to 6 inches of frozen soil, 1 foot of compacted snow, or 24 inches of settled snow. These guidelines, or a combination of frozen soil and snow cover conditions sufficient to minimize or eliminate soil displacement, soil compaction, and ground cover disturbance would be required.

Reforest Burned Conifer Stands to Move Toward Desired Conditions

Planting conifers is proposed on approximately 9,980 acres within high and mixed-high fire mortality areas where limited and poorly distributed seed sources currently exist. The breakdown of the planted acres is: ponderosa pine on 7,625 acres and mixed conifers (ponderosa pine and Douglas-fir) on 2,353 acres. This includes salvage units and other areas where the soil inventory indicates a moderate to high potential for planting success. Preplanting surveys will occur at the stand level and a regeneration prescription will be developed based on current and desired stand conditions; including re-establishing mixed conifer habitat for Mexican spotted owls. Seedlings would be planted in groups with irregular spacing between each group with desired stocking levels ranging from 30 trees per acre to 160 trees per acre. Some sites may need to have more seedlings planted per acre initially, based on anticipated seedling survival rates. The reforestation effort within designated MSO stands will promote the establishment of Douglas-fir seedlings to the greatest extent possible based on current site conditions. The planting pattern would be based on the prefire stand structure with groups being concentrated adjacent to where legacy trees existed before the fire. Approximately 4,800 acres of previous conifer forest types are determined to have enough aspen present to restock the stand through sprouting and would be managed for aspen reforestation to provide for relatively fast tree canopy and restoration of forested conditions. Artificial regeneration of conifers would not occur on sites dominated by aspen. Additional sites may also be planted with conifers in the future as needed, based on site specific vegetation recovery and where there is a lack of progress toward desired forested conditions.

Break Up Fuel Continuity in the Project Area

Slash disposal is proposed on all salvage logged areas and additional fuels treatments are proposed on approximately 73 acres of the salvage logged areas to protect future regeneration and move areas toward meeting scenic integrity objectives. These treatments may include a combination of lop and scatter of tops and limbs to 18-inch depth, chipping, mastication, and/or hand pile or jackpot burning of 50 percent of the 3- to 12-inch material. A minimum of 15 to 20 tons per acre will be retained onsite post harvest to address soil resource concerns. Treatments along Highway 67 are designed to meet scenic integrity objectives while other treatments along Forest System roads or trails are designed to meet recreation objectives.

Alternative 3 Specific Project Design Feature

Commonly used guidelines to achieve soil protection during winter ground-based harvesting are 4 to 6 inches of frozen soil, 1 foot of compacted snow, or 24 inches of settled snow. These guidelines, or a combination of frozen soil and snow cover conditions sufficient to minimize or eliminate soil displacement, soil compaction, and ground cover disturbance will be required.

Alternative 4 – Maintain Designated Mexican Spotted Owl Habitat

This alternative was developed in response to issues regarding salvage logging effects to wildlife and wildlife habitat. It was developed by modifying the proposed action to maintain all snags in stands designated Mexican spotted owl critical habitat. See figures 7 and 10 for activities proposed.

The actions developed to address maintaining all snags in designated Mexican spotted owl habitat are described below.

Recover Economic Value from Burned Timber

Ground-based salvage logging of fire-killed trees on approximately 5,541 acres would remove approximately 42 MMBF of gross timber volume. However, it is expected that the timber has lost some economic value due to deterioration of the wood and may result in approximately 22.5 MMBF of commercial volume. The removals would contribute to economics, forest recovery and fuels reductions. Salvage harvest would not occur in stands designated as Mexican spotted owl habitat. The salvage operations would occur within high and mixed-high fire mortality areas of the project area. Only fire-killed trees 14 inches d.b.h. and larger would be salvaged. Five to seven snags per acre would be left within post-Warm Fire harvest units that were previously designated MSO critical habitat; three to five snags per acre in stands that were previously ponderosa pine areas, targeting largest diameters in clusters, would be left. The majority of salvage activities would occur on slopes under 20 percent, with short spans (less than 100 feet) of activities on slopes over 20 percent where material could be directionally felled or endlined to restrict use of ground-based equipment to slopes below 20 percent. The transportation system required to access salvage operations is in place. No new roads would be constructed with this project; however, approximately 72 miles of older, existing spur roads would need to be re-opened to access salvage operations, and then closed at completion of the project. Other Forest System roads would be maintained as needed.

Reforest Burned Conifer Stands to Move Toward Desired Conditions

Planting conifers is proposed on approximately 9,980 acres within high and mixed-high fire mortality areas where limited and poorly distributed seed sources currently exist. The breakdown of the planted acres is: ponderosa pine on 7,625 acres and mixed conifers (ponderosa pine and Douglas-fir) on 2,353 acres. This includes salvage units and other areas where the soil inventory indicates a moderate to high potential for planting success. Preplanting surveys will occur at the stand level and a regeneration prescription will be developed based on current and desired stand conditions; including re-establishing mixed conifer habitat for Mexican spotted owls.

Seedlings would be planted in groups with irregular spacing between each group with desired stocking levels ranging from 30 trees per acre to 160 trees per acre. Some sites may need to have more seedlings planted per acre initially, based on anticipated seedling survival rates. The reforestation effort within designated MSO stands will promote the establishment of Douglas-fir seedlings to the greatest extent possible based on current site conditions. The planting pattern

would be based on the prefire stand structure with groups being concentrated adjacent to where legacy trees existed before the fire. Approximately 4,800 acres of previously conifer forest types are determined to have enough aspen present to restock the stand through sprouting and would be managed for aspen reforestation to provide for relatively fast tree canopy and restoration opportunities and artificial regeneration of conifers would not occur.

Planting is proposed on 3,192 acres (or 44 percent) of MSO mixed-high and high mortality habitat. This project will plant Douglas-fir and ponderosa pine trees across 2,353 acres of mixed-high and high mortality in MSO habitat. Another 1,517 acres of MSO habitat is proposed to be planted to ponderosa pine rather than mixed conifer due to concerns regarding the survival of mixed conifer species in the post-fire landscape.

Break Up Fuel Continuity in the Project Area

Slash disposal is proposed on all salvage logged areas and additional fuels treatments are proposed on approximately 214 acres of salvage logged areas to protect future regeneration and move areas toward meeting scenic integrity objectives. These treatments may include a combination of lop and scatter of tops and limbs to 18-inch depth, chipping, mastication, and/or hand pile or jackpot burning of 50 percent of the 3- to 12-inch material. A minimum of 15 to 20 tons per acre will be retained onsite post harvest to address soil resource concerns. Treatments along Highway 67 are designed to meet scenic integrity objectives while other treatments along Forest System roads or trails are designed to meet recreation objectives.

Alternatives Compared

Table 1 compares alternatives by activities proposed for the Warm Fire Recovery project area.

Table 1. Alternatives compared

Project Area Activity	A	Alt. 2	Alt. 3	Alt. 4
Salvage harvest (acres) Acres of harvest on severe erosion rated soils	0	9,114 7,592	5,756 4,364 (winter harvest required)	5,541 4,350
Fuels treatments (acres) Chipping or masticating 50 percent of the 3- to 12-inch material, or pile burning acres	0	9,114 283	5,756 73	5,541 214
Approximate gross volume of fire-killed trees removed Commercial volume: Mixed conifer sawtimber Ponderosa pine sawtimber	0	73.4 MMBF (146,853 CCF) 35.7 MMBF (22,112 CCF) (49,217 CCF)	52.8 MMBF (105,612 CCF) 26.8 MMBF (17,343 CCF) (36,186 CCF)	42.0 MMBF (83,391 CCF) 22.5 MMBF (6,067 CCF) (38,875 CCF)
Plant ponderosa pine (acres)	0	7,625	7,625	7,625
Plant mixed conifers (acres)	0	2,353	2,353	2,353
Temporarily open closed roads (Maintenance Level 1 roads to be used then closed after use)	0	94.6 miles	65.2 miles	72.3 miles
Open road density during project implementation Post-implementation open road density	1.6 mi/square mile 1.6 mi/square mile	3.2 mi/square mile 1.6 mi/square mile	2.7 mi/square mile 1.6 mi/square mile	2.8 mi/square mile 1.6 mi/square mile

Summary of Changes from the Draft Environmental Impact Statement

Based on comments on the DEIS from the public and other agencies (appendix D) changes were made for the FEIS. More substantive changes include the following:

- Clarification of the desired coarse woody debris for the dry, mixed conifer and ponderosa pine types found on the Kaibab Plateau as per Brown et al. 2003 is 5 to 20 tons per acre. The DEIS used a range appropriate for cooler and wetter habitat types that do not occur in the Warm Fire area.
- Clarification of specific actions included in salvage logging activities. Logging operations include felling trees then skidding them to a landing site where nonmerchantable tops would be cut off and the remaining tree boles loaded onto trucks to be hauled to processing mills. The trucks would use the existing road system in place, which would require maintenance work such as blading of the road surface.
- Clarification of project design features including where ground-based equipment access may occur, noting which items are applicable to the designated Mexican Spotted Owl (MSO) habitat areas (chapter 2), and inclusion of expanded California Condor protection measures in the event one is sighted within the project area during activities (chapter 2).
- Incorporation of additional fire modeling information to show how future estimated fuels within the project area could affect fire events.
- Updated commercial volume and economic information to reflect updated defect percentages provided by the Region 3 measurement specialist and currently in use.
- Addition of the literature review and response to comments submitted for the DEIS added as appendices B and D, respectively.
- Correction of typos.