United States
Department of
Agriculture

Forest
Service

**Southwestern
Region**

Draft Environmental Impact Statement for the Rodeo-Chediski Fire Salvage Project

Apache-Sitgreaves and Tonto National Forests

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Rodeo-Chediski Fire Salvage Project

Draft Environmental Impact Statement

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Abstract: The 2002 Rodeo-Chediski Fire affected approximately 178,000 acres of National Forest System lands within the Apache-Sitgreaves and Tonto National Forests. This Draft Environmental Impact Statement (DEIS) discloses analysis of five alternatives for the recovery of these lands. The Rodeo-Chediski Fire Salvage Project area lies between Show Low and Payson, Arizona near the communities of Linden, Pinedale, Aripine, Heber, Overgaard and Forest Lakes Estates. The alternatives consist of a no action alternative, and 4 action alternatives proposing harvest of merchantable dead trees as sawtimber and products other than lumber (POL). All action alternatives would improve watersheds through road maintenance and contour felling of dead trees.

Alternative 1 – No Action Alternative. No new activities would be initiated at this time.

Alternative 2 – Proposed Action –Harvest on approximately 45,109 acres using ground-based and helicopter yarding. A forest plan amendment would be required.

Alternative 3 –Harvest on approximately 38,533 acres utilizing only ground-based yarding systems on slopes less than 40 percent and avoiding areas with severe soil erosion potential.

Alternative 4 – Agency Preferred Alternative –Harvest on approximately 41,059 acres utilizing only ground-based yarding systems on slopes less than 40 percent, including areas that have been classified as having severe soil erosion potential.

Alternative 5 –Harvest on approximately 42,850 acres utilizing only ground-based yarding systems on slopes less than 40 percent and in areas classified as having severe soil erosion potential.

Reviewers should provide the Forest Service with their comments during the review period of this draft environmental impact statement. This will enable the Forest Service to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decision making process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' position and contentions. Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 553 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement. City of Angoon v. Hodel (9th Circuit, l986) and Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334, 1338 (E.D.

Wis. 1980). Comments on the draft environmental impact statement should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3).

Comments on this DEIS must be received or postmarked within 45 days of the Environmental Protection Agency's publication of the Notice of Availability in the Federal Register.

Send Comments to:

Rodeo-Chediski Fire Salvage Team
Apache-Sitgreaves National Forests
P.O. Box 640
Springerville, AZ 85938

Date Comments Must Be Received: December 1, 2003

Summary

Introduction

On June 18, 2002, the Rodeo Fire was ignited on the Fort Apache Indian Reservation near Cibecue, Arizona. On June 20th, the Chediski Fire was ignited on Chediski Ridge also on the Fort Apache Indian Reservation. The two fires grew rapidly and merged on June 22nd. By the time the fires were contained on July 7th, the complex had grown to approximately 460,000 acres. Of this acreage, approximately 10,711 acres are on the Pleasant Valley Ranger District of the Tonto National Forest, and 164,440 acres are on the Lakeside and Black Mesa Ranger Districts of the Apache-Sitgreaves National Forests. Almost 8,700 acres of private lands were also burned.

This document is a summary of the Draft Environmental Impact Statement (DEIS) for the Rodeo-Chediski Fire Salvage Project. It provides a brief overview of the proposed action; purpose and need for the project; process used to formulate the alternatives; alternatives developed to respond to public issues; and effects that the proposed alternatives may have on the human environment. The summary conclusion identifies the environmentally preferred and agency preferred alternative.

Proposed Action

In order to respond to existing resource conditions, initiate rehabilitation efforts, and salvage some of the timber resources killed by the Rodeo-Chediski Fire of 2002, the Apache-Sitgreaves and the Tonto National Forests propose conducting a series of salvage operations.

Harvest activities would include salvaging dead, standing trees with merchantable value on approximately 37,180 acres of lands burned at moderate and high severity levels. In areas with slopes less than 40 percent, ground-based yarding systems would be used. On lands with slopes greater than 40 percent, helicopter-yarding systems would be used. Fuelwood, specialty wood products, and other sawtimber sales would be harvested on an additional 7,929 acres of lands. These areas are termed “small sale” areas and are designed to offer smaller quantities of wood products to interested parties. This action would require a site specific non-significant amendment to both Forest Plans to harvest dead trees on slopes over 40 percent by helicopter.

No new permanent road construction is proposed for harvest activities. Road maintenance activities would be made part of the timber sale contracts and would occur prior to or during harvest activities. Approximately 19.9 miles (40 segments) of temporary road would be constructed following Best Management Practices (BMPs) design criteria to provide access to log landing sites. Following unit harvest, all temporary roads would be scarified, obliterated, and reseeded.

Purpose and Need for the Proposed Action

The primary need for this project is to remove dead trees from portions of the burned area while the trees still have economic value. Dead trees in the fire area are deteriorating. As a tree deteriorates, its value as lumber decreases. Depending on the species type, tree size, and other environmental factors, trees can lose their economic value as timber 12 to 18 months after their death. Most trees suitable for commercial harvest—those having 12-inch or larger diameters—lose much of their economic value within 18-24 months of their deaths.

Due to rapid decay rates of trees killed by the fire, trees need to be harvested in a timely manner to recover any economic value from the wood fiber. Salvaging dead trees is one method of providing products to meet the public’s demand for wood products and provide economic opportunity for communities and wood products industries.

Process Used to Formulate Alternatives

Public Involvement Process

During and following the Rodeo-Chediski Fires, the public has remained heavily involved and well informed of the fire-fighting efforts and post-fire burned area emergency rehabilitation (BAER) activities. In addition to media coverage, Incident Command teams assigned to the fires kept the public updated on the fires and its impacts through community meetings and briefings.

The forests initiated and facilitated an open planning process with interested and affected parties. Representatives from interest groups, along with other interested individuals and federal agencies have remained actively involved throughout the planning process. Other outreach and public information efforts provided the public with an opportunity to discuss post-fire treatment needs. These meetings also provided a forum for the public to review and critique the season's fire fighting efforts, public involvement during the wildfire season, and other forest management issues.

The information expressed in comments and at these meetings helped the Forest Service develop long-term management strategies for lands affected by the Rodeo-Chediski Fire. This DEIS is only one part of an integrated effort to manage lands within the fire's boundary. Other management and restoration activities will be addressed under separate analyses in compliance with the NEPA process and are addressed as reasonably foreseeable actions in the cumulative effects analyses disclosed in Chapter 3.

The Forest Service's public participation process for informing the public on proposed activities in the Rodeo-Chediski Fire area included:

- Conducting public field trips through the project area.
- Distributed a scoping letter on August 24, 2002 to notify the public and solicit comments about the proposed project.
- Issuing a Notice of Intent (NOI) to prepare an environmental impact statement in the *Federal Register* on September 26, 2002. The public comment period for the NOI ended on November 15, 2002.
- Submitting news releases and information to the media, generating newspaper articles, editorials, and letters to the editor.
- Creating a website providing links to project information.
- Coordinating volunteer efforts for rehabilitation and disaster relief efforts.
- Developing multimedia presentations for Forest Service staff and the public on the fires, their impacts, and the proposed projects.
- Conducting special tours of the project areas for government officials and other Federal and State agencies.
- Conducting press conferences and media tours for television, radio, and printed media sources.

Issue Development

The Rodeo-Chediski Fire Salvage Interdisciplinary (ID) Team reviewed comments received during the public scoping process to identify issues, determine appropriate analysis procedures, and identify alternatives to the proposed action. Issues are defined as discussion, dispute, or debate about the effects of the proposed action. Non-significant issues are identified as those that are outside of the scope of the project; already decided by law, regulation, Forest Plan, or other higher level decision; (irrelevant to the decision to be made); or conjectural and not supported by scientific or factual evidence. A list of non-significant issues and reasons for their categorization as non-significant can be found in the project record.

The ID Team identified two issues as significant and were used to develop alternatives to the proposed action. The issue statements are followed by measures that provide a means to gauge the effects of each alternative.

Issue #1: Salvage logging may cause erosion, sedimentation, and the accompanying loss of soil nutrients in areas that are sensitive or where accelerated soil erosion is possible. Erosion and increased sediment delivery could lead to a loss of productive soils and a decline in water quality downstream. Measures: Sediment delivery rates, timing of delivery, and percent of ground cover remaining on acres treated.

Issue #2: Salvage logging may reduce habitat or jeopardize the viability of wildlife species that require woody material in the habitat. Measures: Changes in habitat for specific management indicator species, pre- and post-fire changes in average number of snags per acre at a landscape scale, and average amounts of down logs on the forest floor.

In order to minimize developing alternatives that were environmentally, technically or economically unfeasible, the ID Team developed "Design Criteria" to limit the scope of alternatives within known resource constraints, Forest Plan standards, and laws and regulations. These constraints served as a basis for resource protection or enhancement when the ID Team developed action alternatives.

Description of Proposed Alternatives

Three alternatives (in addition to the No Action and Proposed Action alternatives) were designed to reflect the range of issues, resource conditions and the purpose and need of the project. None of the action alternatives address long-term vegetation restoration needs associated with past fire suppression and stand manipulation. Other long-term resource protection needs such as road reconstruction, road closures, culvert replacement, replacement of grazing facilities, and fuel reduction treatment of the forest that burned at low intensity levels or was unburned will be addressed in additional NEPA documents. Action alternatives were designed to meet the short-term need to remove dead trees from portions of the burned area while the trees still have economic value, meet the public's demand for wood products, and provide economic opportunity for communities and wood products industries.

Alternative 1 – No Action

The "No Action" alternative is required by NEPA and serves as a baseline for projected effects and displays existing resource conditions. Under this alternative, no proposed activities would occur. Some previously authorized forest management activities and projects unaffected by the fire would continue in their development. Natural restoration processes would recover areas impacted by the fires and previous land uses. Roads currently open for motorized vehicle use would remain open.

This alternative would not preclude Forest management activities identified under previous decisions, nor would it preclude the potential for activities identified under future decisions.

Alternative 2 – Proposed Action

Alternative 2 is the Apache-Sitgreaves and Tonto National Forests' proposed action. This action is designed to maximize harvest volumes for sawtimber while providing sufficient mitigation to minimize impacts to all affected resource areas. It would require a non-significant amendment to the Apache-Sitgreaves and Tonto National Forest Plans to allow timber harvest on slopes over 40 percent.

Alternative 3

Areas proposed for harvest in Alternative 3 were selected based on public and internal concerns over logging in areas with sensitive soils or where accelerated soil erosion is possible. Alternative 3 is also designed to further minimize the risk of salvage activities to wildlife populations in the fire area, especially in the Canyon Creek and Mule Creek drainages that may still contain habitat for Mexican spotted owl populations and critical fisheries. To best address these concerns, Alternative 3 does not include harvest activities on slopes over 40 percent or on soil units that have been classified as having severe soil erosion potential.

In response to public concerns regarding the amount of wildlife habitat retained, an increased retention of snag volume would occur under this alternative compared to Alternative 2. Snags would be left from the largest trees in the harvest area instead of meeting the 18-inch diameter at breast height (dbh) requirements of Alternative 2. Additional snags would be retained in areas adjacent to Protected Activity Centers (PACs) and Post-Fledgling Family Areas (PFAs). Areas proposed for treatments within a quarter-mile of PFAs and PACs would have five of the largest snags and three downed logs left per acre. Diameter limits for oak and juniper species would be identical to Alternative 2 to provide snags and habitat for wildlife species in these woodland areas.

Alternative 3 would not require any site-specific amendments to the Apache-Sitgreaves and Tonto Forest Plans.

Alternative 4

Alternative 4 was developed in response to public concerns over the impacts of management activities on wildlife habitat. Similar to Alternative 3, this alternative does not include harvest activities on steep slopes in the Canyon Creek and Mule Creek drainages in order to reduce impacts to Mexican spotted owl (MSO) populations and critical fisheries. No helicopter yarding would occur under this alternative. Snag and downed log retention standards would be identical to Alternative 3. Logging would be allowed on soils with high erosion potential.

In response to public concerns regarding the amount of wildlife habitat retained, Alternative 4 includes the same snag retention standards as those described in Alternative 3. Diameter limits for oak and juniper species would be identical to Alternative 2 to provide snags and habitat for wildlife species in these woodland areas.

Alternative 4 would not require any site-specific amendments to the Apache-Sitgreaves and Tonto Forest Plans.

Alternative 5

Alternative 5 was developed to provide an alternative that achieves a balance of minimizing management activities on steep slopes in the Canyon Creek and Mule Creek drainages while still

maximizing timber volumes in other areas. Similar to Alternatives 3 and 4, no harvest or helicopter yarding would occur in these drainages in order to reduce impacts to Mexican spotted owl populations and limit soil disturbing activities on steep slopes. On areas with slopes under 40 percent, harvest activities, habitat management, and road work activities would be identical to those described in Alternative 2. This alternative would provide the most timber volume out of Alternatives 3, 4 and 5. Snag and downed woody debris retention standards would be the same as those described in Alternative 2.

Alternative 5 would not require any site-specific amendments to the Apache-Sitgreaves and Tonto Forest Plans.

Mitigation and Monitoring Measures

Where potential impacts to resources are predicted, environmental protection measures would be employed to mitigate the effects of conducting activities. Monitoring would be used to determine whether the objectives of the project were met and if additional action is needed. Implementation monitoring would be used to determine if the goals, objectives, guidelines, and standards of the Forest Plans are achieved. Monitoring provides quality control to project planning and allows the agency to compare the end results to those projected, and apply new knowledge to similar projects in the future.

Summary Comparison of the Activities and the Predicted Environmental Effects of all Alternatives

Introduction

The effects of the alternatives on the human environment vary according to the location and quantity of activities proposed in each alternative. The alternatives can be compared quantitatively and qualitatively by: their activities; how they meet the purpose and need for the project; their response to the issues; and their effects on individual resources.

Comparison of Alternative Activities

Information in the following table is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives. The activities provide a baseline for the ability of each alternative to meet the purpose and need of the project, the ability for the alternatives to respond to issues, and the effects of the alternatives on individual resources.

Table 1 - Comparison of activities by alternative

Resource Area / Issue	Alternative 1 No-Action	Alternative 2 Proposed Action	Alternative 3	Alternative 4 Preferred Alternative	Alternative 5
Soils and Watersheds					
Ground Cover Created in Treatment Areas (percent)	0	30	30	30	30
Soil Productivity	Severely Damaged	Enhanced	Enhanced	Enhanced	Enhanced
Erosion Rates	Highest	Slightly Lower	Slightly Lower	Slightly Lower	Slightly Lower
Sediment Transport	No Change	Slight Change	Slight Change	Slight Change	Slight Change
Soil Quality	Not Improved	Improved	Improved	Improved	Improved
Soil Compaction	None	Some	Some	Some	Some
Equivalent Disturbed Area (acres)	None	8,279	7,284	8,116	8,120
Stream Channel Condition	Not Improved	Improved	Improved	Improved	Improved
Post-fire Flooding	Highest Peak Flows	Reduced Peak Flows	Reduced Peak Flows	Reduced Peak Flows	Reduced Peak Flows
Water Quality, 303d Streams	Out of Compliance	Out of Compliance	Out of Compliance	Out of Compliance	Out of Compliance
Watershed Conditions	No Change	Slight Improvement	Slight Improvement	Slight Improvement	Slight Improvement
Sediment Influx	Highest	Slightly Less	Slightly Less	Slightly Less	Slightly Less

Resource Area / Issue	Alternative 1 No-Action	Alternative 2 Proposed Action	Alternative 3	Alternative 4 Preferred Alternative	Alternative 5
Recreation and Visual Resources					
Recreation Use Patterns	Long-term impacts	Short-term impacts	Short-term impacts	Short-term impacts	Short-term impacts
Recreation Opportunities	Limited	Improved	Improved	Improved	Improved
Visual Impacts along highways and high use areas	Long-term impacts to foreground views	Long-term improvement to foreground views	Long-term improvement to foreground views	Long-term improvement to foreground views	Long-term improvement to foreground views
Vegetation					
Harvest Sawtimber on slopes less than 40 % (acres)	0	34,921	30,770	34,156	34,921
Harvest Sawtimber on slopes greater than 40% (acres)	0	2,259	0	0	0
Small Sale area (acres)	0	7,929	7,763	6,903	7,929
Total Salvage Acres	0	45,109	38,533	41,059	42,850
Sawtimber volume	0	84.0 mmbf	48.4 mmbf	68.3 mmbf	84.0 mmbf
Helicopter yarding volume	0	9.8 mmbf	0	0	0

Resource Area / Issue	Alternative 1 No-Action	Alternative 2 Proposed Action	Alternative 3	Alternative 4 Preferred Alternative	Alternative 5
Small Sale area volume including Specialty Wood Products and Sawtimber	0	11.8 mmbf	6.8 mmbf	7.5 mmbf	11.8 mmbf
Total Sawtimber and Specialty Wood Products Volume	0	105.6 mmbf	55.2 mmbf	75.8 mmbf	95.8 mmbf
Fuelwood Volume	0	9,900 cords	8,700 cords	7,300 cords	9,900 cords
Sensitive Plants	No impact to Blumer's Dock or Eastwood Alum Root	May impact, will not affect viability of Blumer's Dock and Eastwood Alum Root	May impact, will not affect viability of Blumer's Dock and Eastwood Alum Root	May impact, will not affect viability of Blumer's Dock and Eastwood Alum Root	May impact, will not affect viability of Blumer's Dock and Eastwood Alum Root
Wildlife and Habitat					
Threatened and Endangered Species	No noise disturbance to bald eagle and Mexican spotted owl	Most noise disturbance to bald eagle and Mexican spotted owl	Least noise disturbance to bald eagle and Mexican spotted owl	Some noise disturbance to bald eagle and Mexican spotted owl	Some noise disturbance to bald eagle and Mexican spotted owl
Sensitive Species	No noise disturbance to American peregrine falcon and northern goshawk	Most noise disturbance to American peregrine falcon and northern goshawk	Least noise disturbance to American peregrine falcon and northern goshawk	Some noise disturbance to American peregrine falcon and northern goshawk	Some noise disturbance to American peregrine falcon and northern goshawk
Management Indicator Species	No change in habitat or population trend	No change in habitat or population trend	No change in habitat or population trend	No change in habitat or population trend	No change in habitat or population trend

Resource Area / Issue	Alternative 1 No-Action	Alternative 2 Proposed Action	Alternative 3	Alternative 4 Preferred Alternative	Alternative 5
Big Game Habitat	Less habitat diversity, slower forage recovery	More habitat diversity, faster forage recovery	More habitat diversity, faster forage recovery	More habitat diversity, faster forage recovery	More habitat diversity, faster forage recovery
Average Snags/Acre in Treatment Areas	7.6	1.7	1.9	2.1	1.7
Fisheries and Aquatics					
Black Canyon Watershed	No treatment	1,100 acres treated	377 acres treated	1,100 acres treated	1,100 acres treated
Canyon Creek Watershed	No treatment	4,960 acres treated	2,666 acres treated	2,554 acres treated	2,701 acres treated
Heritage Resources					
Impacts to Heritage Sites	Sites not protected, adverse effect on site integrity and significance	Sites protected, no effect on site integrity or significance	Sites protected, no effect on site integrity or significance	Sites protected, no effect on site integrity or significance	Sites protected, no effect on site integrity or significance
Air Quality and Fuels					
Air Quality	No change	No change	No change	No change	No change
Long-term Fuel Loads Remaining	Highest	Less	Slightly Less	Slightly Less	Slightly Less
Activity Fuels Created by Salvage Logging (acres)	0	45,109	38,533	41,059	42,850

Resource Area / Issue	Alternative 1 No-Action	Alternative 2 Proposed Action	Alternative 3	Alternative 4 Preferred Alternative	Alternative 5
Transportation System					
Existing open roads (Levels 2, 3, and 4) to remain open after use (miles)	0	249	221	223	234
Existing closed roads (Level 1) to be opened and re-closed after use (miles).	0	117	88	100	105
Temporary Roads to be Constructed and Closed after use (miles)	0 mi.	19.9 mi.	14.2 mi.	18.2 mi.	19.0 mi.
Social and Economic Resources					
Cost of Activities:	0	$2,556,354	$1,385,154	$1,819,454	$2,311,354
Revenue from Sale of Forest Products	0	$2,366,000	$1,160,200	$1,669,800	$2,091,600
Benefit to Cost Ratio for USFS	0	1.58	1.39	1.57	1.55
Benefit to Cost Ratio for All Partners	0	0.93	0.84	0.92	0.90
Employment Created (Jobs)	0	238	128	171	217

Achieving the Purpose and Need

The following table displays the levels that each alternative achieves in meeting the objectives of the purpose and need. Because each alternative was designed to address various issues, the types and quantity of activities in each alternative provide different levels of meeting the purpose and need.

Table 2 - Comparison by alternative of achieving the purpose and need

Objectives	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Provide Sawtimber Harvest Volume	No—does not provide sawtimber harvest volume	Yes—provides the most harvest volume	Yes—provides the least harvest volume	Yes—provides some harvest volume	Yes—provides some harvest volume
Provide Forest Products Other Than Sawtimber	No—does not provide forest products	Yes—provides the most volume of specialty products	Yes—provides the least volume of specialty products	Yes—provides some volume of specialty products	Yes—provides some volume of specialty products
Capture Value of Sawtimber and Forest Products	No—does not capture the value of sawtimber and forest products	Yes—provides the highest revenue	Yes—provides the least revenue	Yes—provides some revenue	Yes—provides some revenue
Provide Project Related Jobs	No—does not provide project related jobs	Yes—provides the highest number of jobs	Yes—provides the least number of jobs	Yes—provides some jobs	Yes—provides some jobs

Response to Issues and Resource Concerns

Each alternative was designed to respond to issues and resource concerns voiced internally and by the public. Because the effects of the alternatives are resource associated, they are described by resource.

Range of Alternatives

Five alternatives were developed to respond to: public and internal issues; resource conditions; and purpose and need for conducting post burn salvage activities.

Alternative 1 would respond to the public's request for conducting no post burn salvage activities.

Alternative 2 would respond to the public's request for an alternative that is designed to maximize harvest volumes for sawtimber while providing sufficient mitigation to minimize impacts to all affected resource areas.

Alternative 3 would respond to the public's concerns over logging on areas with steep slopes over 40 percent or on soil units that have been classified as having severe soil erosion potential. In response to the public's concerns regarding the amount of wildlife habitat retained, an increased retention of snag volume would occur under this alternative.

Alternative 4 would respond to the public's concerns over the impacts of management activities on wildlife habitat. An increased retention of snag volume would occur under this alternative. While logging would not occur on slopes over 40 percent, logging would occur on soils with severe erosion potential.

Alternative 5 was developed to provide an alternative that would achieve a balance between minimizing management activities on steep slopes and maximizing timber volumes in other areas. Logging would not occur on slopes over 40 percent. Logging would occur on soils with severe erosion potential.

Soils and Hydrologic Resources

The only areas proposed for salvaging timber in any of the alternatives were those areas that burned at moderate and high severity levels. These areas experienced very high or complete tree mortality, and retained almost no or very little ground cover. Harvesting timber in any of the action alternatives would generate slash from the non-merchantable treetops as well as branches. This material would be left on the ground and lopped to a two-foot height, with no further treatment. In most areas where salvage logging is proposed, this remaining material would be the only effective ground cover present after logging is completed.

Normally skidding or yarding operations have the greatest impacts to soils and watersheds and are mitigated through Best Management Practices (BMPs). The negative impacts of logging operations anticipated by salvage activities proposed in all action alternatives have been accounted for through modeling. The results of runoff modeling for each action alternative show that overall effects are slightly positive which indicates that the positive effects of slash as ground cover overshadow negative effects of logging.

See Table 1 for a summary comparison of effects on soil and hydrologic resources.

Alternative 1 would produce the highest soil erosion of all alternatives considered in detail. No logging slash would be generated to produce ground cover and no dead trees would be felled. Soil erosion would be allowed to continue at maximum potential rates due to lack of ground cover. Thin top soils would be lost at non-sustainable rates of erosion and areas of shallow soils could turn into bedrock outcrops. Loss of topsoil results in the removal of substantial quantities of nutrients, which take centuries to replace through natural processes. In areas of shallow soils, larger exposures of bedrock are anticipated and are not expected to recover for many centuries. Overall, sediment transport through the area's drainage network is expected to be highest in this alternative.

Geology and Minerals

None of the alternatives would impact the geology of the analysis area. The analysis area is not characterized by significant mineralization due to the geology of the area. None of the alternatives affect any active mineral operations nor do they preclude any opportunity for development of future mineral operations. All of the action alternatives propose to apply crushed aggregate surfacing to existing roads. The aggregate would be acquired from commercial sources located on private lands, not from National Forest System lands.

Vegetation

The effects of the Rodeo-Chediski Fire on vegetation eclipse those of any previous vegetation treatments implemented in the analysis area. Regardless of stand condition or successional status prior to the fire, 54 percent of the analysis area subjected to high and moderate burn intensity levels has reverted to an early vegetation structural stage (VSS 1) (grass and forb). Within the remaining 46 percent that burned at lesser intensity levels, effects of previous changes in vegetative composition and structure remain an influence in environmental conditions. While the number and size of dead trees that remain on site would affect forest characteristics such as fuel loading and wildlife habitat quality, it would have no direct effect on the vegetative composition and structure of the future forest whether these trees are harvested or not.

Average volume derived from the vegetation analysis indicates there is approximately 285 million board feet (mmbf) of timber of salvageable timber 12-inches in diameter and larger on the 97,582 acres burned at high and moderate severity levels in the analysis area, with an average density of 3,040 board feet per acre. This estimate includes volume reductions for retaining snags and expected defect predicted to occur thorough the summer of 2003. While it is unrealistic to assume all that the estimated volume would be available for harvest due to resource coordination needs and terrain/access limitations, it does approximate the total volume available and establishes a baseline against which to compare the alternatives. Actual timber volume projected for each alternative is listed in Table 1.

Changes in MSO habitat designations, VSS distributions, and old growth replacement would occur gradually over decades as tree regeneration occurs and forest succession progresses. Alternatives do not differ in these respects as salvage harvest objectives of proposed action alternatives do not include any activities directed at bringing about change in these forest attributes.

Under Alternative 1, snags would be the most abundant of all the alternatives and average 7.1 per acre. Downed logs would be deficient for the next several years but would gradually become abundant over the next 5-10 years as dead trees fall down.

Fire and Fuels

The action alternatives all include management direction to salvage dead timber in the fire area and have similar effects on fuel loading and future fire potential. In the short-term (two years), harvesting of dead trees would increase fuel loads above current post-fire levels. Leaving 12-inch tops from harvest activities would increase fuel loads for fine, medium and large fuels. Woody fuels would not present a hazard until fine herbaceous fuels grow densely enough to act as a carrier for ground or surface fires. Created slash in all alternatives would be lopped or crushed to a two-foot height to greatly reduce this hazard.

Smaller diameter dead trees would be removed for fuelwood and specialty products in areas designated for small sales. Fuel loading would be less in these areas than those designated for commercial sawtimber sales because more potential fuels would be removed. Slash from these treatments would also be lopped to two-foot height or crushed to reduce the fire hazard from activity fuels.

Salvage logging is not expected to reduce short-term fire risk or hazard in moderately to severely burned areas because the fine fuels have already been reduced. In the short-term, salvage logging would not decrease the risk of fire ignitions and spread. Salvage harvest would decrease the future intensity of fires (especially under drought conditions) and resulting soil damage by reducing the number of large dead trees that would fall and increase fuel loading. Anticipated effects of all action alternatives in areas that are unburned and those that burned at low severity

levels would be the same as in Alternative 1 because no salvage logging would occur in these areas.

Total fuel loading without treatment for the analysis areas was predicted for a time period of 20 years post-fire. Currently, extreme or erratic fire behavior scenarios are mostly non-threatening within the moderate and severely burned areas because most of the ground fuel was consumed during the fire. The large amount of residual fuel loading that will be created on site due to blow-down and fall-down of the standing material over the next few years poses the most immediate concern to future fuel loading and fire behavior.

Air Quality

No prescribed burning activities of any kind are proposed in any of the alternatives considered in detail. Without prescribed burning treatments, there would be no impact to air quality or human health from smoke in the short-term. However, without salvage logging and some mechanical fuel treatment in selected areas, there would be an increase in the potential for future wildfire and smoke. Harvesting activities proposed under all of the action alternatives would produce dust as well as vehicle emissions, although their contribution to air pollution would be insignificant.

In the event of a large wildfire, the amount and dispersal of smoke could not be controlled. The amount of smoke from such a fire would contain large amounts of pollutants that would likely exceed Federal air quality standards for particulate matter. A wildfire would probably produce significant adverse effects to air quality within a large perimeter around the area.

Air quality within the analysis area is excellent. No facilities or activities that impact air quality exist. There are no Class I airsheds within the analysis area. The closest Class I areas are the Sierra Ancha Wilderness 30 air miles south, and Mazatzal Wilderness and Mount Baldy Wilderness, both located 37 air miles to the west and east of the analysis area respectfully. None of these areas would be impacted by activities proposed in this project. There are no non-attainment areas in proximity to the analysis area.

Alternative 1 does not propose to conduct any harvest activities or prescribed burning to reduce current and future heavy fuel loading. There would be no effect on air quality or human health in the short-term. However, in the long-term, this alternative is expected to produce the greatest potential amount of wildfire activity and potentially create the most emissions.

Wildlife

None of the action alternatives would alter existing big game habitat because the existing ratio of forage to cover would not be altered through salvage harvest. The VSS classes in big game habitat would remain the same before and after post-fire salvage logging activities. The action alternatives should allow for faster recovery of forage, especially within those areas that burned at high severity levels, in part because logging slash can provide micro-sites for grass and forb establishment.

By providing greater amounts of forage and browse, early successional vegetation in salvage-logged areas would provide a positive response benefiting big game herbivore species. The action alternatives would provide more habitat diversity than Alternative 1 because 39 to 51 percent (depending on the alternative selected) of areas burned at moderate to high severity levels would be salvage logged, producing more open habitat in a shorter period of time than would leaving all burn areas as they are.

The loss of most large trees to harvest; and some small trees, which would be knocked down during salvage operations or removed in small sale areas; would decrease effective hiding cover while increasing forage growth (grasses, forbs, and shrubs). Forest Plan standards and guidelines

for forage to cover ratios (forage:live tree cover) should be between 60:40 and 70:30. Pre-fire ratios of 18:82 did not meet these guidelines. The forage to cover ratio post-fire is more consistent with Forest Plans standards and guidelines than pre-fire conditions. All live tree cover was destroyed in areas that burned at moderate to high severity levels and the stands reverted to VSS 1 (grass and forb stage). The post-fire forage:cover ratio of 64:36 would remain the same after salvage because only dead trees would be removed.

Table 3 - Comparison of effects of alternatives on threatened, endangered, and sensitive species.

Species	FWS/FS Status and Year	Critical Habitat Present	Determination of Effect by Alternative
MAMMALS (none present or affected)			
BIRDS			
Haliaeetus leucocephalus **Bald Eagle**	T/SEN 1995	N/A	**NO EFFECT (Alt 1, 3, 4, 5) MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT (ALT. 2).**
Strix occidentalis lucida **Mexican Spotted Owl**	T/SEN 1993	N/A	**NO EFFECT (ALT. 1) MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT (ALTS. 2, 3, 4, 5)**
Falco peregrinus anatum **American Peregrine Falcon**	SEN delisted	N/A	**NO IMPACT (ALT. 1) MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALTS. 2, 3, 4, 5)**
Accipiter gentilis **Northern Goshawk**	SEN	N/A	**NO IMPACT (ALT. 1) MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALTS. 2, 3, 4, 5)**
Buteogallus anthracinus **Common Black Hawk**	SEN	N/A	**No Impact (Treatments are not proposed in suitable habitat – Alts. 1, 3, 4, 5) MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALT. 2)**
REPTILES (none present or affected)			
AMPHIBIANS			

Species	FWS/FS Status and Year	Critical Habitat Present	Determination of Effect by Alternative
Rana chiricahuensis **Chiricahua leopard frog**	T/SEN 2002	N/A	**NO EFFECT (Alt. 1) MAY AFFECT NOT LIKELY TO ADVERSELY AFFECT (Treatments not proposed in habitat plus Mitigations in place to reduce effects – Alts. 2, 3, 4, 5).**
Bufo microscaphus microscaphus **Southwestern toad**	SEN	N/A	**No impact (ALT 1.) Alts. 2, 3, 4, 5: Treatments not proposed in habitat plus Mitigations in place to reduce impacts – MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOTAFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING**
Rana pipiens **Northern leopard frog**	SEN	N/A	**No impact (ALT 1.) Alts. 2, 3, 4, 5: Treatments not proposed in habitat plus mitigations in place. MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING**
Rana yavapaiensis **Lowland Leopard Frog**	SEN	N/A	**No impact (ALT 1.) Alts. 2, 3, 4, 5: Treatments not proposed in habitat plus Mitigations in place to reduce impacts – MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING**
FISHES			
Ptychocheilus lucius **Colorado Pikeminnow (squawfish)**	E/SEN	N/A	**NO EFFECT (no Treatments within habitat ALTS. 1, 3, 4, 5) NOT LIKELY TO JEOPARDIZE (ALT. 2)**
Xyrauchen texanus **Razorback Sucker**	E/SEN	NO	**NO EFFECT (ALT. 1, 3, 4, 5) NOT LIKELY TO JEOPARDIZE (Alts 2)**
CLAMS (none present or affected)			
SNAILS (none present or affected)			
INSECTS			

Species	FWS/FS Status and Year	Critical Habitat Present	Determination of Effect by Alternative
Cicindela hirticollis corpuscula **Hairy-Necked Tiger Beetle**	SEN		**No impact (Alt. 1) MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALTS. 2, 3, 4, 5)**
Cicindela praetextata pallidofemora **Tiger Beetle**	SEN		**No impact (Alt. 1) MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALTS. 2, 3, 4, 5)**
Agathon arizonicus **Netwing Midge**	SEN		**No Impact (NOT PRESENT – Alts. 1, 3, 4, 5) MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALT. 2)**
Dragonflies			
Libelula nodisticta **Hoary Skimmer**	SEN		**No impact (Alts. 1, 3, 4, 5) MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALT. 2)**
BUTTERFLIES			
Callophrys Comstock **Comstock's Hairstreak**	SEN		**No impact (Alt. 1) MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALT. 2, 3, 4, 5)**
Agathymus neumoegeni **Neumogen's Giant Skipper**	SEN		**No impact (Alt. 1) MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALT. 2, 3, 4, 5)**
Lycaena ferrisi **Arizona copper**	SEN		**No impact (Alt. 1) MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALT. 2, 3, 4, 5)**

Species	FWS/FS Status and Year	Critical Habitat Present	Determination of Effect by Alternative
PLANTS			
Rumex orthoneurus **Blumer's dock**	SEN		**No impact (Alt. 1) MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALT. 2, 3, 4, 5)**
Heuchera eastwoodiae **Eastwood Alum Root**	SEN		**No impact (Alt. 1) MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALT. 2, 3, 4, 5)**

Summarized from appendix D of this document, and the Biological Assessment and Evaluation (BAE) on file in the project record.

Table 4 - Comparison of effects of alternatives on management indicator species.

Species	Cover Type	Status within Action Area of Project and Environmental Consequences	Change/No Change in Habitat/Population Trend by Alternative
MAMMALS			
Antilocapra americana **Pronghorn Antelope**	PP, PJ, Oak, Grass	Occurs on northern edge of analysis area, in more open grassland habitats. Openings created may create more forage and help increase populations.	**ALTS. 1: NO CHANGE – TREATMENTS NOT PLANNED IN PREFERRED HABITAT. ALTS. 2, 3, 4, 5: SMALL SALES WOULD IMPROVE FORAGING HABITAT AFTER 1-3 YEARS**
BIRDS			
Accipiter gentiles **Northern Goshawk**	PP, MC	Breeding areas within analysis area. Analysis area also provides foraging habitat.	**ALT. 1: NO CHANGE. ALTS. 2, 3, 4, 5: NO CHANGE TO CURRENT LIVE HABITAT; COULD IMPACT POPULATION TREND BY DISTURBING NESTING PAIRS – MITIGATION IN PLACE TO MINIMIZE WHERE NESTS LOCATED.**

Species	Cover Type	Status within Action Area of Project and Environmental Consequences	Change/No Change in Habitat/Population Trend by Alternative
Meleagris gallopavo merriami **Merriam's Turkey**	MC, PP, PJ, Oak	Known to be very common in analysis area before fire. Likely some poults died in fire because they were too young to fly. The action alternatives would not impact the remaining live habitat for this species. The largest impact from all the action alternatives on turkeys will be the openings created. Because turkey prefer small openings and are more susceptible to predation in large openings, fire had more impact than salvage will.	**ALT. 1: NO IMPACT TO CURRENT HABITAT. ALTS. 2, 3, 4, 5: WILL CREATE LARGE OPENINGS SOONER, BUT WILL NOT IMPACT CURRENT HABITAT/POPULATION BECAUSE ACTIONS IN HIGH/MODERATE SEVERITY BURNS.**
Strix occidentalis lucida **Mexican Spotted Owl**	MC, PP, PP/Oak	Known breeding areas within analysis area. Treatments proposed in PACs in Alt. 2 only	**ALT. 1: NO CHANGE. ALTS. 2: HABITAT DISTURBANCE IN BURNED OVER PACS. POTENTIAL DECREASE IN NUMBERS ATTEMPTING TO NEST IN BURNED PACS. ALTS. 3, 4, 5: NO CHANGE TO HABITAT OR POPULATION TREND. SOME DISTURBANCE FROM VEHICULAR TRAFFIC COULD OCCUR NEAR PACS.**
Sphyrapicus nuchalis **Red-naped sapsucker**	MC, AS, PP	Suitable habitat and some records from analysis area. Fairly common in pinyon-juniper, ponderosa pine, and mixed conifer habitats across the forest. Nest success did not differ significantly between unharvested and harvested forest plots (including patch cuts and clear cuts)	**ALT. 1: NO CHANGE IN HABITAT OR POPULATION TREND. ALTS. 2, 3, 4, 5: LACK OF DATA ON SALVAGE AND THIS SPECIES. LOGGED FORESTS WERE BENEFICIAL; DO NOT ANTICIPATE CHANGE FROM POST-BURN TREND GIVEN SNAG DENSITIES TO REMAIN.**
Picoides villosus **Hairy Woodpecker**	MC, PP, PJ	The species is fairly common throughout the analysis area. More frequently found in cut than in uncut forests; detected most frequently in early post-fire forests. Less abundant and lower nesting success in salvage-logged stands relative to unlogged post-fire forests.	**Alt 1: NO CHANGE . Alts. 2, 3, 4, 5: DECREASE IN MAXIMUM POPULATIONS**

Species	Cover Type	Status within Action Area of Project and Environmental Consequences	Change/No Change in Habitat/Population Trend by Alternative
Contopus sordidulus **Western Wood-Pewee**	Riparian	Common nesters in PJ/pine, pine, and mixed conifer in Analysis Area. Their dependence on standing dead trees in post-fire habitats makes it likely a potential negative effect could occur from post-fire salvage logging on this species.	**ALT. 1: NO CHANGE IN HABITAT OR POPULATION TREND. ALTS. 2, 3, 4, 5: LIKELY DECREASE FROM MAXIMUM POPULATIONS DUE TO SALVAGE. ALTS. 3, 4 LESS IMPACT THAN ALTS. 2, 5.**
Sitta pygmaea **Pygmy Nuthatch**	PJ, PP, MC	Common nester and winter resident in analysis area. Their dependence on standing dead trees in post-fire habitats makes it likely a potential negative effect could occur from post-fire salvage logging on this species.	**ALT. 1: NO CHANGE IN HABITAT OR POPULATION TREND. ALTS. 2, 3, 4, 5: LIKELY DECREASE FROM MAXIMUM POPULATIONS DUE TO SALVAGE. ALTS. 3, 4 LESS IMPACT THAN ALTS. 2, 5.**
Sialia mexicana **Western Bluebird**	PP	Common nester in analysis area. Snag availability in postfire communities is a substantial positive influence on western bluebird activity. Can use lower snag densities than primary cavity nesters. Snags should be greater than 20 inches dbh.	**ALT. 1: NO CHANGE. ALTS. 2, 5: CHANGE TO CURRENT SNAG HABITAT COULD DECREASE HABITAT/POPULATION TREND OVER ALT.1, BUT NO CHANGE DETECTED IN HQI ANALYSIS. ALTS. 3, 4: INCREASED SNAG DENSITIES AND LARGER SNAGS COMBINED WITH MORE UNTREATED STANDS SHOULD MAINTAIN POPULATIONS AT OR ABOVE CURRENT LEVELS.**

Summarized from appendix E of this document, and the Biological Assessment and Evaluation (BAE) on file in the project record.

Fisheries and Aquatic Resources

All action alternatives propose salvage logging within portions of Black Canyon and Canyon Creek watersheds. Other watersheds do not contain adequate fish or macro invertebrate habitat, or contain extremely limited habitat that would not likely be significantly impacted by any of the action alternatives being analyzed. Alternative 1 would leave the watersheds in their current condition resulting in continued high erosion rates, sediment yields, and loss of soil nutrients; as well as physical and biological changes in stream channels.

The effects of no treatment would be most severe in the Canyon Creek Watershed. Scouring and sedimentation would continue putting both riparian and wet meadow habitats at risk. While debris flows have been minimal thus far because much of the debris in the channels burned up, that

would change as hillside erosion and stream scouring undermine stream banks and trees, causing channel instability. It is highly likely that Canyon Creek and its fishery would be affected well beyond 20+ years.

Black Canyon Watershed is expected to recover more rapidly than the Canyon Creek Watershed because damage is less severe. Under Alternative 1, Black Canyon Lake could become completely filled in with sediment within two to three years requiring dredging. With little or no efforts to stop the flow into the lake, the lake could refill with sediment again after it is dredged.

Alternative 2 would use land based logging to remove trees from 2,701 acres (46percent) of areas burned at moderate to high severity levels within the Canyon Creek Watershed. These areas have less potential for soil loss than the steeper areas. Treetops, limbs and logging slash would be left on the site to provide ground cover and debris to slow water and soil movement down slope. In these areas, the primary source for sediment would be the ephemeral channels and the skid roads. No salvage logging activities would occur within the streamside management zones.

Salvage logging is proposed on approximately 1,100 acres (29percent) of the Black Canyon watershed. This logging would be accomplished using land based logging systems. Approximately 566 acres (15 percent) of the watershed that burned at moderate to high severity levels would not be logged. The areas selected for salvage logging are for the most part in the middle of the watershed, over 1/3 mile from Black Canyon Lake and the Mexican spotted owl PACs nearer to the lake.

Alternative 3 proposes a significant reduction in the amount of salvage logging in Black Canyon watershed as compared to Alternatives 2, 4, or 5. Since the logging is proposed approximately 1.25 miles from Black Canyon Lake, this alternative would not significantly reduce sedimentation into the lake or benefit the fisheries resource.

Alternative 4 does not propose salvage logging on the steep slopes of Canyon Creek watershed and also reduces salvage on the Mogollon Rim by 147 acres when compared to Alternative 2. The reduction in soil loss and stream sedimentation is similar to Alternatives 3 and 5, which is a reduction greater than Alternative 1. Alternative 4 would only marginally benefit Canyon Creek and Mule Creek over post-fire conditions. The anticipated impacts to the watershed and these perennial streams would resemble those predicted under Alternative 1. Alternative 4 proposes salvage logging in the same amount of area within Black Canyon Watershed as Alternative 2, making the potential effects from Alternative 4 the same as Alternative 2.

Heritage Resources

The White Mountain Apache, San Carlos Apache, Tonto Apache, Yavapai-Apache Nation, Yavapai-Prescott Indian Tribe, Pueblo of Zuni, Hopi Tribe, Navajo Nation, and Fort McDowell Indian Community have historic ties and an interest in portions of the Apache-Sitgreaves or Tonto National Forests (or both) and have been consulted concerning this project proposal. Each group has their own history, traditions, and relationship to the land and to the other groups. Traditional use of this area and its resources by these groups date back several generations and for some, many centuries.

Approximately 56,000 acres within the Rodeo-Chediski Fire have been adequately surveyed. A total of approximately 1,643 sites have been identified through record and site atlas searches on the Apache-Sitgreaves National Forests with an additional 45 situated on the Tonto National Forest. It is likely that many more un-inventoried sites are present, as evidenced by sites newly inventoried during Burned Area Emergency Rehabilitation (BAER) activities. All treatment areas proposed in action alternatives will be 100 percent surveyed and consultation with the Arizona State Historic Preservation Officer obtained prior to any ground disturbing activities occurring.

Mitigation measures will minimize potential impacts to heritage resources by prohibiting the use of mechanized equipment within site boundaries and reducing heavy fuel loads adjacent to site surfaces. No impacts to heritage resources from road maintenance and temporary road construction activities are anticipated. Standard mitigation measures of avoidance of all heritage resources would be applied.

Alternative 1 may have the greatest potential for adverse effects on heritage resources by not reducing accumulated fuel loads and if dead standing trees are allowed to fall and uproot naturally. Without implementing road management and soil and watershed mitigation measures, the risk of erosion and flooding are greatly increased, in addition to increased risk of looting and vandalism due to site visibility.

Scenic and Visual Resources

Under all the action alternatives, many of the salvage-logging units visible from State Highway 260 and Mogollon Rim communities would be treated with commercial saw timber and small sale activities to remove dead trees. Two or three years following these activities, grasses, forbs and shrubs would dominate the understory. Skid trails resulting from tractors and skidders may be apparent for some time after activities have been implemented.

Since no management activities would be implemented under Alternative 1, existing visual conditions would continue. Burned areas would revegetate over time and the forest would fill in the burned areas and harvest openings. In the short-term (less than 10 years), Alternative 1 would result in a less visually diverse landscape then under alternatives proposed for salvage logging treatments. Visual effects along State Highway 260 would continue to be the same as immediately after the fire. Evidence of the fire and BAER treatments would be obvious in the foreground immediately along the highway and in the background on distant ridges. In the long-term, the landscape would recover to its previous forested character unless a reburn occurs and starts this process anew. Past human-related changes to the landscape would remain evident for many years.

Recreation

Selection of any one of the alternatives considered in detail would not change the Recreation Opportunity Spectrum (ROS) classification or acreages within the analysis area.

There are no wilderness or roadless areas within the analysis area.

A segment of Canyon Creek was identified as eligible for potential wild, scenic, recreational river designation in the 1993 Resource Information Report (USDA, 1993). The segment, located within a half-mile wide corridor approximately 5.4 miles in length, begins at Canyon Creek Springs and continues to the boundary of the Fort Apache Reservation. The segment meets eligibility requirements because it is free flowing, free of impoundments and has outstanding remarkable wildlife and ecological values. This segment has not been officially designated as part of the Wild and Scenic Rivers system to date.

Removal of dead trees by helicopter yarding methods would not affect the potential eligibility of this stream as a wild and scenic river. As the vegetation and wildlife return to this area, the outstanding remarkable ecological and wildlife values for which it was nominated will likewise return. Recreational activities occurring in developed recreation sites and along Canyon Creek would be temporarily impacted by noise from equipment and helicopters but will be of short duration.

Ten developed recreation sites were damaged to some degree. No damages occurred from the Fire at Black Canyon Rim Campground, Black Canyon Lake Day Use/Picnic/Boat Ramp and Gentry Lookout Campground. Vegetation in the Canyon Point Campground was back burned

during fire suppression efforts. Lewis Canyon Group Campground received minimal damage to signs and other improvements. A single vault toilet in Valentine Ridge Campground was destroyed. Fire damages to facilities in Canyon Creek, Colcord Ridge and Airplane Flat Campgrounds were minimal. Twenty-three concentrated use areas were also burned over.

All of the burned area was closed to public access during the fire until emergency work was completed under Burned Area Emergency Rehabilitation authorities. Public access is currently restricted by Closure Order #01-377 that allows motorized vehicles to travel on specified roads only. Overnight camping, campfires, smoking and fuelwood cutting are currently prohibited within the fire perimeter.

Table 5 - Comparison summary of recreation activities by alternative

Recreation Use/Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Developed Sites	Visitor safety not improved	Visitor safety improved	Visitor safety improved	Visitor safety improved	Visitor safety improved
Concentrated Use Areas	Visitor safety not improved	Visitor safety improved	Visitor safety improved	Visitor safety improved	Visitor safety improved
Outfitter Guiding Activities	Client safety not improved	Client safety improved	Client safety improved	Client safety improved	Client safety improved
Recreation Events	No change	No change	No change	No change	No change
Hunting/Fishing Opportunities	Long-term impacts	Short-term impacts	Short-term impacts	Short-term impacts	Short-term impacts
Cross Country Travel/OHV Use	Use will decrease in long-term	Use will increase in short-term	Use will increase in short-term	Use will increase in short-term	Use will increase in short-term

There are over 106 miles of trails within the analysis area including portions of the General Crook Trail, a National Recreation Trail. Approximately 49 miles of these trails are being treated to remove dead hazard trees authorized in a separate Decision Memo signed December 23, 2002.

Recreational activities that occurred before the fire will continue on into the reasonably foreseeable future in areas that were unburned or burned at a low severity level. In areas that burned at moderate and high severity levels, recreation use patterns and activities would be impacted longer by implementing Alternative 1 than any other alternative.

Transportation System

Emergency road repair and stabilization was performed on some of the main roads within the fire area under Burned Area Emergency Rehabilitation authorities. The work consisted of removing culverts, hardening drainage crossings and installing numerous grade dips to handle expected

increased flows resulting from loss of groundcover. Work was performed on 129 miles of the existing 390 miles of open roads in the area.

Treatments are anticipated to bring the roads into conformance with assigned maintenance levels and meet best management practices (BMPs) to minimize erosion and sedimentation. Deferred maintenance items would be completed based upon priority, with emphasis on health and safety items. The following road maintenance treatments would occur in accordance with post-fire assessment recommendations and deferred maintenance identified in condition surveys.

Table 6 - Summary comparison of road maintenance activities by alternative

Proposed Road Treatment	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Spot Surfacing (miles)	0	130	108	130	130
Spot Pit-run Materials (miles)	0	212	174	189	193
Drainage Structures (miles)	0	319	281	290	293
Turnouts (miles)	0	151	142	136	139
Clearing (miles)	0	145	117	115	124
Dust Abatement (miles)	0	59	30	46	49

Treatments would only occur in high priority areas where needed and not over the entire number of miles indicated by each alternative. Maintenance activities would be commensurate with level of use.

See Table 1 for comparison summary of roads by maintenance level.

Temporary road construction would be necessary to access several areas not having an adequate road system to meet skidding distance requirements. Temporary roads would be constructed to minimal standards to provide access for harvesting equipment and log trucks. Temporary roads would be used to minimize skidding through unburned and lightly burned areas. Temporary roads would be used for short durations, normally less than one season of operation and closed and seeded in accordance with mitigation measures and best management practices.

See Table 1 for comparison summary of miles of temporary road construction.

Alternative 1 would have the greatest potential impact on the transportation system since limited maintenance would be performed to stabilize and rehabilitate Forest system roads. Non-commercial and commercial user conflicts associated with commercial timber haul would not occur with this alternative. Private landowners would continue to use these roads to remove dead trees from their property; however, this traffic is considered to be light and sporadic in nature.

Social and Economic Setting

Business income lost during and following the fire is likely to be in the hundreds of millions of dollars. Forest recovery efforts have offset a portion of these dollars, creating new jobs and

indirectly contributing to the overall economy. Emergency rehabilitation efforts have generated approximately 250 jobs through the investment of over ten million dollars in the economy. The majority of these jobs were created in the forestry and agriculture related industries.

In the event that an action alternative is selected, the Fort Apache Tribally owned sawmill at White River would probably utilize much of the salvaged volume. The majority of these jobs are already in place, but would be supported by this material for the next two years.

See Table 1 for a summary comparison of economic impacts by alternative.

Cost of activities, volumes harvested, net acres treated, revenue from sale of forest products, benefit to cost ratio for all partners and estimated number of jobs are highest in Alternative 2; followed by Alternatives 5, 4 and 3. Benefit to cost ratio for the Forest Service is highest in Alternative 2; followed by Alternatives 4, 5 and 3.

The human health and environmental effects associated with the project are generally considered within acceptable norm for the area. None of the effects were deemed to be significant as identified by NEPA and specified in the CEQ Regulations on Environmental Justice. None of the proposed projects present an environmental justice issue as lands treated were done so based solely upon the severity of burned area, resulting in no disparate impact to any particular population.

Identification of the Agency's Preferred Alternative

The Forest Supervisors from the Apache-Sitgreaves and the Tonto National Forests have identified **Alternative 4** as the agency's preferred alternative (40 CFR 1502.14(e)). Alternative 4 best balances the objective as stated in the purpose and need with consideration to the natural resources found within the analysis area. Alternative 4 is responsive to internal and public scoping issues and concerns, and allows for an expedient implementation of resource recovery efforts from the Rodeo-Chediski Fire including: soils and watershed restoration; future fire protection and fuels reductions; air quality protection and preservation; protection to threatened, endangered, and sensitive species of wildlife whose habitat was significantly altered by the fire; heritage resource protection; scenic and visual resource maintenance and enhancement; forest visitor safety considerations; transportation facilities maintenance; and social and economic resource consideration.

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Chapter 1 – Purpose of and Need for Action

Document Structure

The Forest Service has prepared this Draft Environmental Impact Statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and state laws and regulations. This Draft Environmental Impact Statement (DEIS) discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and its alternatives. The document is organized into four chapters:

- Chapter 1. Purpose of and Need for Action: This chapter introduces the Rodeo-Chediski Fire Salvage Project. It includes information on the background and history of the project proposal, the purpose of and need for the project, and the agency's proposal to achieve the purpose and need. This chapter also describes the decisions that the forest supervisors must make concerning the project, and the relevant laws, regulations, and consultation with which the Apache-Sitgreaves and Tonto National Forests must comply.

- Chapter 2. Alternatives, including the proposed action: This chapter provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose and need. This chapter also details how the Forest Service informed the public of the proposal and how the public responded. Alternatives to the proposed action were developed based on significant issues raised by the public and other agencies. Finally, this chapter provides summary tables of the environmental consequences associated with each alternative.

- Chapter 3. Affected Environment and Environmental Consequences: This chapter describes the current environmental conditions of the project area and environmental effects of implementing the proposed action and other alternatives. This analysis is organized by [insert topic (i.e., resource area, significant issues, environmental component)].

- Chapter 4. List of Preparers: This chapter provides a list of preparers who were primarily responsible for the preparation of the DEIS.

- Chapter 5. List of Agencies, Organizations, and Persons to Whom Copies of the DEIS are sent.

- Appendices: The appendices provide more detailed information to support the analyses presented in this DEIS.

Additional documentation, including more detailed analyses of project area resources, is located in the project planning record located at Black Mesa Ranger District, Apache-Sitgreaves National Forests, Overgaard, Arizona.

Rodeo-Chediski Fire

On June 18, 2002, the Rodeo fire was ignited on the Fort Apache Indian Reservation near Cibecue, Arizona. On June 20, the Chediski fire was ignited on Chediski Ridge also on the Fort Apache Indian Reservation. The two fires grew rapidly and merged on June 22. By the time the fires were contained on July 7, the complex had grown to approximately 460,182 acres. Of this acreage, approximately 10,711 acres are on the Pleasant Valley Ranger District of the Tonto National Forest, and 166,440 acres are on the Lakeside and Black Mesa Ranger Districts of the Apache-Sitgreaves National Forests. The remaining burned areas were within the Fort Apache

Reservation (276,335 acres), and private lands (8,673 acres). See Appendix G, Map 2 for a map of the burn severity.

While fires are a natural part of ecosystems in the burned area, the Rodeo-Chediski fire was outside the range of natural fire behavior. The fire left many resources in an unacceptable condition and susceptible to further degradation without management intervention.

Figure 1 - Aerial view of the Rodeo-Chediski Fire

The Burned Area Emergency Rehabilitation (BAER) team was assembled during the fire to conduct an analysis of fire effects throughout the lands impacted by the fire. The team provided emergency treatment to areas within and adjacent to burned areas and prescribed post-fire mitigation measures necessary to protect human life, property, and critical cultural and natural resources.

After the fire, an interdisciplinary (ID) team was formed to develop long-term management proposals for resources affected by the fire and to analyze the effects of these activities. This DEIS is only one project that attempts to deal with resources affected by the fire. Other management and restoration activities will be addressed under separate analyses in compliance with the National Environmental Policy Act (NEPA), and are addressed as reasonably foreseeable actions in the cumulative effects analyses disclosed in Chapter 3.

Analysis Area

The Rodeo-Chediski Fire Salvage Project analysis area includes all National Forest System lands affected by the fire in addition to private inholdings within the fire area. It includes portions of the Black Mesa and Lakeside Ranger Districts of the Apache-Sitgreaves National Forests and the Pleasant Valley Ranger District of the Tonto National Forest. Management activities described in the proposed action and its alternatives would occur on specified National Forest System lands within the boundaries of this analysis area.

Management Activities

The forests have identified several reasons for proposing management activities in areas affected by the Rodeo-Chediski fire. These are based on several factors including: current resource conditions, desired conditions, forest plan direction, and public input. The need for changing the existing conditions is derived from the differences between current resource conditions and desired conditions. Desired conditions are based on management objectives and forest plan direction.

Figure 2 - Heavy fuel loading contributed to moderate and high severity burns in much of the fire area

Current Conditions

Immediately following the fires, the Tonto and Apache-Sitgreaves National Forests began assessing conditions in the burned areas. The BAER team conducted intensive field surveys and, with the help of satellite imagery and map products provided by the Remote Sensing Application Center in Salt Lake City, developed a fire severity map. From this map, modeling, and field observations, the Forest Service was able to determine general resource conditions of the burn area. This information was important in determining the post-fire conditions of soil and water resources of the project area. Potential flood flow rates, soil loss rates, and sediment delivery estimates were made. Sub-watersheds were evaluated and prioritized for treatment depending on soil and water conditions, timber stand composition, and fire severity including tree mortality. Timber stands and stand data were also evaluated to determine suitable areas for the harvest of dead trees.

Figure 3 - A high severity burn with no ground vegetation remaining

Vegetation

The wildfires left a mosaic of burn patterns in many areas and large areas of charred or unburned land in others. In most areas, the fire killed or weakened trees, increasing their susceptibility to insect attack. Similarly, most areas that were burned still contain substantial fuel loads which continue to present a wildfire hazard. The mosaic nature of the burn left areas of low, moderate, and high burn severities. These burn classes have the following characteristics:

- Low Burn Severity – Fires that consume some litter on the forest floor without damaging a majority of tree crowns. Many trees are normally expected to survive. These burns have minimal effect on a watershed's reactivity and soil infiltration rates.

- Moderate Burn Severity – Fires that burn very hot on the ground, consuming all litter and killing some trees through their roots, rather than consuming their crowns. More than half of the trees in these burns are killed. Impacts to soils are fairly severe, though ground cover is improved when tree needles drop off dying trees.

- High Burn Severity – Fires that consume all ground vegetation and trees, including tree crowns. There is 100 percent mortality of all vegetation. Only blackened dead trees remain in the burn area. This category is considered a stand-replacement fire. These burns have a high impact on soil infiltration rates, and runoff rapidly leads to short watershed concentration times, usually resulting in flooding.

The project area burn severity is characterized by 47 percent low severity or unburned areas, 26 percent moderate severity, and 27 percent high severity. Trees that experience moderate and high burn severity are either dead or dying.

Soils and Hydrologic Resources

In many locations, the fire degraded watershed and soil conditions. The fire impacted soil beyond accepted limits of natural variability, including reduced soil aggregate stability, reduced permeability, increased runoff and erosion, and reduced organic matter/nutrient status. Many areas with moderate and high burn severity have significant soil damage. The loss of soil in these areas has led to higher than normal flooding and erosion levels. Due to this soil and ground cover loss, water resources have been impacted as well. Water quality has suffered in perennial drainages such as Mule Creek and Canyon Creek due to the mass influx of sedimentation and debris from rain events. Stream flows are higher in many high-burn severity areas, and sedimentation rates are much higher than historical levels.

Figure 4 - Crown fires lead to soil damage, excessive water runoff, and severe soil erosion.

Transportations Systems

Due to direct effects of the fire and flooding events and a lack of ground cover and soil resources, roadways in the project area also have been damaged. The BAER team removed culverts along certain roads to reduce the hazards to culverts, roads, and reduce erosion potential in certain areas.

Figure 5 - Road damage from flooding following the fire.

Desired Conditions

When looking at desired conditions for the forest, it is important to note that the Rodeo-Chediski fire had much more impact to forest resources than historical fires. Because of this, desired conditions for a fully functioning and healthy forest are not realistic goals for a project at this time. Recovery of the burned area will take many years and a long-term restoration effort is being organized to look at all the social and ecological needs of the burned area. The proposed action would begin to change current resource conditions and trends toward meeting some of the desired conditions for resources as described in the forest plans.

The desired condition is that the project area is sustained to produce outputs in the form of wood products such as fuelwood and lumber. The sustainable flow of wood fiber would provide the public with wood products and provide local and regional populations with employment, helping to keep rural communities healthy and stable.

Dead trees will have been removed from moderate and high severity burn areas. In areas where treatment occurs, logging slash and downed woody debris assists in stabilizing soils and reducing soil erosion and related flooding. Mitigation measures provide for wildlife habitat and the stability of soils that assists in watershed recovery until long-term restoration plans are developed and implemented.

The ID team identified areas where the existing conditions and anticipated trends do not meet or are likely to move toward these desired future conditions. These differences form the basis of the purpose and need for taking action.

Purpose and Need

The primary need for this project is to remove dead trees from portions of the burn area while the trees still have economic value. Dead trees in the fire area are starting to deteriorate. As a tree deteriorates and rots, so does its value as lumber. Depending on species type, tree size, and other environmental factors, trees can lose their economic value as timber in 12 to 18 months from their death. Most trees suitable for commercial harvest—those that have 12-inch or larger diameters—will lose their economic value within 18 months of their death.

Due to rapid decay rates of trees killed by the fire, trees need to be harvested in a timely manner to recover any economic value of the wood fiber. Salvaging dead trees is one method of providing products to meet the public's demand for wood products and provide economic opportunity for communities and wood products industries.

Proposed Action

The proposed action is designed to meet the purpose and need of the project and involves the following actions (described in greater detail in Chapter 2):

- Harvest activities would include salvaging dead, standing trees with merchantable value that are 12 inches and larger in diameter at breast height (DBH). Harvest would occur on approximately 37,180 acres of lands burned by the Rodeo-Chediski fire. All harvest activities would only occur on moderate and high severity burn areas.

- In areas with slopes less than 40 percent, ground-based yarding systems would be used. These ground-based-systems include tractors, skidders, and other mechanical equipment. On lands with slopes greater than 40 percent, helicopter yarding systems would be used. A site-specific forest plan amendment to the Apache-Sitgreaves and Tonto National Forest Plans would be required to harvest in areas with slopes over 40 percent.

- Fuelwood, specialty wood products, and other sawtimber sales would be harvested on an additional 7,929 acres of lands. These areas are termed "small sale" areas and are designed to offer smaller quantities of wood products to interested parties.

- Within all harvest units, large snags would be retained for wildlife habitat. Snag retention standards would comply with the forest plans for specific habitat and vegetation types. Logging slash would be left scattered on the ground and lopped to aid in stabilizing soils, preventing erosion, and enhancing visual quality.

- No new permanent road construction is proposed for harvest activities. Road maintenance and temporary road construction activities would be made part of timber sale contracts and would occur prior to or during harvest activities.

- Maintain and repair approximately 249 miles of currently open National Forest System roads to be used for salvage harvest that were damaged during the fire and subsequent weather events.

- Open approximately 117 miles of currently closed National Forest System roads to facilitate salvage operations. Roads would be closed and reseeded after use.

- Construct approximately 19.9 miles (40 segments) of temporary road following Best Management Practice (BMP) design criteria to provide access to landing sites where roads currently do not exist. Roads would be closed and reseeded after use.

- Landings for harvested timber would be located along existing roads wherever possible. Where existing landings are not available, new landings would be constructed close to existing roads. Approximately 19.9 miles (40 segments) of temporary road would be constructed following Best Management Practice (BMP) design criteria to provide access to landing sites. Most temporary road sections would be less than 1,000 feet in length and would be constructed to access safer or environmentally preferable landing areas. Following unit harvest, all temporary roads would be scarified, obliterated, and reseeded.

Salvage harvesting and associated activities could occur over a period up to 3 years, although harvest would be implemented quickly before the commercial value of wood is significantly reduced due to damage from insects, weathering, and decomposition. Fuelwood and specialty wood products sales would be made available longer than salvage harvest. These sales would occur over a period up to 10 years.

Forest Plan Amendment

In 1996, the Apache-Sitgreaves and Tonto National Forest Plans were amended by a "Record of Decision for Forest Plan Amendments to Southwestern Region National Forests." The Record of Decision (ROD) was designed to be consistent with the management direction of the U.S. Fish and Wildlife Service Mexican Spotted Owl Recovery Plan. The recovery plan included recommendations for the protection of Mexican spotted owl habitat in southwestern forests. The portion of the Mexican spotted owl habitat management standard in the 1996 amendment that is applicable to the project area prior to the fire, states: "Allow no timber harvest except for fire risk abatement in mixed conifer and pine-oak forests on slopes greater than 40% where timber harvest has not occurred in the last 20 years." (USDA, 1996 p 70-3)

Current Situation

The Rodeo-Chediski Fire severely burned portions of drainages leading into Canyon Creek on both the Apache-Sitgreaves and Tonto National Forests. Along the face of the Mogollon Rim, from Valentine Ridge to Mule Creek Point, the fire was responsible for damaging Mexican spotted owl habitat, consisting of four PACs, and mixed conifer and pine-oak forests on slopes greater than 40 percent where timber harvest has not occurred in the last 20 years.

Proposed Amendment

The Apache-Sitgreaves and Tonto National Forest Plans were developed to guide forest management in healthy forest conditions. Although current forest plan direction for both forests prohibits salvage harvest in protected areas for Mexican spotted owl and northern goshawk species, these areas have changed in appearance and biological function since the fire, and no longer represent the fully functional habitat for which the forest plan standards and guides were intended. The proposed project-specific amendment is designed to clarify the intent of the plans, consider the extent and effects of the Rodeo-Chediski Fire, and guide project implementation regarding management activities in these areas.

Existing Forest Plan Standard: Allow no timber harvest except for fire risk abatement in mixed conifer and pine-oak forests on slopes greater than 40 percent where timber harvest has not occurred in the last 20 years (Apache-Sitgreaves Forest Plan, Amendment 6, p. 70-1, 06/05/96 and Tonto Forest Plan, Amendment 22, p. 40-2, 06/05/96).

Amendment to Standard: Allow harvest of burned, dead trees on slopes over 40 percent in portions of the headwaters of the Canyon Creek drainage that have, as a result of the Rodeo-Chediski Fire, reverted to vegetation structural stage 1 (VSS1), grass and forbs.

It was determined that this action would not be a significant amendment to either of the forest's plans. See the Forest Plan Amendment Determination of Significance, located in the project record, for more information.

Relationship to Forest Plan

The 1985 Tonto National Forest Plan and 1987 Apache-Sitgreaves National Forests Plan set forth broad, programmatic direction for all resource management programs and resource activities on the forests. They embody the provisions of the National Forest Management Act (NFMA) and its implementing regulations. This DEIS is a project level analysis, and is designed to reflect the goals and objectives outlined within the plan.

Forest Plan Management Area Direction

The forest plans for the Apache-Sitgreaves and Tonto National Forests assign management areas (MAs) to regions of the forests to guide forest management. Descriptions of MAs and associated goals and standards are described in Chapter 3 of both forest plans. The following provides a brief summary of management area goals for those areas located within the burn area.

The project area includes: MA 01 (Forest Lands), MA 02 (Woodlands), MA 03 (Riparian Areas), and MA 11 (Water) on the Apache-Sitgreaves National Forests, and MA 5D on the Tonto National Forest.

MA 01 – For forest lands, management emphasis is a combination of multiple uses including a sustained yield of timber and firewood production, wildlife habitat, livestock grazing, watershed, and dispersed recreation.

MA 02 – Management emphasis for woodlands consists of fuelwood production, wildlife habitat, watershed condition, and livestock grazing. Other resources are managed in harmony with the emphasized resources.

MA 03 – Management emphasis for riparian areas recognizes "the importance and distinctive values of riparian areas when implementing management activities" by giving preferential consideration to riparian area dependent resources (as defined in the FLMP, p. 277-1; note that these resources include watershed condition) in cases of unsolvable conflicts, managing to maintain or improve riparian areas to satisfactory riparian condition (as defined in the FLMP, page 277-1), and implementing other resource uses and activities to the extent that they support or do not adversely affect riparian dependent resources. Management emphasis of riparian (MA 03) is directed at areas with riparian dependent resources in the priority order of: threatened and endangered species; cold water fisheries; warm water fisheries; and all other riparian areas.

MA 11 – Management emphasis for water resources consists of the production of fish and wildlife including waterfowl. Areas are managed for dispersed recreation use.

MA 5D – Emphasis is management for a variety of renewable resource outputs with primary focus on intensive, sustained yield timber management, timber resource protection, creation of wildlife habitat diversity, increased populations of emphasis harvest species, and recreation opportunity. Timber harvesting methods and timing will include improvement of wildlife habitat quality and watershed condition, and will consider impacts on intensive range and recreation management. Visual quality protection will be emphasized in the area of the General Crook Trail, a National Recreation Trail.

Project Scope and Decision Framework

The actions proposed in this document are not intended to serve as a general management plan for the fire area. If the responsible official selects an action alternative as a result of the analysis, implementation of the activities specifically identified will begin as soon as possible and without further NEPA documentation. The responsible official could also modify alternatives to address issues at the time of the decision.

The responsible officials for this proposal are the forest supervisors. Based on the analysis in the Final EIS, the responsible officials will make the following decisions and document them in a Record of Decision:

- The extent and timing, if any, of salvage activities. If implemented, where and how these activities would be conducted.
- Management requirements and mitigation measures.
- Appropriate monitoring requirements to evaluate project implementation.
- Whether or not a site-specific forest plan amendment is required for implementation.

Implementation of the decision for this EIS is contingent upon resource constraints, or conditions, available budgets, and agency priorities.

Chapter 3 of this document analyzes the direct and indirect effects of the proposed action and alternatives, and the cumulative effects of this and other activities (past, present, and reasonably foreseeable future) to existing resources. These include a variety of past events and management activities, including the Rodeo-Chediski fire, timber harvesting, and road construction.

Chapter 2 – Alternatives Including the Proposed Action

Introduction

This chapter describes and compares the proposed action and alternatives considered for the Rodeo-Chedeski Fire Salvage Project and how they were developed. It includes a description and map of each alternative considered in detail. This chapter also summarizes the environmental impacts of the proposal and alternatives in comparative form, defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public.

Public Involvement

During and immediately following the Rodeo-Chediski fire, the public remained heavily involved and well informed of the fire-fighting efforts and post-fire (BAER) activities. In addition to media coverage, Incident Command teams assigned to the fire kept the public updated on the fire and its impacts through community meetings and briefings.

The forests initiated and facilitated an open planning process with interested and affected parties. Representatives from interest groups, along with other interested individuals and federal agencies have remained actively involved throughout the planning process.

The planning team conducted meetings in communities near and most directly influenced by the fires. These meetings, along with other outreach and public information efforts, provided the public with an opportunity to discuss post-fire treatment needs. These meetings also provided a forum for the public to review and critique the season's fire fighting efforts, public involvement during the wildfire season, and other particular forest management issues.

The information expressed in comments and at these meetings helped the Forest Service develop long-term management strategies for lands affected by the Rodeo-Chediski fire. This DEIS is only one part of an integrated effort to manage lands within the fire's boundary. Other management and restoration activities will be addressed under separate analyses in compliance with the NEPA and are addressed as reasonably foreseeable actions in the cumulative effects analyses disclosed in Chapter 3.

The Forest Service's public participation process for informing the public on proposed activities in the Rodeo-Chediski fire area included:

- Conducting public field trips through the project area.
- Issuing a Notice of Intent to Prepare and Environmental Impact Statement in the *Federal Register* on September 26, 2002.
- Distributing a scoping letter to notify the public and solicit comments about the proposed project.
- Attending community meetings in communities near and most directly affected by the fire and presenting project information.
- Submitting news releases and information to the media, generating newspaper articles, editorials, and letters to the editor.
- Creating a comprehensive Web site providing links to project information including the DEIS, analyses and reports, public comments, and future public outreach efforts.

- Coordinating volunteer efforts for rehabilitation and disaster relief efforts.
- Developing multimedia presentations for Forest Service staff and the public on the fire, the impacts, and the proposed project.
- Conducting special tours of the project area for government officials and other federal and state agencies.
- Conducting press conferences and media tours for television, radio, and printed media sources.

Involvement of Other Agencies

In addition to involving the general public, the forests consulted with several other agencies for resource data and issue identification as required under 40 CFR 1508.5. Several of these agencies are required by law to administer resources including endangered species, heritage resources, and water quality.

U.S. Fish and Wildlife Service

Under the requirements of Section 7 of the Endangered Species Act (ESA) (16 U.S.C. Section 1531-1544), the forest supervisors are required to consult with the United States Fish and Wildlife Service (USFWS) to determine biological significance of activities on any species designated or proposed as threatened and endangered, or "at risk" (50 CFR Part 402).

In accordance with the ESA Consultation Process (USFWS, et al. August 2001), USFWS biologists have been involved in project planning throughout the analysis process. Fish and Wildlife Service representatives attended field tours and ID team meetings.

Arizona Game and Fish Department

The Arizona Game and Fish Department has worked with the ID team since the fire. Game and Fish Department representatives have consulted on management activities and assisted in developing mitigation measures to best protect wildlife habitat and fisheries.

State Historic Preservation Officer

The Forest Service is required to consult with the Arizona State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (ACHP) under the requirements of Section 106 of the National Historic Preservation Act (16 U.S.C. 470(f). The SHPO advises and assists the agency in carrying out historic preservation responsibilities.

Forest archaeologists and heritage resource specialists have worked with the SHPO to coordinate plans for heritage resource protection, approve appropriate levels of field surveys, evaluate the effects on cultural resource sites, and develop monitoring plans.

Tribal Consultation

The Apache-Sitgreaves and Tonto National Forests consult with all tribes having treaty rights, historic ties, or interests in the two forests. The White Mountain Apache, San Carlos Apache, Tonto Apache, Yavapai-Apache Nation, Yavapai-Prescott Indian Tribe, Pueblo of Zuni, Hopi Tribe, Navajo Nation, and Fort McDowell Indian Community have historic ties and an interest in portions of the Apache-Sitgreaves or Tonto National Forests (or both), and consultation concerning this project proposal is ongoing. Each group has their own history, traditions, and

relationship to the land and to the other groups. Traditional use of this area and its resources by these groups dates back several generations and for some, many centuries.

Scoping

Scoping is an early and open process for determining the scope of the issues to be addressed and for identifying the significant issues related to a proposed action (40 CFR 1501.7).

On August 24, 2002 a scoping notice was mailed to 389 groups, organizations, affected parties, and individuals who asked to be kept informed of activities on the Apache-Sitgreaves and Tonto National Forests in regards to the Rodeo-Chediski fire. In addition to the scoping notice, a Notice of Intent (NOI) to prepare and environmental impact statement was published in the *Federal Register* on September 26, 2002, informing the public of the Forest Service's decision to write an EIS. The public comment period for the NOI ended on November 15, 2002.

Two hundred thirty-two replies were received in response to both documents, including 188 e-mail form letters expressing opposition to any form of management action within the fire area.

Public Comment Analysis

While there is a general agreement among respondents that a change in forest management is needed to prevent future catastrophic fires like the Rodeo-Chediski event, there is divergence in opinion as to how the fire area should be recovered. This debate is driven in large measure by competing social values and conflicting views regarding what constitutes appropriate uses of national forests.

Many respondents who oppose the idea of salvage logging in the burn area consider the area highly disturbed and feel it should recover through natural processes. These people place a high priority on ecosystem protection and feel that the long-term restoration of the burn area supercedes any short-term economic gain from timber harvest. Many of these respondents reference the *Beschta Report* and other scientific studies to sustain their claims that salvage logging after the fire can only further harm these disturbed areas. Trees need to be retained, they add, for nutrient retention and cycling, watershed and soil protection, and wildlife habitat. Some argue that the Forest Service should instead focus on activities such as educating and informing residents about the dangers of living in fire-prone areas and developing prescribed fire plans.

In contrast, some respondents stress the need for prudent removal of timber in the burn. They note that the forests are currently not in healthy condition and feel that timber removal can help stimulate local and regional economic growth, as well as reduce fuels and prevent future catastrophic wildfires. Soil loss and erosion can be prevented, they add, if logging slash is left on the ground. Sustainable resource extraction, in their view, only adds to ecosystem health. Believing it is a waste of natural resources to not utilize burned timber in the area, many support the proposed action and an urgent removal of timber before trees lose their economic value. Many respondents who promote salvage logging also feel that the Forest Service should not close any roads in the area after harvest occurs.

There were many other recommendations on how to best manage and recover the burned area. Suggestions ranged from thinning the entire forest, to implementing major treatments in the Wildland-Urban Interface (WUI), to not managing the area at all and designating it a study area for post-fire effects. Many respondents expressed concern over erosion and soil loss in the area. Suggestions were made to minimize vehicular and mechanical disturbance to prevent further watershed disturbance, and fall dead trees parallel to slopes to aid in erosion control. Other individuals advocate the crushing or chipping of trees to aid in soil stabilization.

There is also dispute over the protection of wildlife habitat in the burn area. Many respondents provided detailed guidance on how to best protect wildlife and their habitat. Salvage logging would jeopardize the viability of species that thrive in disturbed forests and watersheds, some argue. Many respondents feel that all alternatives should retain snags and downed logs for wildlife needs and thermal cover. Contesting this perspective, other respondents claim that there are sufficient numbers of live trees within the project area to provide adequate habitat for remaining wildlife species.

Offering support for new alternatives that would implement ecosystem restoration activities without salvage logging, many respondents suggest that the Forest Service concentrate efforts on educating the public on fire ecology, protecting structures in the WUI, and rehabilitating burned lands in the forests. See the *Alternatives Considered but Eliminated from Detailed Study* section in this chapter for additional information on these alternatives.

Issues

An issue is defined as a discussion, dispute, or debate about the effects of the proposed action. The Rodeo-Chediski fire Interdisciplinary (ID) Team reviewed comments received during the public scoping process to identify issues, determine appropriate analysis procedures, and identify alternatives to the proposed action.

These issues were examined to determine how they could best be addressed in this DEIS and associated analysis processes. Some issues were best addressed by developing alternatives to the proposed action. These are significant issues. Other issues were best addressed by disclosing the effects of implementing the proposed action or its alternatives. These issues are discussed in individual resource sections in Chapter 3. Other issues were best addressed by developing mitigation measures and management requirements that are common to all action alternatives.

Non-significant issues are identified as those that are: outside the scope of the project; already decided by law, regulation, forest plan, or other higher level decision; irrelevant to the decision to be made; or conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations explain the delineation between significant and non-significant issues in Sec. 1501.7. "…Identify and eliminate from detailed study the issues which are not significant and which have been covered by prior environmental review" (Sec. 1506.3). A list of non-significant issues and reasons for their categorization as non-significant can be found in the project record.

Issues Used to Develop Alternatives

The following statements are the significant issues identified by the ID Team and used to develop alternatives to the proposed action. The issue statements are followed by measures, which provide a means to gauge the effects of each alternative.

Issue 1: Salvage logging may cause erosion, sedimentation, and the accompanying loss of soil nutrients in areas that are sensitive or where accelerated soil erosion is possible. Erosion and increased sediment delivery could lead to a loss of productive soils and a decline in water quality downstream.

Measures: Sediment delivery rates, timing of delivery, and percent of ground cover remaining on acres treated.

Issue 2: Salvage logging may reduce habitat or jeopardize the viability of wildlife species that require woody material in their habitat.

Measures: Changes in habitat for specific Management Indicator Species, pre- and post-fire changes in average number of snags per acre at a landscape scale, and average amounts of down logs on the forest floor.

Alternatives Considered in Detail

The Forest Service developed five alternatives, including a No Action alternative and proposed action alternative, in response to issues raised by the public and internal comments, and are considered in detail in the following section. Three other alternatives were considered but eliminated from further detailed analysis. They are listed in the *Alternatives Considered but Eliminated from Detailed Study* section of this chapter.

Alternative 1 – No Action

The "No Action" alternative is required by NEPA; serving as a baseline for the projected effects and displaying existing resource conditions. Under this alternative, no proposed activities would occur. Some previously authorized forest management activities and projects that were unaffected by the fire would continue in their development. Natural restoration processes would recover areas impacted by the fires and previous land uses. Roads currently open for motorized vehicle use would remain open.

This alternative would not preclude forest management activities identified under previous decisions, nor would it preclude the potential for activities identified under future decisions.

Alternative 2 – Proposed Action

Alternative 2 is the Apache-Sitgreaves and Tonto National Forests' proposed action. This action is designed to maximize harvest volumes for sawtimber while providing sufficient mitigation to minimize impacts to all affected resource areas. The proposed action includes management activities to:

- Harvest dead standing trees with merchantable value that are 12 inches and larger diameter at breast height (dbh) on approximately 37,180 acres of lands burned by the Rodeo-Chediski fire.
- Utilize ground-based yarding systems (tractors, skidders, and other mechanical equipment) in areas with slopes less than 40 percent, yielding approximately 84 million board feet (mmbf) of timber.
- Utilize helicopter yarding systems in areas with slopes greater than 40 percent, yielding approximately 9.8 mmbf of timber. A site-specific forest plan amendment to the Apache-Sitgreaves and Tonto National Forest Plans would be required to harvest in areas with slopes over 40 percent.
- Harvest fuelwood, specialty wood products, and other sawtimber on an additional 7,929 acres of lands, yielding approximately 11.8 mmbf of specialty wood products and sawtimber, and 9,900 cords of fuelwood. These areas are termed "small sale" areas and are designed to offer smaller quantities of wood products to interested parties.
- Maintain and repair approximately 249 miles of currently open National Forest System roads that were damaged during the fire and subsequent weather events for use during salvage harvest.

- Open approximately 117 miles of currently closed National Forest System roads to facilitate salvage operations. Roads would be closed and reseeded after use.
- Construct approximately 19.9 miles (40 segments) of temporary road following Best Management Practice (BMP) design criteria to provide access to landing sites where roads currently do not exist. Roads would be closed and reseeded after use.

Harvest Activities

In total, dead trees would be salvaged from 45,109 acres of land within the burned area under this alternative. For all alternatives including the proposed action, harvest activities would occur only on moderate and high severity burn areas and treat only dead trees. Dead trees are defined as trees that contain no green needles. Burn severity maps were used preliminarily to determine treatment areas. Due to the mosaic pattern of the burn, however, these maps could only reveal burn severity to a certain degree. The maps did not always reveal small areas of low severity or unburned timber within larger areas of moderate or high severity burns, and vice versa. Supplemental ground truthing has been used to determine actual treatment areas.

For all action alternatives, logging slash would be left scattered on the ground and lopped to aid in stabilizing soils, preventing erosion, and enhancing visual quality.

Implementation monitoring in these salvage areas would occur to ensure that only dead trees are harvested. Specific harvest activity management standards for Alternative 2 are listed in Table 7 – Mitigation Measures.

Wildlife Habitat Management

Within all salvage units, large snags would be retained for vertical structure, wildlife habitat, and long-term nutrient cycling. Snag retention standards would comply with the forest plans for specific habitat and vegetation types.

Within areas proposed for treatments that were formerly ponderosa pine stands, two snags and three downed logs would be left per acre. Within areas that were formerly mixed conifer stands, three snags and five downed logs would be left per acre. Snags would be at least 18 inches at dbh and 30 feet tall. Downed logs would be at least 12 inches in diameter at mid-length and at least 10 feet long. Harvest in areas containing oak and juniper species would be subject to maximum diameter limits to provide snags and habitat for wildlife species.

Both wildlife and soil and watershed mitigation measures serve to reduce harm to fisheries and aquatic habitat. No salvage harvest would take place within 100 feet of springs or perennial tanks. In areas with a slight erosion hazard no salvage harvest would take place within 100 feet of the top of each stream bank. In areas with moderate or severe erosion hazard no salvage harvest would take place within 150 feet of the top of each stream bank. Specific wildlife mitigation measures for Alternative 2 are listed in Table 7 – Mitigation Measures.

Road Management Activities

A Roads Analysis Process (RAP) was performed on forest system roads that would be used in salvage activities in the burn area. This was done to identify those roads needing improvement and maintenance to provide a safe, effective, and economical transportation system for salvage logging operations and future public use. No new permanent road construction is proposed for harvest activities.

Road maintenance and temporary road construction would be made part of timber sale contracts and would occur prior to or during harvest activities. Road work activities are expected to be completed within approximately two years.

A summary of road work activities is listed in Table 10 – Road Maintenance Activities. A complete listing of specific proposed road maintenance activities and temporary road construction details is listed in the project record under *Transportation Management*. Mitigation measures for all road-related activities are listed in Table 7 – Mitigation Measures.

Road Maintenance

Roads would be maintained during and after harvest activities following Best Management Practice (BMP) design criteria. Roads currently closed that would be used for harvest activities would be closed and reseeded after salvage activities have occurred.

Road maintenance activities would include replacing or removing culverts, restoring natural drainage patterns, installing drainage dips and other surface water diversions, constructing turnouts, employing dust abatement treatments, applying gravel surfacing and/or borrow to segments that are maintained on poor soils or near streams, installing sediment filters between streams and road fills, surfacing road segments and hardening crossings, and installing road-guide signs.

Culvert replacement would be designed to stabilize streambanks and bottoms and improve road conditions. New culverts would be designed to match natural stream gradients and provide natural stream bottom characteristics.

Temporary Roads

Landings for harvested timber would be located along existing roads wherever possible. Where existing landings are not available, new landings would be constructed close to existing roads. Temporary roads would be constructed between those landing sites and haul routes where roads do not exist. Most temporary road sections would be less than 3,000 feet in length and would be constructed to access safer or environmentally preferable landing areas.

Following unit harvest, all temporary roads would be scarified and obliterated. Obliteration efforts would include reshaping the road prism to match the original contour, placing slash and woody debris on the disturbed area, and seeding the disturbed area.

Forest Plan Amendment

Alternative 2 would require a non-significant amendment to the Apache-Sitgreaves and Tonto National Forest Plans to allow timber harvest on slopes over 40 percent. See Chapter 1 for further detail on this amendment.

Timing of Proposed Action

Salvage harvesting and associated activities would occur over a period of up to 3 years. Salvage would be implemented quickly, before the commercial value of wood is significantly reduced due to damage from insects, weathering, and decomposition.

Fuelwood and specialty wood products sales would be made available longer than salvage harvest activities. These sales would occur over a period up to 10 years.

Harvest activities would comply with certain seasonal and weather-related restrictions to protect soils and wildlife species. These restrictions are listed in Appendix C – PAC and PFA Management Restrictions.

Alternative 3

Areas proposed for harvest in Alternative 3 were selected in response to issue 1, that logging may cause erosion in areas with sensitive soils or where accelerated soil erosion is possible. Alternative 3 also responds to issue 2, minimizing the risk of salvage activities to wildlife populations in the fire area, especially in the Canyon Creek and Mule Creek drainages that may still contain habitat for MSO populations and critical fisheries.

To best address these issues, Alternative 3 does not include harvest activities on steep slopes over 40 percent or in Terrestrial Ecosystem Survey (TES) soil units classified as having severe erosion potential. See Appendix G, map 8, east and west, of alternative 3 for specific treatment area boundaries. Alternative 3 includes management activities to:

- Harvest dead standing trees with merchantable value that are 12 inches and larger diameter at breast height (dbh) on approximately 30,770 acres of lands burned by the Rodeo-Chediski fire.
- Utilize ground-based yarding systems (tractors, skidders, and other mechanical equipment) in areas with slopes less than 40 percent, yielding approximately 48.4 mmbf of timber.
- Harvest fuelwood, specialty wood products, and other sawtimber on an additional 7,763 acres of lands, yielding approximately 6.8 mmbf of specialty wood products and sawtimber, and 8,700 cords of fuelwood.
- Maintain and repair approximately 221 miles of currently open forest system roads that were damaged during the fire and subsequent weather events for use during salvage harvest.
- Open approximately 88 miles of closed National Forest System roads to facilitate salvage operations. Roads would be closed and reseeded after use.
- Construct approximately 14.2 miles (30 segments) of temporary road following Best Management Practice (BMP) design criteria to provide access to landing sites. Roads would be closed and reseeded after use.

Mitigation measures for all action alternatives can be found in Table 7, and those specific to this alternative can be found in Table 8.

Harvest Activities

In total, dead trees would be salvaged from approximately 38,533 acres of land within the burned area under this alternative. Harvest would not occur in areas with slopes over 40 percent, or in TES soil units classified as having severe soil erosion potential. These areas were identified by the ID team as the most sensitive areas in the burn area and are a priority for rehabilitation efforts. Specific harvest activity standards for Alternative 3 are listed in Table 7 – Mitigation Measures.

Wildlife Habitat Management

In response to public concerns regarding the amount of wildlife habitat retained, snag volume retention would increase under this alternative compared to Alternative 2. Snag retention would start with the largest trees in the harvest area instead of starting with the 18-inch dbh requirements of Alternative 2.

In addition, snags would be retained in areas adjacent to Protected Activity Centers (PACs) and Post-Fledgling Family Areas (PFAs) in higher densities than under alternative 2. Under alternative 3, areas proposed for treatment within a quarter-mile of PFAs and PACs would have five of the largest snags and three downed logs left per acre.

Diameter limits for oak and juniper species would be identical to Alternative 2 to provide snags and habitat for wildlife species in these woodland areas.

Road Management Activities

Road maintenance activities for Alternative 3 would be similar to those described in Alternative 2 in areas where harvest occurs on slopes less than 40 percent. Since no harvest would occur on slopes over 40 percent, road management activities would not occur in the Canyon Creek and Mule Creek drainages. Because harvest would not occur in as many areas as Alternative 2, only 13 miles of temporary roads would be constructed to access landing areas. A summary of road work activities is listed in Table 10 – Road Maintenance Activities. A complete listing of specific proposed road maintenance activities and temporary road construction details for this alternative can be found in the project record under *Transportation Management.*

Forest Plan Amendment

Alternative 3 would not require any site-specific amendments to the Apache-Sitgreaves and Tonto National Forest Plans.

Timing of Proposed Action

Implementation of Alternative 3 would occur over the same time periods as those described in Alternative 2.

Alternative 4

Alternative 4 responds to issue 2, the potential impacts of management activities on wildlife habitat. Similar to Alternative 3, this alternative does not include harvest activities on steep slopes in the Canyon Creek and Mule Creek drainages to reduce impacts to MSO populations and critical fisheries. Snag and downed log retention standards would be identical to Alternative 3. Logging would be allowed, however, on TES soil units with severe erosion potential. See Appendix G, map 9 east and west of alternative 4 for specific treatment area boundaries. Alternative 4 includes management direction to:

- Harvest dead standing trees with merchantable value that are 12 inches and larger diameter at breast height (dbh) on approximately 34,156 acres of lands burned by the Rodeo-Chediski fire.
- Utilize ground-based yarding systems (tractors, skidders, and other mechanical equipment) in areas with slopes less than 40 percent, yielding approximately 68.3 mmbf of timber.

- Harvest fuelwood, specialty wood products, and other sawtimber on an additional 6,903 acres of lands, yielding approximately 7.5 mmbf of specialty wood products and sawtimber, and 7,300 cords of fuelwood.
- Maintain and repair approximately 223 miles of currently open forest system that were damaged during the fire and subsequent weather events for use during salvage harvest.
- Open approximately 100 miles of currently closed National Forest System roads to facilitate salvage operations. Roads would be closed and reseeded after use.
- Construct approximately 18.2 miles (36 segments) of temporary road following Best Management Practice (BMP) design criteria to provide access to landing sites. Roads would be closed and reseeded after use.

Mitigation measures for all action alternatives can be found in Table 7, and those specific to this alternative can be found in Table 8.

Harvest Activities

In total, dead trees would be salvaged from approximately 41,059 acres of land within the burned area under this alternative. Similar to Alternative 3, harvest would not occur in areas with slopes over 40 percent.

Wildlife Habitat Management

In response to issue 2, Alternative 4 includes the same snag retention standards as those described in Alternative 3.

Diameter limits for oak and juniper species would be identical to Alternative 2 to provide snags and habitat for wildlife species in these woodland areas.

Specific harvest activity standards for Alternative 4 are listed in Table 7 – Mitigation Measures.

Road Management Activities

Road maintenance activities for Alternative 4 would be similar to those described in Alternative 2 in areas where harvest occurs on slopes less than 40 percent. Since no harvest would occur on slopes over 40 percent, road management activities would not occur in the Canyon Creek and Mule Creek drainages. Because harvest would not occur in as many areas as Alternative 2, only 16.5 miles of temporary roads would be constructed to access landing areas.

A summary of road work activities is listed in Table 10 – Road Maintenance Activities. A complete listing of specific proposed road maintenance activities and temporary road construction details for this alternative is listed in the project record under *Transportation Management*.

Forest Plan Amendment

Alternative 4 would not require any site-specific amendments to the Apache-Sitgreaves and Tonto National Forest Plans.

Timing of Action

Implementation of Alternative 4 would occur over the same time periods as those described in Alternative 2.

Alternative 5

Alternative 5 was developed to provide an alternative responsive to issue 2, by minimizing management activities on steep slopes in the Canyon Creek and Mule Creek drainages, while maximizing timber volumes in other areas. Similar to Alternatives 3 and 4, no harvest would occur in these drainages to reduce impacts to MSO populations and limit soil disturbing activities on steep slopes. On areas with slopes under 40 percent, however, harvest activities, habitat management, and road work activities would be identical to those described in Alternative 2. This alternative would provide the greatest timber volume out of Alternatives 3, 4, and 5. See map10 of alternative 5 in Appendix G for specific treatment area boundaries. Alternative 5 includes management direction to:

- Harvest dead standing trees with merchantable value that are 12 inches and larger diameter at breast height (dbh) on approximately 37,180 acres of lands burned by the Rodeo-Chediski fire.
- Utilize ground-based yarding systems (tractors, skidders, and other mechanical equipment) in areas with slopes less than 40 percent, yielding approximately 84 million board feet (mmbf) of timber.
- Harvest fuelwood, specialty wood products, and other sawtimber on an additional 7,929 acres of lands, yielding approximately 11.8 mmbf of specialty wood products and sawtimber, and 9,900 cords of fuelwood.
- Maintain and repair approximately 234 miles of currently open forest system roads that were damaged during the fire and subsequent weather events for use during salvage harvest.
- Open approximately 105 miles of currently closed National Forest System roads to facilitate salvage operations. Roads would be closed and reseeded after use.
- Construct approximately 19.0 miles (38 segments) of temporary road following Best Management Practice (BMP) design criteria to provide access to landing sites. Roads would be closed and reseeded after use.

Mitigation measures for all action alternatives can be found in Table 7, and those specific to this alternative can be found in Table 8.

Harvest Activities

In total, dead trees would be salvaged from 42,850 acres of land within the burned area under this alternative. Salvage treatment areas would be identical to those described in Alternative 2 for areas with slopes under 40 percent. Similar to Alternatives 3 and 4, harvest would not occur in areas with steep slopes over 40 percent.

Wildlife Habitat Management

Snag and downed woody debris retention standards would be the same as those described in Alternative 2.

Road Management Activities

Road maintenance activities for Alternative 5 would be identical to those described in Alternative 2 for areas where harvest occurs on slopes less than 40 percent. Since no harvest would occur on slopes over 40 percent, road management activities would not occur in the Canyon Creek and

Mule Creek drainages. Because harvest would not occur in as many areas as Alternative 2, only 17 miles of temporary roads would be constructed to access landing areas. A summary of road maintenance activities is listed in Table 10 – Road Maintenance Activities. A complete listing of specific proposed road maintenance activities and temporary road construction details for this alternative can be found in the Project record under *Transportation Management.*

Forest Plan Amendment

Alternative 5 would not require any site-specific amendments to the Apache-Sitgreaves and Tonto National Forest Plans.

Timing of Action

Implementation of Alternative 5 would occur over the same time periods as those described in Alternative 2.

Mitigation Measures

The mitigation measures listed in Table 7 and Table 8 are prescribed to avoid, minimize, or compensate for any adverse environmental effects that may occur during project implementation. The following environmental protection measures would be employed in all action alternatives to mitigate the effects of conducting activities in areas where potential impacts to resources are anticipated. They are designed to address issues from public comments as well as meet Best Management Practice standards.

Table 7 - Mitigation measures common to all action alternatives

Mitigation Measure ID	Mitigation Measure and Management Description	Alternatives
Soils and Watershed – General Treatments		
SOILS-M-1	Limit ground disturbing activities (tractor skidding, decking, machine piling, etc.) to dry or frozen conditions especially on soil map units 183, 191, 192, 193, 197, 198, and 202. This would reduce compaction and soil displacement (rutting) associated with timber harvesting activities on sensitive soils when they are wet or saturated.	2, 3, 4, 5
SOILS-M-2	At the discretion of the Sale Administrator, restrict hauling and skidding during wet periods to prevent damage to soils or road systems. See AS NF Guidelines for Excessive Rutting, 6/10/92. These guidelines are applicable to any TES unit but particularly to units 53, 187, 198, and 202.	2, 3, 4, 5
SOILS-M-3	Slope Limitations for Logging: Limit salvage and removal of trees to areas with slopes less than 40% for ground-based logging. Operating on or near the contour, where possible, allows for natural drainage of skid trails, minimizing gully formation within skid trails.	2, 3, 4, 5
SOILS-M-4	Employ a “felling to lead” method to complement skidding practices. This practice involves felling trees toward a predetermined pattern. Allow operators to skid in random patterns to minimize soil compaction associated with single skid trails.	2, 3, 4, 5

Mitigation Measure ID	Mitigation Measure and Management Description	Alternatives
SOILS-M-5	Employ directional felling and end-lining to minimize damage to live vegetation and soils, especially in Streamside Management Zones.	2, 3, 4, 5
SOILS-M-6	Design, locate, and use designated skid trails when skidding logs through areas not receiving treatment (such as unburned or low-severity burn areas).	2, 3, 4, 5
SOILS-M-7	Select landing locations and sizes that minimize vegetation and soil loss. After harvest, close landings by scarifying them, placing slash and woody debris on disturbed areas, and seeding them.	2, 3, 4, 5
SOILS-M-8	Lop all logging slash to a 2-foot height.	2, 3, 4, 5
Soils and Watershed – Channel Treatments		
SOILS-M-9	Fall dead trees away from the channel in bottom areas along 2nd order streams with defined bed and banks. Avoid felling into or across drainages.	2, 3, 4, 5
SOILS-M-10	In channels, remove dead and down salvage generated debris that may become mobilized in flood events, deposited in debris jams, and lodged downstream in constricted channel reaches, culverts, bridges, and/or spillways.	2, 3, 4, 5
Stream Channel Protection: The following guidelines apply to Streamside Management Zones (SMZs).		
SOILS-M-11	Minimum Filter Strip Widths in Streamside Management Zones: In areas with “Slight” erosion hazard: 100 feet (slope distance) on each side of the stream channel from the top of each bank. (TES Mapping Units 53, 178, 183, 186, 191, 193, 197, 198, and 5078).	2, 3, 4, 5
SOILS-M-12	Minimum Filter Strip Widths in Streamside Management Zones: In areas with “Moderate” or “Severe” erosion hazard: 150 feet (slope distance) on each side of the stream channel from the top of bank. (TES Mapping Units 52, 54, 55, 181, 182, 187, 192, 189, 202, 5161, 5080, 5162, and 6405).	2, 3, 4, 5
SOILS-M-13	Permitted activities within filter strips are limited to: Directional felling of trees away from the channel, and not across it; ground skidding or end-lining logs out of the area; skidding perpendicular across channels at designated crossings; and decking of logs and machine piling permitted only along existing roads that are already located within filter strips.However, logs must be decked at least 100 feet away from the channel and only on the uphill side of the road away from the channel.	2, 3, 4, 5
SOILS-M-14	Activities not permitted within filter strips: Skidding up or down the filter strip or within the stream channel; new road construction; piling and burning of slash; and refueling or servicing of equipment.	2, 3, 4, 5

Mitigation Measure ID	Mitigation Measure and Management Description	Alternatives
The following guidelines apply to all stream channels:		
SOILS-M-15	Cross all drainages at designated crossings only. Roads and skid trails need to cross drainages perpendicular to the channel.	2, 3, 4, 5
SOILS-M-16	Maintain leadout ditches and waterbars to divert runoff from the road directly away from stream channels. Runoff shall be discharged onto areas far enough away from streams so sediment can be deposited before reaching a watercourse.	2, 3, 4, 5
SOILS-M-17	Remove debris generated from product harvest activities away from stream channels. Operating equipment within channels shall be avoided. Removal of material by hand or through end-lining is allowed. NOTE: Slash and debris can be left in first order headwater channels of ephemeral drainages designated by the district watershed representative, where slash can help retain runoff and sediment and provide headcut stabilization.	2, 3, 4, 5
SOILS-M-18	If dead trees are harvested from channel banks, directionally fell trees away from the channel, rather than across it.	2, 3, 4, 5
The following guidelines apply to the protection of bottom areas, low points, swales, or depressions in headwater areas of ephemeral channels: (These areas may not have well-defined channel bottoms or banks).		
SOILS-M-19	Ensure that no skidding occurs up or down channel bottoms.	2, 3, 4, 5
SOILS-M-20	Ensure that no temporary road construction occurs within 75 feet of ephemeral channels.	2, 3, 4, 5
SOILS-M-21	Minimize the number of skid trails and road crossings over drainages and keep them perpendicular to the channel.	2, 3, 4, 5
SOILS-M-22	Cut only dead trees within channels or swales. High stumping would be allowed to facilitate catching debris during floods.	2, 3, 4, 5
SOILS-M-23	Ensure that logs are not decked within ephemeral streams or swales.	2, 3, 4, 5
Heritage Resources		
HERIT-M-1	The forest archaeologist may approve additional measures to further protect sites; however, if a lesser level of protection is recommended, or if it is likely that adverse effects cannot be avoided, the forest shall consult with the SHPO on additional protection measures prior to approving Heritage Resources Clearance and prior to implementation of each phase of the project.	2, 3, 4, 5
HERIT-M-2	Treat all sites not currently evaluated for National Register eligibility as eligible for the National Register for all levels of project(s) implementation.	2, 3, 4, 5

Mitigation Measure ID	Mitigation Measure and Management Description	Alternatives
HERIT-M-3	Ensure that no use of mechanized equipment (trucks, skidders, chippers, crushers, e.g.) occurs within established site boundaries.	2, 3, 4, 5
HERIT-M-4	Ensure that no staging of equipment or supplies occurs within established site boundaries.	2, 3, 4, 5
HERIT-M-5	Ensure that no logging slash is piled within site boundaries.	2, 3, 4, 5
HERIT-M-6	Directionally fell large-sized dead standing trees away from site features within and adjacent to established site boundaries to avoid uprooting and site damage. Trees will be left on site and felled using hand-falling techniques only.	2, 3, 4, 5
HERIT-M-7	Scatter logging slash to limit fuel concentration within established site boundaries and provide erosion protection.	2, 3, 4, 5
HERIT-M-8	Ensure that no snags are designated on identified heritage sites.	2, 3, 4, 5
Forest Infrastructure and Roads		
ROADS-M-1	Employ dust abatement to reduce hazards caused from poor visibility and to minimize dust on road sections adjacent to private land. Magnesium chloride or lignin will not be permited on 400-foot sections of roads identified in Appendix-F of the Biological Assesment and Evaluation.	2, 3, 4, 5
ROADS-M-2	Install signs in accordance with MUTCD (Manual on Uniform Traffic Control Devices, 2000 edition).	2, 3, 4, 5
ROADS-M-3	Construct turnouts or double lane sections in accordance with FSH 7709.56. No additional turnouts will be constructed from Gentry lookout west on FR300 for one mile.	2, 3, 4, 5
ROADS-M-4	Restrict activities on weekends and holidays on high use travel routes. Close FR86 to public traffic from Gibson Ranch road to FR300 during harvest activities.	2, 3, 4, 5
ROADS-M-5	Restrict hauling on unsurfaced roads to dry or frozen conditions.	2, 3, 4, 5
ROADS-M-6	Employ radio communication and and install mile-posting signs to warn operators of traffic conditions.	2, 3, 4, 5
ROADS-M-7	Implement road closures and/or one way travel restrictions during logging and salvage activities to minimize conflicts with haul vehicles.	2, 3, 4, 5
ROADS-M-8	Install additional signing on State 60 and 260 during harvest or road work activities and consider adding flag people under extremely heavy traffic conditions.	2, 3, 4, 5

Mitigation Measure ID	Mitigation Measure and Management Description	Alternatives
ROADS-M-9	Obliterate temporary roads by scarifying roadbeds, reshaping the road prism to match the original contour, placing slash and woody debris on the disturbed area, and seeding the disturbed area.	2, 3, 4, 5
ROADS-M-10	Discharge drainage from the road prism and associated ditches into buffer strips (or scattered slash piles) where its energy can be dispersed and sediment can drop out before reaching the natural drainage system. If this is not possible, relocate that portion of the road away from the channel or identify it as needing future relocation as part of the long-term rehabilitation of the burned area.	2, 3, 4, 5
ROADS-M-11	Improve or correct rolling dips, stream crossings, and culverts. Extend and enlarge, as needed, the raised portion of water bars on the uphill side of the road to ensure all flow from ditches or drainages is diverted across the road.	2, 3, 4, 5
ROADS-M-12	Install hardened drainage crossings at natural grade. Additional rolling dips or water bars are preferred to culverts to divert water off roads and out of roadside ditches.	2, 3, 4, 5
Wildlife		
WILD-M-1	Ensure that oaks with a main stem of 10 inches dbh or greater are not harvested.	2, 3, 4, 5
WILD-M-2	Ensure that junipers 18 inches" dbh or greater are not harvested.	2, 3, 4, 5
WILD-M-3	In woodland species type, leave at least 100 snags per 100 acres on 40 percent of the pinyon juniper woodland acres in each diversity unit. Snags are defined for this species type as at least 9 inches diamter at root collar (DRC) and at least 10 feet high.	2, 3, 4, 5
Chiricahua Leopard Frog		
WILD-M-4	Establish a 100 foot no-action buffer around potential habitat. Complete surveys for the Chiricahua leopard frog prior to any activities in or within 100 feet of potential habitat. Potential habitat consists of any ponds, lakes, or streams in the analysis area. Magnesium chloride or lignin will not be permited on 400-foot sections of roads identified in Appendix-F of the Biological Assesment and Evaluation.	2, 3, 4, 5
Mexican Spotted Owls		
Mitigation measures for Mexican spotted owls are listed on a PAC-by-PAC basis, see Appendix C – Wildlife Management Restirctions.		
WILD-M-5	Maintain a speed limit of 25 m.h. through all PACs or areas within ¼ mile of PACs to minimize vehicle-owl collisions.	2, 3, 4, 5

Mitigation Measure ID	Mitigation Measure and Management Description	Alternatives
	Northern Goshawks	
Mitigation measures for northern goshawks are on a PFA by PFA basis, see Appendix C – Wildlife Management Restrictions. These mitigation measures assume that treatments would only take place in medium and high severity burn locations.		

The following alternative specific environmental protection measures are designed to mitigating impacts to resources.

Table 8 – Alternative specific mitigation measures

Mitigation Measure ID	Mitigation Measure and Management Description	Alternatives
Wildlife		
WILD-M-6	Create a ¼ mile no-fly zone for helicoptors around Canyon Creek Fish Hatchery to reduce disturbance to Bald Eagles.	2
WILD-M-7	In areas that were formally mixed conifer habitats and are proposed for treatments, leave 3 snags and 5 dead and down trees per acre. Snags would be selected from the largest trees on site and left in groups of 2 to 6 snags.	3, 4
WILD-M-8	In areas that were formally ponderosa pine habitats and are proposed for treatments, leave 2 snags and 3 dead and down trees per acre. Snags would be selected from the largest trees on the site and left in groups of 2 to 6 snags.	3, 4
WILD-M-9	Within a quarter-mile of PFAs and PACs, leave 5 of the largest snags per acre and 3 logs 12 inches in diameter or greater at the midpoint and 10 feet or greater in length.	3, 4
WILD-M-10	In areas that were formerly mixed conifer habitats and are proposed for treatments, leave 3 snags, preferably in groups of 2-6, and 5 logs per acre. Snags would be at least 18 inches DBH and 30 feet tall. Logs would be at least 12 inches in diameter at mid-length and at least 10 feet long.	2, 5
WILD-M-11	In areas that were formerly ponderosa pine habitats and are proposed for treatments, manage for 2 snags, preferably in groups of 2-6, and 3 logs per acre. Snags would be at least 18” DBH and 30 feet tall. Logs would be at least 12” in diameter at mid-length and at least 10 feet long.	2, 5
WILD-M-12	No salvage logging activities, not including haul truck traffic, will be implemented within one mile of the active peregrine falcon nesting habitat between March 1 and August 15.	2

Monitoring Measures

Monitoring would be used to determine whether the objectives of the project were met and if additional action is needed. Monitoring provides project planning with a quality control element, allowing the agency to compare the end results to those projected and apply new knowledge to similar projects in the future. Monitoring activities can be divided into forest plan monitoring and project-specific monitoring.

Project-specific implementation monitoring would be used to determine if the goals, objectives, guidelines, and standards of the forest plans are achieved.

For this project, monitoring would be conducted in accordance with the requirements outlined in both the Apache-Sitgreaves and Tonto National Forest Plans.

Monitoring for sale activities would occur during and immediately following sale implementation. Forest Service representatives would monitor unit layouts, road closures, road maintenance activities, and harvest operations to ensure compliance with contract requirements and specifications.

A more detailed monitoring plan for this project is located in Appendix F – Monitoring Plan. A summary of monitoring activities grouped by resource areas is listed there.

Vegetation and Forest Resources

Surveys would be conducted on all treatment areas after salvage activity is completed to determine whether treatment objectives were effective and met the desired vegetation conditions including the amount of snags and downed woody debris. Monitoring during harvest would be conducted to ensure that only dead trees are harvested in moderate and high severity burn areas.

Changes in canopy structure and seral stage, and the number of acres treated would be monitored and recorded.

Fuels

Timber stands would be monitored before and after treatment to determine changes and trajectories in fuel levels.

Soils

Field reviews would be conducted during harvest to ensure compliance with Best Management Practices. Ground cover would be monitored before and after project implementation to estimate soil stability and sediment delivery.

Visual Resources

Critical viewing points would be established during project layout and used to monitor the changes in visual appearance. Viewing points would be used to assess the change in visual patterns in harvest units and in areas where road maintenance activities occur.

Heritage Resources

Monitoring of heritage sites would occur during and after harvest activities to ensure compliance with established mitigation measures for site protection.

Infrastructure and Transportation Systems

Roads would be monitored after harvest occurs to determine the effectiveness of road closures and rehabilitation practices. Areas reseeded after road closure would be monitored to ensure regeneration success and need for additional seeding. Areas disturbed during road maintenance and temporary road construction activities would be monitored to determine needs for additional soil stabilization measures and improvement of BMPs.

Water and Hydrologic Resources

Peak flows before and after treatment, as well as subsequent changes in stream morphology would be monitored to determine whether treatments have caused any detrimental impacts to stream channels.

Wildlife

Gross changes in acres of MSO and northern goshawk habitat resulting from project activities would be measured. Acreage changes in vegetation, composition, structure, and density would be recorded and reported.

Timber stands would be monitored before and after treatment to determine changes and trajectories in snag basal areas, volume of snags and down logs, and basal area of hardwood trees. Current Habitat Quality Indices (HQI) and forage/cover ratios for MIS species would be calculated.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by the National Environmental Policy Act (NEPA) to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the proposed action provided suggestions for alternative methods to manage lands affected by the Rodeo-Chediski fire. The following alternatives were considered, but eliminated from detailed study for reasons cited below:

- A "Conservation and Local Economy" alternative was proposed by respondents that would carry out ecosystem restoration activities without salvage logging, and concentrate efforts on protecting structures in the wildland-urban interface (WUI). This alternative was considered but eliminated from detailed study because it fails to meet the purpose and need of this project to recover some of the value of the timber killed by the Rodeo-Chediski fire.

- Another respondent suggested a similar alternative that "focuses on the natural recovery of the burned area while providing for local economies." This alternative would provide for WUI treatments and post-fire treatments needed to ensure public safety. It follows the *Beschta Report* and recommends that burned areas recover naturally. Another feature of this alternative is that road rehabilitation would take place through use of road closures rather than reconstruction. This alternative was considered but eliminated from detailed study because it fails to meet the purpose and need for this project to recover some of the value of the timber killed by the Rodeo-Chediski fire.

- Another alternative was developed that was similar to the proposed action, but included other harvest areas with slopes over 40 percent in the Bull Flat area on the Apache-Sitgreaves National Forests. Timber volume in this alternative would be substantially larger than that of the proposed action. This alternative was not considered in detailed study due to the unacceptable environmental consequences related to the potential impacts to Mexican spotted owl and northern goshawk habitat.

Comparison of Alternatives

This section provides a summary of activities and the effects of implementing each alternative. Information in the table is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 9 - Comparison of Alternatives – Management Activities

Management Activity	Alternative 1 No-Action	Alternative 2 Proposed Action	Alternative 3	Alternative 4 Preferred Alternative	Alternative 5
Sawtimber acres on slopes less than 40 percent.	0	34,921	30,770	34,156	34,921
Sawtimber acres on slopes greater than 40 percent (Helicoptor Yarding)	0	2,259	0	0	0
Small Sale area acres	0	7,929	7,763	6,903	7,929
Total Salvage Acres	0	45,109	38,533	41,059	42,850
Sawtimber volume	0	84.0 mmbf	48.4 mmbf	68.3 mmbf	84.0 mmbf
Helicopter yarding volume	0	9.8 mmbf	0	0	0
Small Sale area volume including Specialty Wood Products and Sawtimber	0	11.8 mmbf	6.8 mmbf	7.5 mmbf	11.8 mmbf
Total Sawtimber and Specialty Wood Products Volume	0	105.6 mmbf	55.2 mmbf	75.8 mmbf	95.8 mmbf
Fuelwood Volume	0	9,900 cords	8,700 cords	7,300 cords	9,900 cords

Management Activity	Alternative 1 No-Action	Alternative 2 Proposed Action	Alternative 3	Alternative 4 Preferred Alternative	Alternative 5
Temporary Road Construction	0	19.9 miles, consisting of 40 segments	14.2 miles, consisting of 30 segments?	18.2 miles, consisting of 36 segments?	19.0 miles, consisting of 38 segments?
Road Maintenance Associated with Harvest Activities on Open Roads	0	249 miles	221 miles	223 miles	234 miles
Project Specific Amendment to Forest plans Required?	No	Yes	No	No	No
Achieves the Purpose and Need?	No	Yes	Yes	Yes	Yes

Table 10 - Road Maintenance Activities.

Maintenance Activity	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3	Alternative 4 Preferred Alternative	Alternative 5
Spot Surfacing	0	130 miles	108 miles	130 miles	130 miles
Spot Borrow	0	212 miles	174 miles	189 miles	193 miles
Drainage Structures	0	319 miles	281 miles	290 miles	293 miles
Turnout Construction	0	151 miles	142 miles	136 miles	139 miles
Roadside Clearing*	0	145 miles	117 miles	115 miles	124 miles

Maintenance Activity	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3	Alternative 4 Preferred Alternative	Alternative 5
Dust Abatement Measures	0	59 miles	30 miles	46 miles	49 miles

***Roadside clearing is performed for sight clearance on dangerous curves and intersections.**

Table 11 displays and summarizes the primary differences among the alternatives with respect to environmental effects, and how well they address public issues. Effects are described in detail in Chapter 3.

Table 11 - Comparison of effects by alternative

Resource Area / Issue	Alternative 1 No-Action	Alternative 2 Proposed Action	Alternative 3	Alternative 4 Preferred Alternativ	Alternative 5
Soils and Watersheds					
Ground Cover Created	None	30 percent	30 percent	30 percent	30 percent
Predicted Discharge Rate	173,809 cfs	153,804 cfs	153,856 cfs	153,739 cfs	153,763 cfs
Equivalent Disturbed Area	None	8,279 acres	7,284 acres	8,116 acres	8,120 acres
Post-fire Flooding	Highest Peak Flows	Reduced Peak Flows	Reduced Peak Flows	Reduced Peak Flows	Reduced Peak Flows
Recreation and Visual Resources					
Recreation Use Patterns	Long-term impacts	Short-term impacts	Short-term impacts	Short-term impacts	Short-term impacts
Recreation Opportunities	Limited	Improved	Improved	Improved	Improved
Visual Impacts along highways and high use areas	Long-term impacts to foreground views	Long-term improvement to foreground views	Long-term improvement to foreground views	Long-term improvement to foreground views	Long-term improvement to foreground views

Resource Area / Issue	Alternative 1 No-Action	Alternative 2 Proposed Action	Alternative 3	Alternative 4 Preferred Alternativ	Alternative 5
Vegetation					
Average number dead trees/acre harvested in treatment areas	N/A	6.5 trees/acre	5.5 trees/acre	5.3 trees/acre	6.0 trees/acre
Average number snags/acre retained in treatment areas	N/A	1.7 snags/acre	1.9 snags/acre	2.1 snags/acre	1.7 snags/acre
Average number snags/acre after harvest across analysis area	N/A	5.8 snags/acre	6.3 snags/acre	6.1 snags/acre	5.9 snags/acre
Sensitive Plants	No impact to Blumer's Dock or Eastwood Alum Root	May impact, not affect viability of Blumer's Dock and Eastwood Alum Root	May impact, not affect viability of Blumer's Dock and Eastwood Alum Root	May impact, not affect viability of Blumer's Dock and Eastwood Alum Root	May impact, not affect viability of Blumer's Dock and Eastwood Alum Root

Resource Area / Issue	Alternative 1 No-Action	Alternative 2 Proposed Action	Alternative 3	Alternative 4 Preferred Alternativ	Alternative 5
Wildlife and Habitat					
Threatened and Endangered Species	No noise disturbance to bald eagle and MSO. No effect for Colorado pikeminnow and Chiricahua Leopard Frog	Most noise disturbance to bald eagle and MSO. Not likely to jeopardize Colorado pikeminnow. May impact, not likely to adversely affect MSO and Chiricahua Leopard Frog	Least noise disturbance to bald eagle and MSO. No effect to the bald eagle and Colorado pikeminnow. May affect, not likely to adversely affect MSO and Chiricahua Leopard Frog,	Some noise disturbance to bald eagle and MSO. No effect to the bald eagle and Colorado pikeminnow. May affect, not likely to adversely affect MSO and Chiricahua Leopard Frog	Some noise disturbance to bald eagle and MSO. No effect to the bald eagle and Colorado pikeminnow. May affect, not likely to adversely affect MSO and Chiricahua Leopard Frog
Sensitive Species	No noise disturbance to American peregrine falcon and NOGO. No impact to either species.	Most noise disturbance to peregrine falcon and NOGO. May impact, will not affect viability of American peregrine falcon and NOGO	Least noise disturbance to peregrine falcon and NOGO. May impact, will not affect viability of American peregrine falcon and NOGO	Some noise disturbance to peregrine falcon and NOGO. May impact, will not affect viability of American peregrine falcon and NOGO	Some noise disturbance to peregrine falcon and NOGO. May impact, will not affect viability of American peregrine falcon and NOGO
Management Indicator Species	No change in habitat or population trend	No change in habitat or population trend	No change in habitat or population trend	No change in habitat or population trend	No change in habitat or population trend

Resource Area / Issue	Alternative 1 No-Action	Alternative 2 Proposed Action	Alternative 3	Alternative 4 Preferred Alternativ	Alternative 5
Big Game Habitat	Less habitat diversity, slower forage recovery	More habitat diversity, faster forage recovery	More habitat diversity, faster forage recovery	More habitat diversity, faster forage recovery	More habitat diversity, faster forage recovery
Heritage Resources					
Impacts to Heritage Sites	Sites not protected, adverse effect on site integrity and significance	Sites protected, no effect on site integrity or significance	Sites protected, no effect on site integrity or significance	Sites protected, no effect on site integrity or significance	Sites protected, no effect on site integrity or significance
Fuels					
Range Of Average Fuel Loads At Year 5 in Ton/Acre (by Analysis Zones)	12.0-32.4	16.4-43.5	14.7-44.2	15.9-39.9	16.4-43.5
Total Acres Activity Fuels Created by Salvage Logging	0	45,109	38,533	41,059	42,850

Resource Area / Issue	Alternative 1 No-Action	Alternative 2 Proposed Action	Alternative 3	Alternative 4 Preferred Alternativ	Alternative 5
Social and Economic Resources					
Cost of Activities					
Salvage Preparation		$1,480,500	$813,300	$1,041,600	$1,333,500
Road Maintenance	0	$1,056,000	$552,300	$758,000	$958,000
Mitigation Activities		$19,854	$19,854	$19,854	$19,854
Total Costs		**$2,556,354**	**$1,385,154**	**$1,819,454**	**$2,311,354**
Revenue from Sale of Forest Products	0	$2,366,000	$1,160,200	$1,669,800	$2,091,600
Benefit to Cost Ratio for USFS	0	1.58	1.39	1.57	1.55
Benefit to Cost Ratio for All Partners	0	0.93	0.84	0.92	0.90
Employment Created	0	238	128	171	217

Chapter 3 - Affected Environment and Environmental Consequences

This chapter summarizes the physical, biological, social, and economic environments of the project area and the effects of implementing each alternative on that environment. It also presents the scientific and analytical basis for the comparison of alternatives presented in the alternatives chapter.

Soils and Hydrologic Resources

This section describes current conditions of the soils and hydrologic resources resulting from the Rodeo-Chediski Fire and describes anticipated effects of each alternative being considered in detail. Soils and hydrologic resources were both severely affected by the loss of ground cover over large areas within the burned area. For this reason, these two interrelated resource areas are discussed in one section.

Introduction

During a fire, many soil properties are affected to various degrees, which can result in significant alteration of site potential in terms of potential vegetation, as well as watershed hydrology. The largest impact to soils results from loss of organic ground cover that normally acts to protect the soil from rain drop impact and slows surface runoff, allowing greater infiltration and less soil erosion. Fires can also affect other important characteristics of soils such as soil structure, fertility, and hydrophobicity and can result in extensive soil erosion due to lack of ground cover.

The hydrologic characteristics of watersheds can be significantly altered as well, mainly due to the reduction or elimination of ground and canopy cover. Rainfall and snow melt run off the ground much faster, allowing water to concentrate into floods at significantly greater frequency and magnitude than would normally be expected. This can result in downstream flooding; sheet, gully and stream channel erosion; and sedimentation problems.

Area of Analysis

The area of analysis lies generally within the perimeter of the Rodeo-Chediski Fire where proposed salvage activities will occur. The total area proposed for salvage in each alternative is far smaller than the entire area within the burn perimeter. The hydrologic and cumulative effects analysis covers a greater area in some cases, as it deals with impacts aggregated over entire watersheds within and downstream from the analysis area.

Methodology Used for Data Collection and Analysis

References were consulted to substantiate findings and narrative, and are discussed in more detail in the specialist's report located in the project record. This section was also compiled from field information collected by specialists both during and after the Fire, as well as narrative written by specialists to interpret field data.

Terrestrial Ecosystem Survey

Information regarding soils was obtained from the soil survey of the Apache-Sitgreaves National Forests, termed the Terrestrial Ecosystem Survey (TES). This published work compiles information regarding soil-mapping units and includes information on the vegetation found on site as well as soil characteristics. Information includes cover type, typical composition of overstory and understory, site indices for timber species, and more. Typical ground cover elements of each of the mapping units are also described and used to predict erosion rates, which are derived from the standard Universal Soil Loss Equation (USLE). TES information is available

in the project record concerning USLE soil loss rates, Potential Soil Loss Rates, Tolerance Soil Loss Rates, and expected ground cover conditions that parallel each soil loss rate.

Universal Soil Loss Equation

Soil erosion rates were modeled using USLE to compare conditions expected to result from implementation of each alternative considered in detail. Total quantities of post fire soil losses were computed in the BAER Report of 2002. However, these are not absolute predictions of total soil loss. The erosion off of one acre may well be deposited on its neighboring acre, making the utility of such computations questionable. However, the rate of soil movement (tons/acre) is greatly affected by ground cover, which provided the basis for alternative comparisons.

Soil Quality and Soil Condition

Soil quality, as measured through soil condition, was used to assess the impact the fire had on soils, and it was also used to assess impacts of proposed activities. Soil condition is a function of its ability to hold and release water, its ability to resist erosion and degradation, and its ability to hold and release nutrients. Various standard indicators are used to evaluate each function, and whose presence or absence can also be used to describe desired conditions. Soil condition ratings result in a classification of satisfactory or unsatisfactory soil condition according to site conditions. Improvement of unsatisfactory elements of soil conditions results in improved soil and watershed conditions, trending towards a rating of satisfactory.

Best Management Practices

Best management practices (BMPs) have been used extensively in the Forest Service in the form of specific recommendations or restrictions for treatment within a project area. The Soil and Water Conservation Practices Handbook (FSH 2509.22) has been in use since 1990, and various Forests require adherence to customized BMP mitigation measures for specific projects. The BMPs recommended for all alternatives considered in this analysis have been specifically tailored to mitigate impacts to soil and water resources found within the analysis area (see Appendix B).

Cumulative Effects Analysis

The list of previous activities within the burn area has been summarized. However, the fire nullified the residual effects of previous management activities. The post fire conditions as modeled incorporate the cumulative effects of all previous activities as well as the effects of the fire. The fire created a new starting point on over half of the watersheds analyzed. Of fifty-one watersheds analyzed, 36 had more than 15 percent of their area moderately and severely burned. The Equivalent Disturbed Area (EDA) method was used to analyze disturbance activities. Generally when over 15 percent of a watershed has been impacted by some disturbing activity, it is likely serious adverse impacts occurred to the water resource values of the watershed.

Equivalent Disturbed Area and Threshold of Disturbance Levels

The equivalent disturbed area (EDA) factor method of analysis was used to quantify the impact of various proposed treatments. Computations regarding equivalent disturbed area (EDA) were made, to estimate how various activities effect runoff. Road surfaces constitute the worst-case scenario as they are compacted during construction and from continuous traffic; and absorb or infiltrate very little rainfall resulting in nearly 100 percent runoff. The threshold of disturbance levels normally used in cumulative effects analyses is 15 percent EDA of the watershed. Disturbance levels exceeding 15 percent greatly increase the chances of reduced infiltration and

increased runoff and soil erosion rates adversely impacting downstream channel stability, flooding and water quality.

Ground cover is a major factor in EDA computations. Ground cover is greatly affected by moderate to high burn severity. High severity areas are totally devoid of all ground cover, and in moderate burn severity cover consists only of scant needle cover, which is drastically lower in effectiveness than pre-burn ground cover. Each watershed analyzed is different depending on the amount and severity of the burn. Many watersheds were completely burned and bare ground exposed over the majority of the watershed area. Very few watersheds showed less than the 15 percent threshold value of barren area, and these generally had a significant proportion of acreage outside the burn perimeter.

Standing dead timber provides very little ground cover, as the only portion of the standing tree that covers the ground is the basal area. Across the burn area, basal area is estimated to vary from less than 50 square feet per acre to a maximum of about 200 square feet per acre. This converts to less than 0.5 percent ground cover per acre.

Logging slash can serve as effective ground cover, especially where no ground cover exists. From field measurements, a larger tree can generate approximately one to two percent ground cover per acre, just in the tops and limbs remaining after removal of the merchantable portion. From computations, salvage logging and the slash it generates on the ground has the potential to create approximately 30 percent ground cover, which would not exist without logging. These are averages, and many acres have no merchantable trees at all, while others may have substantially more.

Hydrologic Analysis Methods

Pre- and post-fire hydrologic models were generated to compare the impact of the proposed salvage operations on runoff from individual sub watersheds within and immediately downstream from the burn area. Standard sixth code watersheds or sub watersheds were selected based on the proximity to the burn perimeter of downstream concentration points of interest and internally within the burn area at various concentration points of interest. Some of the reasons for establishing a concentration point are the location of bridges or other facilities, the edge of the urban interface where downstream flooding might be of concern, or the edge of private property located within the burn perimeter. The post-fire hydrologic model is used as the base model for assessing the impact of each proposed alternative. The various alternatives can be compared to each other, as well as to both pre- and post-fire conditions.

Pre-Fire Hydrologic Model

Previous hydrologic studies in the area were used to estimate pre-fire watershed characteristics. Ground cover type, ground cover density, and hydrologic soil groups were evaluated and a runoff curve number was estimated for approximating pre-fire conditions. Runoff curves are coefficients that display the relationship between ground cover density and the expected amount of runoff for a combination of hydrologic soil groups and a land use and treatment class. The model results were compared to estimated peak flow values for the same watersheds modeled by the BAER Team in July of 2002 and FEMA studies completed for Navajo County.

Because the pre-fire hydrologic model's results are equivalent to other study results from the immediate vicinity, they are assumed to validly represent pre-fire watershed conditions. The pre-fire conditions are also assumed to represent the total sum of the cumulative impacts of all activities that occurred on the watershed up to the time of the fire. Tables in Appendix A

summarize all activities over the past 25 years that were identified from Forest Service records, and includes input from key staff members of the three affected Districts on both National Forests.

Post-Fire Hydrologic Model

The post fire model reflects the watershed conditions immediately following the fire. The changes in watershed characteristics were modeled by modifying the runoff curve number based on burn severity class. The post fire run off curve numbers used were based on research from other post fire studies, and confirmed by field observations within the analysis area. A pre-fire curve number of 74 was used compared to post-fire curve numbers of 91 for high burn severity, 86 for moderate burn severity, 78 for low burn severity, and 74 for all unburned areas. An EDA factor of 1.0 or 100 percent was assumed if the entire watershed was moderately and/or severely burned and assigned a curve number of 91. Very few watersheds analyzed had less than the 15 percent EDA threshold value in the high to moderate burn severity classification. Results from this model were also compared to other studies and determined appropriate and reasonable for runoff estimates for post-fire conditions found within the analysis area.

Post-Fire with Salvage Treatment Hydrologic Models

The post-fire model was used as the existing condition baseline model to compare any changes in watershed conditions as a result of various proposed treatments. Curve numbers in this model were adjusted based on EDA factors applied to the various salvage treatments proposed for each alternative. In order to assess impacts of salvage harvesting operations, a treatment type known as "tractor select cut" was used to represent similar impacts to the watershed. Details of runoff curves used and selection of EDA factors is available in the project record.

The snag requirement found in some alternatives would result in less beneficial logging slash being created, which would protect soil from erosion. To reflect this negative impact, and differentiate between the proposed alternatives, a negative 0.005 EDA was assigned to each additional snag required. The project record contains details of this process.

Some alternatives propose "small sale" areas to be harvested for various products other than sawtimber. These areas are conservatively assumed to have the same impact as all proposed saw timber treatments. The varied snag requirements applying to these areas were also assumed to have the same negative impact to the total EDA factors.

Hydrologic Modeling Methods

The latest version of the U.S. Army Corps of Engineer’s HEC-HMS Hydrologic Modeling System Version 2.1 Jan. 2001 was used to simulate watershed conditions and generate runoff from the analysis area. HEC-HMS is a Windows® based version of the Corp’s standard HEC-1 hydrologic model.

The HMS has various modeling options and components. The Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service, runoff curve number method was selected to reflect soil infiltration characteristics in order to generate excess precipitation and sub basin loss rates. Direct runoff was calculated using the NRCS Unit Hydrograph Method. Channel flows were routed using the Muskingum-Cunge 8-Point Method also called the Standard Method. The Frequency Storm Method was used to input precipitation data. Local weather stations were analyzed to determine the depth/duration of precipitation data for 5, 10, 25, 50 and 100-year precipitation events. The precipitation models for each frequency were created although only the

100-year event was run for analysis purposes on all subwatersheds for alternatives considered in detail.

Regulatory Requirements

Several federal and state laws and regulations pertain to activities affecting soil and water resources. Because soil and water resources are intimately connected, the following section contains regulations applicable to both.

The Federal Water Pollution Control Act of 1972 (Public Law 92-500) as amended in 1977 (Public Law 95-217) and 1987 (Public Law 100-4), also known as the Federal Clean Water Act (CWA) provides the structure for regulating pollutant discharges to waters of the United States. The Act's objective is "…to restore and maintain the chemical, physical, and biological integrity of the Nation's waters," and is aimed at controlling point and non-point sources of pollution. The U. S. Environmental Protection Agency (EPA) administers the Act, but many permitting, administrative, and enforcement functions are delegated to State governments. In Arizona, the designated agency is the Arizona Department of Environmental Quality. Pertinent sections of the Clean Water Act are:

- CWA Sections 208 and 319: recognize the need for control strategies for non-point source pollution.
- CWA Section 303(d): requires waterbodies with water quality determined to be either impaired (not fully meeting water quality standards) or threatened (likely to violate standards in the near future), to be compiled by ADEQ in a separate list which must be submitted to EPA every two years. These waters are targeted and scheduled for development of water quality improvement strategies on a priority basis.
- CWA Section 305(b): require that states assess the condition of their waters and produce a biennial report summarizing the findings.
- CWA Section 401: allows states and tribes to review and approve, set conditions on, or deny Federal permits (such as 404 permits) that may result in a discharge to State or Tribal waters, including wetlands. Applications for Section 404 permits are often joint 404/401 permits to ensure compliance at both the State and Federal levels.
- CWA Section 404: outlines the permitting process for dredging or discharging fill material into waters of the United States, including wetlands. The U.S. Army Corps of Engineers administers the 404 Program.
- Arizona Revised Statute 49-221 is tiered to the CWA and provides water quality standards and a Clean Water Action Plan Summary for the State of Arizona. Arizona Department of Environmental Quality (ADEQ) has primacy requirements over regulating requirements of the CWA.

Executive Orders applicable to this proposal are:

- Executive Order 11988 – Floodplain Management: The purpose of this Order is "…to avoid to the extent possible the long and short term impacts associated with the occupancy and modification of floodplains…" Section 1 further states: "…to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains…"

- Executive Order 11990 - The Protection of Wetlands: Wetlands are protected under this order and directs federal agencies to "…minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands…" Section 5 also states: "In carrying out the activities described in Section 1 of this Order, each agency shall consider factors relevant to a proposal's effect on the survival and quality of the wetlands. Among these factors are: (a) public health, safety, and welfare, including water supply, quality, recharge and discharge; pollution; flood and storm hazards; and sediment and erosion…"

Forest Service Manual requirements applicable to this proposal are:

- Forest Service Manual (FSM) guidelines describe the objectives and policies relevant to protection (and, where needed, improvement) of water quality on National Forest System lands so that designated beneficial uses are protected (FSM 2532.02 and 2532.03). Guidelines for data collection activities (inventory and monitoring) are described. FSM 2554: The National Forest Management Act requires that lands be managed to ensure the maintenance and long-term soil productivity, soil hydrologic function, and ecosystem health. Soil quality is maintained when erosion, compaction, displacement, rutting, burning, and loss of organic matter are maintained within defined soil quality standards.

The Apache-Sitgreaves National Forests Land and Resource Management Plan (Forest Plan) provides management direction, goals and objectives, and standards and guidelines that pertain to soils, watersheds and riparian areas.

- Management direction for riparian areas is stated: "Improve vegetation condition in riparian areas. Improvements will be accomplished by reducing, or in some cases, eliminating adverse impacts from grazing, vehicles, and over-use by man"(p 15).

- "Maintain, or where needed, enhance soil productivity and watershed condition by 2020. Maintain a high quality sustained water yield for Forest users and others. Identify and protect wetlands and floodplains"(p 16).

- Standards and guidelines state: "Ensure compliance with Public Law 92-500 "Federal Water Pollution Control Act" and amendments including the Clean Water Act of 1977. Implement best management practices to prevent water quality degradation. Implement improvement action where water quality degradation does occur, except for special cases where temporary or short-term degradation is occurring from road crossing construction or similar situations" (p 81).

- "Provide adequate drainage to prevent concentrated flow and sediment laden runoff from entering water courses" (p 81).

- "Designate stream courses to receive protection during projects (e.g. timber sales, road work). Those streams shown on 7.5 minute quads as a stream course should be considered for designated stream courses" (p 81).

- “Conserve soil and water resources; avoid permanent impairment of site productivity and ensure conservation of soil and water resources. The minimum soil and resource management requirement is to control surface water runoff and erosion at not less than tolerance conditions. 36 CFR 218.23 and 27 (p 81).

- "Maintain suitable filter/buffer strips between stream courses and disturbed areas and/or road locations to: … b. maintain water quality standards" (p 83).

- "Improvements: Maintain and enhance riparian vegetation along streams to maintain suitable water temperature and other conditions for stream flow" (p 83).
- "Erosion control measures will be included in road plans. Construct roads to keep sediment out of riparian and aquatic habitats" (p 104).
- Standards and guidelines in Management Area 2 state: "Plan/accomplish erosion reduction projects on areas disturbed by project activities where the site is not expected to stabilize within two years or when water quality degradation will occur" (p 153).
- Management emphasis for riparian areas states: "Recognize the importance and distinctive value of riparian areas when implementing management activities. Give preferential consideration to riparian area dependent resources … Manage to maintain or improve riparian areas to satisfactory riparian condition… do not adversely affect riparian dependent resources" (p 155).
- Standards and guidelines for Management Area 11 states: "Coordinate with other resource functions to pursue instream flow rights to protect aquatic ecosystems, fish, and wildlife" (p 207).

The Tonto National Forest Land and Resource Management Plan (Forest Plan) contains parallel language regarding soils, water quality and riparian areas, and additional language specific to the Tonto National Forest, including:

- "Re-establish riparian vegetation in severely degraded but potentially productive riparian areas. Natural regeneration is anticipated to achieve this goal, but artificial regeneration may be necessary in some areas" (p 41).
- "An Interdisciplinary Team will evaluate the need for buffer strips between proposed roads and adjacent water bodies. Where a buffer strip is deemed necessary, the Team will recommend the width of strip needed to achieve adequate protection of aquatic and riparian resources" (pp 43 and 158).
- "Minimize impacts on soil and water resources from all ground disturbing activities" (p 44).
- "Slash and debris should be kept out of protected stream channels" (p 159).

Affected Environment

Soils

Burn Severity Acreage

Mapping of the Rodeo-Chediski Fire by burn severity levels was accomplished using Landsat satellite images taken August 24, 2002. The following table shows the acreage within each National Forest by burn severity and does not include any of the Fort Apache Indian Reservation lands (see Burn Severity Map 2 in Appendix G).

Table 12 - Burn severity level classifications by land ownership within the analysis area

Classification	Apache-Sitgreaves NF	Tonto NF	Total NF Lands	Private Lands	Total Acres
Unclassified	3,762	77	3,839	18	3,857
Unburned	11,033	1,409	12,442	975	13,417
Low	63,394	4,777	68,171	4,677	72,848
Moderate	43,899	2,176	46,075	1,864	47,939
High	46,114	2,349	48,463	1,180	49,643
Totals*	164,440	10,711	178,990	8,696	183,847

***Totals across the bottom row do not include unclassified acreage.**

Productivity and Ground Cover

All areas affected by moderate or high burn severity levels, in addition to some areas classified at low burn severity levels, lost all organic litter ground cover due to the fire. In addition to its hydrological effect on infiltration, groundcover represents a function in nutrient cycling that is stopped through the influence of fire, and must slowly be re-built over decades or centuries. Damaged soils, especially over such extensive areas as the Rodeo-Chediski Fire, cannot recover or be repaired to pre-fire conditions in a human's lifetime. The litter layer that was consumed contained soil nutrients available on-site, which turned to ash through combustion. Ash is highly mobile and can easily be transported by wind or water. Rainfall and runoff events have already blown or washed away most ash.

Certain critical nutrients such as nitrogen tend to vaporize in high fire temperatures that commonly exist during dry conditions (DeBano, 1991; Larson, 1989; and Van Lear, 1989). A small portion of nitrogenous compounds are able to condense out on cool moist mineral soils if conditions are right, but wildfire burning conditions during a severe drought nearly assures a complete loss of organic nitrogen. Other essential elements are also susceptible to fire for similar reasons. Phosphorus can vaporize under high temperatures, but the portion that becomes available to plants in the form of ash is usually blown or washed away.

Outside of the most-essential plant nutrients, the litter layer also provides critical organic compounds from which plants benefit (Stevenson, 1994; MacCarthy, et al., 1990). All of the organic hydrocarbons such as chelating agents, organic acids, and enzymes abundant in semi-decomposed litter are vaporized as well. Products of organic matter decomposition play a significant role in the action exchange complex in soils by adsorbing nutrients and keeping them available to plants similarly to clays (Stevenson, 1994; MacCarthy, et al., 1990). In short, a significant portion of on-site nutrients and compounds essential to plant nutrition have been lost. This is expected to affect vegetative productivity and composition within the analysis area for decades to come.

Organic carbon, (which does not include charcoal), in its myriad of chemical forms, is one of the most vital soil constituents affected by fire. Its role in maintaining fertility and physical properties of soil are fundamental. Organic carbon is formed by slow decomposition of litter. Optimum

levels of organic litter chosen to remain on-site to meet fuel hazard reduction goals may not be sufficient for soils that have been severely burned. Minimum levels of organic litter are at best able to sustain soils that are already at a functioning level, but cannot rebuild severely damaged soils. In this condition, an over-supply of organic carbon input must make up for decimated reserves. In order to reduce flammability, it is imperative to alter the configuration of available organics, rather than the quantity. As surface soil fertility is intimately dependant on flammable carbon-based substances, rebuilding soil fertility with organics always entails a degree of implied risk in fuel accumulation.

Erosion and Sediment Transport

The soils report by the Rodeo-Chediski BAER Team indicates that total post-fire sediment delivery will increase to an average of 1,600 cubic yards/square mile/year or 68 ft^3/acre/year. Increases in total erosion were predicted to increase by an average of 3,200 percent over pre-fire conditions. Individual watersheds with steep slopes and a high percentage of moderate and high burn severity levels will have even greater increases.

Field inspection of a significant portion of the burned area immediately following and approximately a month after the fire revealed that most of the severely burned areas have no groundcover other than the basal area of standing dead trees. These areas have no dead or down material on the ground to protect the soil from raindrop impact, to retard or reduce runoff, to induce infiltration, to protect the soil from erosion, or to provide a seedbed for germination or plant regrowth.

Four years of record drought conditions prior to the fire caused it to burn so intensely that all dead and down material, including 1,000-hour fuels (large logs which need 1,000 hours to dry out and become flammable) were entirely consumed. On approximately 48,463 acres burned at high severity levels, a real threat of widespread and severe soil erosion now persists. The primary objective on bare exposed soils in these areas is to re-establish protective ground cover in order to reduce runoff and erosion, threats of downstream flooding, and sedimentation. More importantly, it will reduce on-site soil erosion and contribute to the long-term health and productivity of the forest.

Soil Quality

Soil quality, as measured through “soil condition,” was severely impacted by the fire. Portions of the analysis area that burned at high fire severity levels and most that burned at moderate severity levels now have unsatisfactory soil conditions. The major element that determines the unsatisfactory rating is the complete loss of ground cover that affects many soil functions. The ability to accept, hold and release water has been severely impacted, which is evidenced through surface crusting from raindrop impact on unprotected soils. Two other elements indicating unsatisfactory soil condition are a decrease in infiltration of greater than 50 percent over more than 10 percent of the area, and a reduction of surface pore space where surface soils have lost structure and become "puddled".

Puddling occurs when direct raindrop impact destroys the integrity of frail surface structure, and upon drying, turns it into a surface crust. Such soils shed water very quickly and have significantly lowered infiltration rates because of lost structure and porosity. The ability to resist erosion and degradation has also been impacted, as evidenced through various forms of visible erosion, and thinning or loss of the A-horizons (top soil layer). Maximizing infiltration is crucial to re-stabilizing soil movement and encouraging soil formation as any amount of runoff reduces available water necessary to form soil horizons.

Another key element to unsatisfactory soil condition is a lack of live vegetative cover, which is completely lacking across large portions of the analysis area. The ability to accept, hold and release nutrients is determined largely by organic litter cover and the presence of coarse woody debris. All of the areas that burned at high severity levels, and some areas that burned at moderate severity levels lack sufficient organic litter and are therefore also in unsatisfactory soil condition. Because only a tiny percentage of on-site biomass production eventually becomes incorporated into soil, massive quantities of organic amendments are required to re-form an A-horizon soil layer out of what currently are surface soils. Most biomass is consumed as forage, burned off during a wildfire or prescribed fire, harvested as wood products, or oxidizes directly into the atmosphere through the sun's ultra violet radiation.

After fires, soil compaction can be affected through natural and man-induced actions. Without sufficient ground cover, barren soils are exposed to the forces of raindrop impact. Though a raindrop does not weigh much, its effects are more related to the destruction of fragile exposed surface soil structure, which causes surface soil porosity to become plugged with fines, blocking infiltration. This leads to surface crusting, which also leads to lower infiltration. Once this happens, only ground cover and growing plants and soil organisms can re-build soil structure over time. Once the crusts are re-aggregated into a granulated or crumb structure, infiltration rates will return to normal.

The effects of harvesting equipment on compaction, as proposed in the various alternatives will be covered in the effects section. Timber harvesting equipment obviously can also compact soils and increase runoff. However, it is anticipated that the benefits of producing ground cover from harvesting slash will offset the potential negative effects of equipment. Especially in areas that burned at high severity, no ground cover of any type is left. Depending on how many trees per acre are harvested, lopped slash and treetops can create over 30 percent ground cover per acre, the benefit of which cannot be ignored. The benefit of leaving logging slash on the ground as ground cover has a much greater positive impact in burned areas than in unburned or "green" areas. For this reason the effects of green logging cannot be directly compared to salvaging burned areas. The specialists report on soil and water resources fully explains this concept.

Hydrologic Resources

Watershed Conditions

Runoff from the burned area has increased significantly. Initial estimates by the BAER Team indicated from two to four fold increases in peak flow rates. The model predicted substantial increases in peak flow events for watersheds where a high percentage of the area was burned at moderate to high severity levels. According to the model, 22 percent of the 51 6th code watersheds within the analysis area had peak flows that doubled. On three washes the peaks increased 2.6 times, one was, 2.8 times and in one very small wash, increased 4.3 times. In summary, current watershed conditions are unsatisfactory, as infiltration rates have declined significantly across the burned area, resulting in greatly increased runoff and short concentration times.

Stream Channel Conditions

Scouring and sediment inundation of high quality fish habitat in Canyon Creek has occurred. Riparian areas and the few wet meadow habitats that exist are at risk from increased channel scour and incision caused by accelerated runoff and erosion from severely burned watershed areas. Riparian areas burned at variable intensities. Some of the small drainages were severely burned and have experienced a loss of riparian vegetation, groundcover, and the ability to buffer the runoff from large rainfall events. Many of the drainage headwater areas were also severely

burned. High water marks of black ash and debris are clearly visible in almost every major channel.

Some of the larger washes that burned were Cottonwood Wash, Decker Wash, Phoenix Park Wash and Buckskin Wash. The riparian areas in the larger washes were not severely burned by the fire because these larger channels are ephemeral and lacked significant quantities of riparian vegetation to fuel the fire.

Overall, the anticipated levels of damage to channel morphology have not yet occurred. As watershed conditions were drastically altered compared to pre-fire conditions, it is anticipated that adjustments to channel width and depth will take decades to achieve equilibrium.

Post-fire Flooding, FEMA Mapped Floodplains

Accelerated runoff from the severely burned areas of National Forest System lands is expected to increase flooding and damage to downstream private properties located in or near floodplains of the major washes. Increases in runoff can be expected to increase the frequency and extent of flooding in all streams that derive the majority of their flows from areas that burned at moderate or high severity levels. Current floodplain maps covering lands downstream of these highly altered watersheds are probably invalid, until ground and canopy cover returns to pre-burn conditions.

Water Quality

Canyon Creek (AZ15060103-041) was listed as a stream impaired due to turbidity on the 1998 303d impaired streams list. Canyon Creek was tested 23 times and found to exceed turbidity standards in 3 instances. New 303d guidance states measurements must exceed standards 5 times before being placed on the 303d impaired list. Canyon Creek has been moved to the "planning list" and will be reevaluated in the future.

Water quality from runoff will be reduced due to the fire, resulting in increased sediment loading in the form of dissolved and suspended solids. It is expected that large amounts of sediment will move because of bare ground within severely burned areas, the soil types involved, and steep slopes within portions of the analysis area.

Dissolved solids typically increase in post-fire runoff as well, and consist of various water-soluble materials such as some plant nutrients found in ash. Initial runoff usually carries away the bulk of soluble materials, with substantially decreasing concentrations in subsequent flows. The initial flush of runoff from the burned area did affect Black Canyon Reservoir and Canyon Creek, resulting in partial fish kills.

Fire Retardant Effects on Water Quality

The fire retardant dropped on the Rodeo-Chediski Fire during suppression operations amounted to over 1 million gallons, but it is unclear exactly where it was dropped. A large proportion of it was dropped near residential areas, none of which are associated with perennial streams. The fire retardant used was mostly of a type that contains a corrosion inhibitor YPS (yellow prussiate of soda) to reduce damage to aircraft aluminum used in tanks and fuselages. The presence of YPS is known to increase the toxicity of this fire retardant, and ultraviolet radiation (UV from sunlight) further increases the toxicity of YPS. YPS releases small amounts of sodium cyanide when in aqueous solution, and when exposed to UV over time. Cyanide is a relatively unstable compound, and it tends to break down rapidly in aerobic soils to form nitrates or is tied up by metals (iron). Highly organic soils are known to reduce the toxicity of YPS, however most soils over the burn

area are not highly organic. Another type of retardant was used on a limited basis by large helicopters using a foam injection system. However this type of retardant usually has a short half-life when exposed to UV radiation, as it is an organic molecule.

Overall, no lasting effects are expected from retardant drops because of the ephemeral nature of most drainages affected, and the high clay content in the area's soils which can absorb potential toxins. The high ion exchange capacity of the predominant clay type (montmorillonite) acts as a buffer by absorbing and slowly releasing potential toxins.

Canyon Creek Fish Hatchery

Access in and out of the hatchery may be of concern during and after flash flood events. No damage is anticipated to the facility itself or associated buildings, although there is the possibility of damage to the spring boxes feeding the hatchery from flooding.

Black Canyon Lake

The tributary watershed above Black Canyon Lake is entirely within the analysis area. Approximately 40 percent of this six square mile watershed burned at moderate or high severity levels. The watershed was heavily forested and contains some of the steeper slopes within the analysis area north of the Mogollon Rim. Tons of ash, large woody debris and sediment have washed into the reservoir, and more can be expected.

The BAER Team's hydrologic analysis of a 100-year, six-hour storm with the addition of a 25 percent bulking factor for debris and sediment was conducted. The results estimate that a volume of runoff, sediment and debris of 884 acre feet could enter the reservoir during a 100-year event, which left a reserve storage capacity of 246 acre feet before reaching the spillway. Recent inflows have further reduced this reserve capacity.

Lone Pine Dam and Schoen's Dam

Lone Pine Dam, on Show Low Creek, is located 5-7 miles downstream of the severely burned watersheds Hog Wash, Linden Draw and Bagnal Hollow. The fire has already affected the low flow outlet of Lone Pine Dam by covering it with debris. Sediment will reduce overall capacity, although this should be minor compared to its overall capacity. There is evidence that past overflows have damaged the 134 Road where it crosses the spillway and structure of Lone Pine Dam.

Schoen's Dam was dry prior to the fire. It will probably be unaffected by flood flows unless Lone Pine Dam fails, which is not anticipated.

Stock Tanks and Fencing

The primary watering facilities located in the burn area are manmade reservoirs of various sizes. The majority are relatively small livestock and wildlife watering facilities. Some of the larger potentially hazardous dams were breached during BAER emergency actions, or spillways were cleaned and enlarged to minimize the potential of failure. Many of these tanks have already filled or partially filled with ash and sediment. Fences protecting riparian areas were either removed after the fire to allow free flow of drainages, or were destroyed by the fire.

Road Systems

Roads within the analysis area are at risk to damage by accelerated runoff, erosion, sediment and debris. The capacity of the road drainage systems, culverts, fords, and bridges could be exceeded or plugged with debris and washed out by the increased flows anticipated from the severely burned watersheds. Increased frequency and magnitude of runoff will increase hazards and maintenance costs. Access during inclement weather may be limited to the Arizona Game and Fish Hatchery in Canyon Creek, Black Canyon Lake and on some roads leading to private lands within the analysis area.

The BAER Team removed many undersized culverts on the main roads and installed low water crossings where there was a likelihood of clogging and failure. Numerous old skid trails and abandoned roads are now visible that were previously hidden by vegetation. Some of these have become small channels or gullies that will require attention to prevent further damage.

Groundwater Aquifers and Springs

The primary aquifer beneath the burned area is the C aquifer located in the Coconino sandstone formation. As runoff is greatly accelerated under post-burn watershed conditions and fine sediments are deposited in the channel, it is anticipated that the general recharge area of most of the precipitation along the Mogollon Rim will shift northward. The ephemeral flow regime of most drainages is not anticipated to change, although live surface water may run more often and for a greater distance northward than prior to the fire. This will allow most streambed infiltration to occur farther north than in the past, and percolation to the water table is expected to shift northward as well.

It is not known whether this will affect ground water table elevations along the Mogollon Rim, although it is conceivable that shallower wells could run dry. Water table elevations are dependent upon the watershed condition of their recharge areas, and pre-burn ground water conditions are not expected to return until watershed conditions have stabilized. Full recovery of the area could take decades. Ground water migration rates are unknown in the area. It will be one to two years before the effects of the fire on the ground water table are known.

The springs that provide water to the Canyon Creek Fish Hatchery are at risk because the slopes above the springs and the collection facility were severely burned. It is not known whether the spring discharge will change. The recharge area for the ground water table that feeds the springs was also affected and is not expected to recover to pre-burn conditions for many decades.

Environmental Consequences

Alternative 1

Direct and Indirect Effects of Alternative 1 on Soils

Productivity and Ground Cover

Under the No Action Alternative, there would be no negative impacts from logging activities such as soil compaction. However, no ground cover would be generated from logging slash. This alternative would have the lowest overall ground cover density. In the long-term, standing trees would eventually fall and contact the ground to become ground cover and to be incorporated into soil organic matter. The sheer quantity of dead material this would generate would raise concerns over fuel accumulation. Treatment by prescribed fire would vaporize much-needed organics, leaving nothing for soil recovery. Randomly falling trees jack straw, resulting in less ground contact than logging slash, and less effective ground cover.

Soil productivity would not be immediately enhanced through organic materials partially incorporated into soils by equipment operation. Soil organic matter is critical to nutrient retention and the sooner this material is replenished the better. This alternative would have the longest recovery period and greatest long-term negative impact on soil stability and productivity.

Erosion and Sediment Transport

This alternative would produce the highest soil erosion of all alternatives considered in detail. No logging slash would be generated to produce ground cover, and no dead trees would be felled. Outside of treatments already accomplished under BAER authorities such as spreading straw, no other work would be done in the near future. Soil erosion would be allowed to continue for 3-5 years at maximum potential rates due to lack of ground cover. Thin topsoils would be lost at non-sustainable rates of erosion and areas of shallow soils may well turn into bedrock outcrops. Loss of valuable topsoil removes substantial quantities of nutrients, which take centuries to replace through natural processes. In areas of shallow soils, larger expanses of bedrock are anticipated and are not expected to recover for many centuries. Overall, sediment transport through the area's drainage network is expected to be highest in this alternative.

Soil Quality

This alternative would do nothing to actively improve or restore soil quality, as measured by soil condition guidelines. These guidelines are: ability to accept, hold and release water; ability to resist erosion and degradation; and ability to accept, hold, and release nutrients. It would leave all soils in an unsatisfactory condition category, as all three elements of soil quality are in unsatisfactory condition. The ability to accept, hold and release nutrients is a function of organic matter being evenly distributed across the soil surface.

This alternative would leave soils barren in areas that burned at moderate and high severity levels. The ability to resist erosion and degradation is affected by a vegetative community that is currently lacking. Surface "A" horizons that are highly erosive would wash away without groundcover, creating erosion pavements that are already extensive in these areas and by rill and gully formation that is in progress. The ability to accept, hold, and release water is a function of surface structure, surface pore space, soil crusting, and a reduction in infiltration by greater than 10 percent over greater than 50 percent of the area.

Direct and Indirect Effects of Alternative 1 on Hydrologic Resources

Watershed Condition

Alternative 1 would do nothing to improve infiltration across the burned area. Recovery would be slow until ground cover is re-established naturally or until dead trees start to topple over and provide some ground cover. Randomly toppled trees generally provide less effective ground cover than logging slash that better contacts the ground. The post-fire peak flows were estimated at two to four times the pre-fire flows, which also have potential to erode and carry away great quantities of soil.

Stream Channel Condition

Stream channels are expected to incur the greatest amount of long-term damage from continuous high watershed discharges predicted for Alternative 1, although there appears to be little difference in discharge peaks between the alternatives. Most of the ephemeral washes currently do not have the capacity to handle peak flows generated by the burned area without significant channel erosion occurring. Channels would destabilize and widen, eroding out banks and partially

established floodplains. This is not expected to stabilize until the watersheds heal by re-vegetating and re-establishing ground cover. Channel configuration is altered through moving water, and as watersheds heal, lower discharge necessarily takes longer to rebuild floodplains and form stable channels. Riparian vegetation can help to heal stream channels, but generally watershed conditions must stabilize before vegetation can make a difference.

Post-Fire Flooding

Alternative 1 would continue to generate the highest possible peak discharge from the entire burned area. Post-fire discharge will be a continual risk factor for downstream resources and private lands as well. Flood potential is not expected to decrease until slow natural watershed healing processes can make a difference in increasing infiltration, attenuating floods.

Water Quality

This alternative may affect Canyon Creek. This alternative proposes no action in this watershed, leaving sediment loss and runoff rates at very high post-fire rates. Excess sedimentation has already been observed in Canyon Creek, filling in the interspaces of once clean gravel and cobble substrates. High sediment loads are expected to persist until natural watershed healing processes return discharge rates back to normal. This may take decades as the dominant soils found in the Canyon Creek watershed are difficult to revegetate.

Ground Water Aquifers and Springs

Although Alternative 1 proposes no action, it is not anticipated that it is different enough from action alternatives to significantly impact the ground water table. The additional runoff that would be generated by this alternative may well be significant when it comes to surface erosion, but once this amount of water infiltrates all the way into the ground water table, it would be difficult to separate its effects from action alternatives. Generally speaking, the fire has caused such major changes in runoff pattern that overall infiltration may shift northward in the direction of runoff. This may lower water table elevations directly beneath the burned area and perhaps raise water tables north of the burned area. Many drainages in the analysis area now flow further north more often than before the fire.

Improvements

Canyon Creek Fish Hatchery: This alternative would perpetuate high soil erosion rates and high surface runoff rates across the analysis area until natural recovery can heal the burned areas. It is conceivable that the Hatchery's water quality would suffer from increased sediment loads carried by Canyon Creek, especially during peak runoff events. During periods of normal flows, water quality and sediment loading may not be measurably impacted.

Black Canyon Lake, Lone Pine Dam, and Schoen's Dam: This alternative would create no beneficial ground cover from logging slash, and higher sedimentation rates are expected to discharge into these reservoirs. Water quality and the reservoir's effective lifetime in terms of reduction of storage volume would be reduced. Great quantities of sediment have already washed into the Black Canyon Lake and restoration of ground cover is critical to reduce sediment yield. The reservoir created behind Lone Pine Dam has also received sediment flows from the burned area; however, the structure is maintained only for flood control, and does not retain water. This alternative would maintain the highest sedimentation rates for the longest periods of time into these reservoir areas.

Stock Tanks and Fencing: This alternative would maintain the highest sedimentation and runoff rates of all alternatives since it does not create harvest related ground cover. This would result in high maintenance requirements for stock tanks, as they will quickly fill with sediment as many already have. Some tanks may not be worth maintaining until watershed conditions stabilize decades away. Because of high runoff rates, some areas that had protective fencing around riparian areas may not be worth repairing, as continual peak flow events damage or tear out fencing that crosses drainages.

Road Systems: This alternative would maintain the highest sedimentation and runoff rates of all alternatives, requiring more road maintenance work near drainages, repair of ditch lead-outs, and culvert cleaning. Highest sediment yields are expected from this alternative, as it would have the lowest effective ground cover.

Cumulative Effects of Alternative 1

Appendix A contains tables summarizing all major activities that have occurred in the analysis area in the past 25 years, as well as all major activities planned 5 years into the future. As the fire has had such profound impacts on the burned area watersheds, future activities are more important than past activities, as most of the past activities have either had time to heal, or they are totally over shadowed by the fire's effects. Watershed and soil impacts are all linked to either compaction or ground cover. However, when ground cover is totally removed, as in areas that burned at high and moderate severity levels, previous impacts tend to vanish as a new baseline is established by the higher impacts of the fire. For this reason, the previous impacts are accounted for by the runoff curve chosen to represent various ground cover conditions.

Alternative 1 would not involve any soil compaction to the burned area caused by logging equipment. This would allow further recovery of subsoil compaction from previous activities. However, this benefit would be more than offset by lack of ground cover, increased surface crusting that reduces infiltration, higher overall erosion rates from bare ground, higher runoff and channel erosion rates, and slower recovery of riparian areas.

In conjunction with past activities, Alternative 1 would maintain a worst-case scenario for runoff and soil erosion for the longest period of time. Watershed recovery and restoration is entirely dependent on natural processes that may take very long periods of time. In the interim, soil erosion would continue at potential rates well above tolerance levels. This would result in a net loss of soil and nutrients over the foreseeable future that may take centuries to replace. Soil quality would suffer and watershed condition would also remain in an unsatisfactory condition. Alternative 1 does not meet forest plan standards and guidelines for either National Forest, nor does it meet the intent of many other regulatory requirements at state and federal levels.

Direct and Indirect Effects Common to Alternatives 2, 3, 4 and 5 on Soil Resources

Productivity and Ground Cover

Salvage logging proposed under action alternatives would generate various levels of ground cover from logging slash, non-merchantable treetops, and non-merchantable trees pushed over or crushed by logging equipment. Depending on the number of trees harvested and their density per acre, this can create ground cover where none existed before harvest. On average, treatment areas within the eastern portion of the analysis area may harvest around 12 trees per acre that are 12 inches dbh or larger. On the western portion of the analysis area, up to 28 trees per acre may be harvested. This converts to an average of over 30 percent ground cover, which would make a difference in sediment yield and surface runoff. Table 13 shows the results of runoff modeling for post-fire peak discharge and the respective drop in discharge attributed to added ground cover.

Table 13 displays affected watersheds within and adjacent to the analysis area by size, pre- and post-fire predicted peak flows in cubic feet per second from a 100 year, six hour storm, by action alternatives. Acres within proposed treatment areas and equivalent disturbed areas are displayed by sixth code sub-watersheds.

Table 13 - Affected watersheds within and adjacent to the analysis area by size; and pre and post-fire predicted peak flows; by alternative

Watershed/ Sub-watershed	Sixth Code	Watershed Size		Predicted Peak Flow (cfs) from a 100-Year Six Hour Storm					
	Identifier	sq. mi.	acres	Pre-Fire	Post-Fire	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Black Canyon Watershed									
Baca Canyon	**L**	**5**	***3163***	**2103**	**2917**	**2888**	**2917**	**2888**	**2888**
Total Proposed Treatment Area by Alternative (acres):						*1102*	*0*	*1102*	*1102*
Equivalent Disturbed Area by Alternative (acres):						*209*	*0*	*222*	*209*
Bear/Turkey Canyon	**M**	**5**	***3043***	**2221**	**3031**	**3001**	**3021**	**2991**	**2991**
Total Proposed Treatment Area by Alternative (acres):						*1214*	*138*	*1214*	*1214*
Equivalent Disturbed Area by Alternative (acres):						*231*	*29*	*244*	*231*
Lower Black Canyon	**I1**	**14**	***8964***	**3615**	**3843**	**3843**	**3843**	**3843**	**3843**
Total Proposed Treatment Area by Alternative (acres):						*264*	*264*	*0*	*264*
Equivalent Disturbed Area by Alternative (acres):						*50*	*40*	*0*	*50*
Black Canyon Lake	**K**	**6**	***3759***	**2863**	**3673**	**3649**	**3661**	**3649**	**3649**
Total Proposed Treatment Area by Alternative (acres):						*1109*	*385*	*1107*	*1109*
Equivalent Disturbed Area by Alternative (acres):						*211*	*79*	*228*	*211*
Lower Buckskin	**O1**	**3**	***1724***	**1504**	**1634**	**n/t**	**n/t**	**n/t**	**n/t**
Middle Black Canyon	**I2**	**2**	***1567***	**1264**	**1764**	**1742**	**1742**	**1742**	**1742**
Total Proposed Treatment Area by Alternative (acres):						*848*	*848*	*848*	*848*
Equivalent Disturbed Area by Alternative (acres):						*161*	*161*	*166*	*161*
Middle Buckskin	**O2**	**7**	***4266***	**3253**	**4242**	**4228**	**4214**	**4214**	**4228**
Total Proposed Treatment Area by Alternative (acres):						*538*	*538*	*538*	*538*
Equivalent Disturbed Area by Alternative (acres):						*102*	*104*	*106*	*102*
Middle Pierce	**Q2**	**8**	***5185***	**2106**	**2464**	**2456**	**2456**	**2456**	**2456**
Total Proposed Treatment Area by Alternative (acres):						*721*	*721*	*706*	*721*
Equivalent Disturbed Area by Alternative (acres):						*137*	*137*	*138*	*137*
Oklahoma Flat	**P1**	**8**	***5083***	**2071**	**2266**	**2266**	**2266**	**2266**	**2266**
Total Proposed Treatment Area by Alternative (acres):						*155*	*155*	*76*	*155*
Equivalent Disturbed Area by Alternative (acres):						*30*	*31*	*16*	*29*
Rocky Draw	**N**	**10**	***6228***	**3681**	**4792**	**4731**	**4731**	**4731**	**4731**
Total Proposed Treatment Area by Alternative (acres):						*3117*	*3103*	*3117*	*3117*
Equivalent Disturbed Area by Alternative (acres):						*592*	*591*	*609*	*592*
Ross Draw	**P2**	**3**	***1888***	**1427**	**2430**	**2365**	**2365**	**2365**	**2365**

Watershed/ Sub-watershed	Sixth Code	Watershed Size		Predicted Peak Flow (cfs) from a 100-Year Six Hour Storm					
	Identifier	sq. mi.	acres	Pre-Fire	Post-Fire	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Total Proposed Treatment Area by Alternative (acres):						*1681*	*1681*	*1681*	*1681*
Equivalent Disturbed Area by Alternative (acres):						*319*	*323*	*331*	*319*
Upper Buckskin Wash	**V**	**10**	***6587***	**4230**	**6225**	**6122**	**6122**	**6122**	**6122**
Total Proposed Treatment Area by Alternative (acres):						*4770*	*4770*	*4770*	*4770*
Equivalent Disturbed Area by Alternative (acres):						*906*	*921*	*941*	*906*
Upper Pierce Wash	**Q3**	**7**	***4136***	**1900**	**2512**	**2488**	**2488**	**2488**	**2488**
Total Proposed Treatment Area by Alternative (acres):						*1991*	*1991*	*1991*	*1991*
Equivalent Disturbed Area by Alternative (acres):						*378*	*378*	*388*	*378*
West Fork Black Canyon	**J**	**8**	***5022***	**3393**	**4130**	**4124**	**4127**	**4124**	**4124**
Total Proposed Treatment Area by Alternative (acres):						*341*	*0*	*341*	*341*
Equivalent Disturbed Area by Alternative (acres):						*65*	*0*	*66*	*65*
Black Canyon Watershed Totals		**95**	**60615**	**35631**	**45923**	**43903**	**43953**	**43879**	**43893**
Total Proposed Treatment Area by Alternative (acres):						***17851***	***14594***	***17491***	***17851***
Equivalent Disturbed Area by Alternative (acres):						***3391***	***2794***	***3455***	***3390***
Canyon Creek Watershed									
Upper Canyon Creek	**B1**	**26**	***16385***	**9096**	**11006**	**10759**	**10773**	**10773**	**10773**
Total Proposed Treatment Area by Alternative (acres):						*4563*	*2666*	*2520*	*2666*
Equivalent Disturbed Area by Alternative (acres):						*639*	*535*	*512*	*506*
Hells Canyon	**C**	**7**	***4427***	**1017**	**1833**	**1833**	**1833**	**1833**	**1833**
Total Proposed Treatment Area by Alternative (acres):						*252*	*252*	*0*	*252*
Equivalent Disturbed Area by Alternative (acres):						*48*	*48*	*0*	*48*
Lower Canyon Creek	**B2**	**3**	***1700***	**1508**	**1713**	**n/t**	**n/t**	**n/t**	**n/t**
Valentine Creek	**A**	**4**	***2460***	**2241**	**2940**	**2940**	**2940**	**2940**	**2940**
Total Proposed Treatment Area by Alternative (acres):						*361*	*0*	*0*	*0*
Equivalent Disturbed Area by Alternative (acres):						*25*	*0*	*0*	*0*
Canyon Creek Watershed Totals		**39**	**24972**	**13862**	**17492**	**15532**	**15546**	**15546**	**15546**
Total Proposed Treatment Area by Alternative (acres):						***5176***	***2918***	***2520***	***2918***
Equivalent Disturbed Area by Alternative (acres):						***712***	***583***	***512***	***554***
Carrizo Creek Watershed									
Buckskin Canyon	**B**	**8**	***5279***	**2142**	**3225**	**3183**	**3183**	**3183**	**3183**
Total Proposed Treatment Area by Alternative (acres):						*322*	*322*	*322*	*322*
Equivalent Disturbed Area by Alternative (acres):						*61*	*61*	*63*	*61*

Watershed/ Sub-watershed	Sixth Code	Watershed Size		Predicted Peak Flow (cfs) from a 100-Year Six Hour Storm					
	Identifier	sq. mi.	acres	Pre-Fire	Post-Fire	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Carrizo Creek	**A**	**11**	***7043***	**n/t**	**n/t**	**n/t**	**n/t**	**n/t**	**n/t**
Phoenix Park Canyon	**C**	**6**	***3736***	**n/t**	**n/t**	**n/t**	**n/t**	**n/t**	**n/t**
Carrizo Creek Watershed Totals		**25**	**16058**	**2142**	**3225**	**3183**	**3183**	**3183**	**3183**
Total Proposed Treatment Area by Alternative (acres):						***322***	***322***	***322***	***322***
Equivalent Disturbed Area by Alternative (acres):						***61***	***61***	***63***	***61***
Chevelon Creek Watershed									
Wildcat Canyon	**X**	**12**	***7702***	**2907**	**2925**	**n/t**	**n/t**	**n/t**	**n/t**
Cottonwood – Dodson Watershed									
Bagnal Wash	**D**	**4**	***2548***	**1191**	**1477**	**n/t**	**n/t**	**n/t**	**n/t**
Dodson Wash	**O**	**27**	***17559***	**4346**	**4686**	**4673**	**4673**	**4673**	**4673**
Total Proposed Treatment Area by Alternative (acres):						*1593*	*1593*	*1515*	*1593*
Equivalent Disturbed Area by Alternative (acres):						*303*	*303*	*296*	*303*
Lewis/Lons Canyons	**L2**	**5**	***3469***	**2002**	**2689**	**2689**	**2689**	**2689**	**2689**
Total Proposed Treatment Area by Alternative (acres):						*32*	*32*	*32*	*32*
Equivalent Disturbed Area by Alternative (acres):						*6*	*7*	*7*	*6*
Lower Cottonwood Wash	**F**	**19**	***12049***	**4611**	**4798**	**4812**	**4812**	**4812**	**4812**
Total Proposed Treatment Area by Alternative (acres):						*127*	*127*	*127*	*127*
Equivalent Disturbed Area by Alternative (acres):						*24*	*24*	*25*	*24*
Lower Day Wash	**C1**	**17**	***11044***	**5344**	**5349**	**n/t**	**n/t**	**n/t**	**n/t**
McCleve Canyon	**J**	**6**	***3943***	**2579**	**3309**	**3277**	**3277**	**3277**	**3277**
Total Proposed Treatment Area by Alternative (acres):						*1572*	*1572*	*1572*	*1572*
Equivalent Disturbed Area by Alternative (acres):						*299*	*299*	*306*	*299*
Middle Cottonwood	**M**	**12**	***7807***	**4835**	**6860**	**6836**	**6836**	**6836**	**6836**
Total Proposed Treatment Area by Alternative (acres):						*299*	*231*	*299*	*299*
Equivalent Disturbed Area by Alternative (acres):						*57*	*46*	*60*	*57*
Middle Day Wash	**C2**	**2**	***1515***	**779**	**815**	**n/t**	**n/t**	**n/t**	**n/t**
Mortenson Wash	**L1**	**12**	***7848***	**4611**	**6225**	**6225**	**6225**	**6225**	**6225**
Total Proposed Treatment Area by Alternative (acres):						*630*	*630*	*630*	*630*
Equivalent Disturbed Area by Alternative (acres):						*120*	*130*	*131*	*120*
Stinson Wash	**G**	**12**	***7848***	**3639**	**4983**	**4983**	**4983**	**4983**	**4983**

Watershed/ Sub-watershed	Sixth Code	Watershed Size		Predicted Peak Flow (cfs) from a 100-Year Six Hour Storm					
	Identifier	sq. mi.	acres	Pre-Fire	Post-Fire	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Total Proposed Treatment Area by Alternative (acres):						*695*	*695*	*695*	*695*
Equivalent Disturbed Area by Alternative (acres):						*132*	*133*	*137*	*132*
Town Draw	**N2**	**1**	***869***	**680**	**1098**	**1094**	**1045**	**1045**	**1045**
Total Proposed Treatment Area by Alternative (acres):						*260*	*260*	*260*	*260*
Equivalent Disturbed Area by Alternative (acres):						*49*	*55*	*55*	*49*
Upper Cottonwood	**I**	**11**	***7061***	**4755**	**6436**	**6394**	**6415**	**6394**	**6394**
Total Proposed Treatment Area by Alternative (acres):						*1991*	*1446*	*1991*	*1991*
Equivalent Disturbed Area by Alternative (acres):						*378*	*288*	*405*	*378*
Upper Day Wash	**C3**	**12**	***7722***	**3027**	**4310**	**4282**	**4282**	**4282**	**4282**
Total Proposed Treatment Area by Alternative (acres):						*2526*	*2526*	*2526*	*2526*
Equivalent Disturbed Area by Alternative (acres):						*480*	*492*	*501*	*480*
Upper Town or Perkins Sp	**N1**	**24**	***15520***	**5488**	**5633**	**5633**	**5633**	**5633**	**5633**
Total Proposed Treatment Area by Alternative (acres):						*193*	*193*	*193*	*193*
Equivalent Disturbed Area by Alternative (acres):						*37*	*40*	*40*	*37*
Water/Bear Canyon	**K**	**8**	***4953***	**2585**	**3480**	**3457**	**3457**	**3457**	**3457**
Total Proposed Treatment Area by Alternative (acres):						*1410*	*1410*	*1410*	*1410*
Equivalent Disturbed Area by Alternative (acres):						*268*	*271*	*277*	*268*
West Fork Cottonwood	**H**	**6**	***3810***	**2621**	**3607**	**3596**	**3607**	**3596**	**3596**
Total Proposed Treatment Area by Alternative (acres):						*276*	*1*	*174*	*276*
Equivalent Disturbed Area by Alternative (acres):						*52*	*0*	*35*	*52*
Willow Wash	**E**	**7**	***4343***	**2151**	**2941**	**2931**	**2931**	**2931**	**2931**
Total Proposed Treatment Area by Alternative (acres):						*312*	*312*	*313*	*313*
Cottonwood-Dodson WaterShed Totals		**187**	**119909**	**55244**	**68696**	**60882**	**60865**	**60833**	**60833**
Total Proposed Treatment Area by Alternative (acres):						***11916***	***11028***	***11737***	***11917***
Equivalent Disturbed Area by Alternative (acres):						***2264***	***2147***	***2336***	***2264***
Phoenix Park Watershed									
Lower Decker Wash	**E1**	**17**	***10677***	**3252**	**3431**	**2931**	**2931**	**2931**	**2931**
Total Proposed Treatment Area by Alternative (acres):						*405*	*405*	*405*	*405*
Equivalent Disturbed Area by Alternative (acres):						*77*	*77*	*79*	*77*
Lower Phoenix Park	**D1**	**15**	***9729***	**3143**	**3560**	**3560**	**3560**	**3560**	**3560**
Total Proposed Treatment Area by Alternative (acres):						*554*	*554*	*10*	*554*
Equivalent Disturbed Area by Alternative (acres):						*105*	*107*	*2*	*105*
Upper Decker Wash	**E2**	**8**	***5209***	**2487**	**3196**	**3175**	**3165**	**3165**	**3175**
Total Proposed Treatment Area by Alternative (acres):						*1888*	*1888*	*1888*	*1888*

Watershed/ Sub-watershed	Sixth Code	Watershed Size		Predicted Peak Flow (cfs) from a 100-Year Six Hour Storm					
	Identifier	sq. mi.	acres	Pre-Fire	Post-Fire	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Equivalent Disturbed Area by Alternative (acres):						*359*	*362*	*370*	*359*
Upper Phoenix Park Wash	**D2**	**15**	***9665***	**4006**	**4990**	**4974**	**4974**	**4974**	**4974**
Total Proposed Treatment Area by Alternative (acres):						*2124*	*1958*	*1864*	*2124*
Equivalent Disturbed Area by Alternative (acres):						*403*	*375*	*366*	*403*
Phoenix Park Watershed Totals		**55**	**35280**	**12888**	**15177**	**14640**	**14630**	**14630**	**14640**
Total Proposed Treatment Area by Alternative (acres):						***4971***	***4805***	***4167***	***4971***
Equivalent Disturbed Area by Alternative (acres):						***944***	***921***	***817***	***944***
Showlow Creek Watershed									
Bagnal Draw	**E2**	**10**	***6594***	**2786**	**3478**	**3434**	**3445**	**3434**	**3434**
Total Proposed Treatment Area by Alternative (acres):						*3050*	*3050*	*3050*	*3050*
Equivalent Disturbed Area by Alternative (acres):						*580*	*451*	*597*	*580*
Bull Hollow Canyon	**B**	**13**	***8442***	**3348**	**3517**	**3517**	**3517**	**3517**	**3517**
Total Proposed Treatment Area by Alternative (acres):						*855*	*855*	*855*	*855*
Equivalent Disturbed Area by Alternative (acres):						*162*	*162*	*167*	*162*
Lower Hog Wash	**E1B**	**7**	***4313***	**3261**	**3452**	**3452**	**3452**	**3452**	**3452**
Total Proposed Treatment Area by Alternative (acres):						*9*	*9*	*9*	*9*
Equivalent Disturbed Area by Alternative (acres):						*2*	*2*	*2*	*2*
Lower Linden Draw	**D1**	**12**	***7377***	**3119**	**3328**	**n/t**	**n/t**	**n/t**	**n/t**
Timberland Estates	**D3**	**1**	***742***	**780**	**1304**	**n/t**	**n/t**	**n/t**	**n/t**
Upper Hog Wash	**E1A**	**2**	***1017***	**876**	**1281**	**1263**	**1267**	**1267**	**1267**
Total Proposed Treatment Area by Alternative (acres):						*406*	*406*	*406*	*406*
Equivalent Disturbed Area by Alternative (acres):						*77*	*77*	*79*	*77*
Upper Linden Draw	**D2**	**6**	***3965***	**2731**	**4011**	**3998**	**3998**	**3998**	**3998**
Total Proposed Treatment Area by Alternative (acres):						*453*	*453*	*453*	*453*
Equivalent Disturbed Area by Alternative (acres):						*86*	*86*	*88*	*86*
Show Low Creek Watershed Totals		**51**	**32449**	**16901**	**20371**	**15664**	**15679**	**15668**	**15668**
Total Proposed Treatment Area by Alternative (acres):						***4773***	***4773***	***4773***	***4773***
Equivalent Disturbed Area by Alternative (acres):						***907***	***778***	***933***	***907***
Grand Total All Watersheds		***464***	***296986***	***139575***	***173809***	***153804***	***153856***	***153739***	***153763***
Grand Total Treatment (acres)						***45009***	***38440***	***41010***	***42752***
Grand Total EDA by Alternative (acres)						***8279***	***7284***	***8116***	***8120***

n/t = no treatment

Based on this peak flow analysis, no one of the action alternatives is preferable to another based on quantitative reasons. All action alternatives would reduce discharge amounts over baseline by about 15 percent compared to average action alternative discharge. Alternative 4 discharges the least, followed by Alternative 5, then Alternatives 2, with Alternative 3 producing the most. Sediment yield and soil erosion differences are similar among action alternatives.

This peak flow analysis integrates an initial increase in flow due to logging activities and a greater offset in effects due to creation of ground cover that did not exist before logging. Some watersheds do not show a significant change in discharge compared to post-fire peaks, which is due to the small proportion of treated acreage within the watershed. A detailed discussion of the modeling procedure and results is found in the project record.

Soil productivity in treatment areas would be enhanced by the incorporation of woody materia l from slash. Areas burned at moderate and high severity levels lost nearly all the surface organics needed to retain soil moisture, store nutrients, and provide organics to maintain soil structure of surface soil horizons.

Erosion and Sediment Transport

Action alternatives would provide some degree of ground cover from slash and have an effect on erosion rates, reducing erosion from potential (highest possible) to near tolerance levels. Tolerance levels of erosion imply some minimal ground cover and the rate of erosion is theoretically near the rate of formation, thus no net soil loss. The benefits of added ground cover only apply to areas that are proposed for salvage logging. Depending on the alternative selected, this would amount to varying proportions of each watershed.

Table 13 displays the harvest acreage proposed in each watershed. These acres would benefit from logging activities while the remaining acres would remain at potential erosion rates. Amounts of sediment transport somewhat follows erosion potentials in that higher levels of ground cover would reduce sediment transport. However, this is also a function of soil type, slope and distances to a drainage channel. Once sediment is delivered into any size of channel, it is basically a matter of time before it leaves the area as net loss. If stream channels are in functioning condition, some of this sediment can be retained in the form of floodplains (see stream channel condition below).

Soil Quality

Soil quality would be improved by any of the action alternatives, as the ability to accept, hold and release water would be improved by addition of ground cover. Infiltration is encouraged with ground cover as it provides additional surface roughness to slow runoff down and allow greater time for infiltration before leaving the site. The ability to resist erosion and degradation would be enhanced as well as the ability to accept, hold and release nutrients through the addition of organics.

Salvage logging under post-fire conditions considers existing conditions vastly different than those found in healthy green forests. In healthy forests, logging can have negative effects as conditions before impacts are either pristine or nearly so. In post-fire salvage situations, conditions before logging are in the worst possible condition with peak erosion and runoff rates present in many areas. Under these conditions, salvage logging can improve all elements of soil quality and result in a net beneficial effect.

Although some level of soil compaction does occur with timber harvesting, the amount of damage is dependent on soil types, the amount of volume harvested, and slope. When assessed individually, soil compaction is a negative effect of logging. The limited negative effects of compaction are more than offset by positive effects of providing ground cover. In addition, many soils within the proposed harvest areas have slight erosion hazard, meaning they have high infiltration rates to begin with, and are only slightly affected by compaction. Those with greater erosion hazards will benefit the most from added ground cover.

Direct and Indirect Effects Common to Alternatives 2, 3, 4 and 5 on Hydrologic Resources

Watershed Condition

Watershed condition is usually measured in terms of the quantity, quality and timing of runoff. As this is a function of soil conditions, it follows that all action alternatives would to some extent improve watershed condition by adding ground cover. As ground cover is generally lacking in the high and moderate severity burn areas, post-logging conditions would be an improvement.

Stream Channel Condition

Stream channel condition is assessed in terms of how well its morphology serves to convey flows discharged by watersheds. Equilibrium must exist between channel morphology and watershed condition for the channel to function properly. As all action alternatives have the effect of slightly reducing post-fire peak flows, equilibrium conditions would be achieved at a faster rate than without treatments. As treatment areas are of limited extent, the benefits are also limited and may not be measurable in terms of years needed to fully recover channels damaged from peak flows.

Many of the ephemeral stream channels in the analysis area were not in pristine condition before the fire, and will need a very long time to reach a state of equilibrium. It can only be anticipated that full recovery will take decades. Currently, some channels lack sufficient floodplains to handle the higher discharges coming off the burned areas without damage to stream banks.

The only perennial stream inside the analysis area is Canyon Creek which includes Mule Creek, one of its tributaries. Canyon Creek has experienced several channel shifts as well as bank erosion due to post-fire peak flows and any reduction of peak discharge can be viewed as beneficial to Canyon Creek's channel condition.

Post-Fire Flooding

All action alternatives show a slightly reduced peak flow after treatment when compared to post-fire peaks. Although the difference is small, the significance of a small difference can be relative. It may only take an inch difference in flood elevation to prevent flows from entering a private home downstream. Generally the differences in peak discharges modeled for each action alternative are not significant enough to allow accurate prediction of peak discharges. However treatments do show some amount of benefit in flow attenuation. These burned watersheds currently have the capability of producing a 100-year flood from a 5-10 year rainfall event, which the proposed treatments do not significantly change.

Water Quality

The only action alternative that proposes to salvage log in this area is Alternative 2, which proposes to yard merchantable material by helicopter yarding in the Canyon Creek area. The slash generated from harvesting activities would benefit the watershed, and theoretically could

help reduce sedimentation to Canyon Creek by providing ground cover. However, Canyon Creek Watershed contains soils that are extremely erosive, hard to stabilize, and difficult to revegetate.

It is expected that Canyon Creek will not meet turbidity standards for decades to come, depending on the rate of healing of watershed conditions. Turbidity, as a standard is being revised by the state and will most likely be replaced by a suspended solids standard. Logging slash would assist in this process, catching sediment on steep slopes and promoting infiltration. Since portions of the watershed are very steep, it naturally has a short concentration time, which combined with the severe effects of the fire on current watershed conditions, tends to dilute the positive effects of slash to the point of insignificance.

Ground Water Aquifers and Springs

It is not anticipated that the small reduction of runoff attributed to the beneficial effects of logging slash would be significant to groundwater recharge, and related discharge of springs. The action alternatives do not significantly reduce post-fire discharges because of limited treatment acreages within each watershed, and as a result it is unlikely there would be a noticeable difference in its effects on groundwater recharge.

Improvements

Canyon Creek Fish Hatchery: Action alternatives that propose treatments in the Canyon Creek watershed may have a slight positive effect on the water quality flowing into the Hatchery, but it is unlikely to be measurably different from other alternatives considered in detail. Most of the Hatchery's water comes from spring boxes, which might be affected by flows in Canyon Creek, however salvage logging related activities are not significant enough to become traceable in spring discharge or water quality.

Black Canyon Lake, Lone Pine Dam, and Schoen's Dam: All action alternatives would generate ground cover, which helps retain soil and reduces runoff. Watershed conditions would be slightly improved and sediment yields are expected to decline slightly in parallel to lowered discharge. Based on these assumptions, it is anticipated that sediment influx into reservoirs would be slightly diminished, adding to the effective life of the reservoir capacity. The proposed treatment acreages are very small in proportional extent, which limits the total beneficial impact that each alternative can produce. Although slight, action alternatives would reduce sediment influx to reservoirs.

Stock Tanks and Fencing: Reservoirs and stock tanks would also benefit from ground cover created by action alternatives, lowering maintenance requirements because they would not fill in with sediment as quickly as when soils can erode at potential rates of erosion. Some tanks may not be worth rebuilding until watershed conditions stabilize. Some areas that originally had protective fencing around riparian areas may not be worth repairing until watersheds stabilize, as continual peak flow events will damage or tear out fencing near drainages. Slash generated by action alternatives should not have any direct effect on fencing. Over time, fallen dead small-diameter trees may affect fencing if they float down into fence crossings and tears them out.

Road Systems: Action alternatives affect roads from the standpoint that they would be used to haul timber resulting in increased maintenance needs. Slightly reduced discharge flows would have positive effects by reducing flows at road crossings. Realistically, the decrease in discharge would be insignificant to road related impacts.

No new permanent roads are proposed in any of the action alternatives. All temporary roads created would be closed, water barred and seeded upon completion of salvage logging activities.

Cumulative Effects Common to Alternatives 2, 3, 4 and 5

Effects of Past Activities:

The cumulative effects of all major activities within the analysis area implemented within the last 25 years (see Appendix A), are integrated through the selection of runoff curves used in flow modeling. Included are grazing, timber harvest, thinning, prescribed burns, reforestation, road and trail construction, and fuelwood harvesting, among other activities.

Fire Effects: The fire reduced or eliminated groundcover resulting in exposed mineral soil; soil crusting; deterioration of site productivity; reduced soil infiltration rates; increased runoff; flooding; channel erosion; sedimentation and water quality impacts;. These effects, including the effects of suppression activities and BAER treatments; were integrated in the selection of representative post-fire runoff curves.

Perspective: Previous activities, as well as the fire, contribute to the cumulative impacts common to all action alternatives. However, the Equivalent Disturbed Area (EDA) concept helps put previous impacts into perspective. For normal cumulative effects analyses, as done for predicting effects of a timber sale proposed to occur in a healthy forest, the established threshold value of disturbance level is 15 percent of any given watershed area. This means, if previous activities affected greater than 15 percent of a given watershed, additional impacts were avoided. The threshold has the purpose of limiting disturbance in a relatively undisturbed watershed.

Disturbance values of 90-100 percent were not uncommon within the analysis area. Such extreme levels of disturbance are severely damaging to soil and watershed resources, and it is the objective to reduce this impact as soon as possible, by whatever means available. The purpose of BAER treatments immediately after fires has the same objective, to reduce the effects of this disturbance level back down towards the 15 percent threshold, although this is almost never achieved. Most of the few watersheds having a disturbance value under 15 percent were those with a significant portion of their area outside the burn perimeter. This emphasizes the significance of the fire, as its large-scale effects currently overshadow all previous impacts, in essence setting a new ecological baseline.

All actions reducing the impacts of the fire on areas burned at moderate and high severity levels need to be given credit, as 'no action' can only prolong the high impact produced by the fire. Logging slash is an immediately effective ground cover that helps reduce soil movement and runoff. It cannot totally replace all groundcover lost during the fire, but it helps reduce EDA significantly, and is far better than no groundcover at all. Slash does have a slightly positive net effect on runoff, which takes into account the negative effects of logging.

Effects of Action Alternatives Added to Past Impacts: Differences between alternatives mainly amount to acreage and location of proposed salvage operations, with smaller differences related to snag retention for wildlife, and methods of yarding (ground based operation vs. helicopter). The only areas that are proposed for salvage logging were burned at moderate and high severity levels with high or complete tree mortality and little remaining ground cover. Harvesting timber in any of the action alternatives would result in generation of slash from the non-merchantable treetops as well as branches. Slash would be left on the ground, lopped to a two-foot height and is not proposed for further treatment. This remaining material becomes the only effective ground cover present after logging is completed.

Alternatives 3 and 4 would require saving 3-5 commercial trees per acre for wildlife snags. However, as the exact number of harvested trees per acre is unknown, this requirement cannot be reflected in calculating ground cover. The project record reflects the source of this information, calculations involved, as well as photos and field measurements on which this is based.

Normally skidding or yarding operations have the greatest impacts to soils and watersheds and are mitigated through BMPs. A listing of BMP's that regulate operations in or near all sensitive areas is displayed in Appendix B. However some impacts would be unavoidable and are implied. The negative impacts of logging operations anticipated from salvage operations proposed in all action alternatives have been accounted for through modeling. The results of runoff modeling for each action alternative show that overall effects are slightly positive, indicating that the positive effects of ground cover more than neutralize the negative effects of logging.

The reason for the limited benefit, shown in terms of slightly lower discharge peaks, is that each modeled watershed has only a small proportional area proposed for treatment. It must be re-emphasized here that the effects of logging on soils and watersheds are analyzed very differently in healthy forests, versus burned areas. Healthy forests already fall under the 15 percent threshold of EDA per watershed, while burned areas are near 100 percent EDA to start with, and all actions that result in runoff mitigation as well as sediment retention will reduce the high EDA impact of fire. As long as net effects are positive, some amount of soil is saved from being washed away, and soil moisture is enhanced through slightly higher infiltration and less runoff. Such trends can only help eventual establishment and recovery of native vegetation.

Three Decision Memos were approved December 23, 2002 to treat hazard trees and fuels in priority areas across the burn: firstly, near administrative sites, roads, trails, developed recreation sites, and concentrated use areas, secondly near fences and utility lines, and thirdly in the wildland-urban interface. These ongoing projects target salvage logging of 12 inch plus dbh dead timber. The cumulative effects of the decision memo activities and the activities proposed for this project would have a net effect of near zero. Logging impacts in the severely burned areas would generally be offset by the resulting ground cover from remaining slash of the harvested trees.

Reasonably Foreseeable Future Actions:

Appendix A displays all known reasonably foreseeable future activities proposed within the burned area. Some activities such as livestock grazing will not resume until available forage has recovered. There is no set time limit to accomplish this, but it is anticipated to take at least five years.

Alternative 2

Direct and Indirect Effects of Alternative 2 on Soils

Alternative 2 is nearly identical to Alternatives 3, 4, and 5, outside of proposing some helicopter logging on 2,258 acres within the Canyon Creek Watershed. This is extremely steep canyon land directly below the Mogollon Rim, and most of it can only be accessed via helicopter yarding. The qualitative discussions below pertain only to the effects that would be different from what has already been discussed in Direct and Indirect Effects Common to Alternatives 2, 3, 4 and 5.

Productivity and Ground Cover

Helicopter logging would create beneficial groundcover that presently does not exist on the steep slopes of Canyon Creek. The extremely steep slopes and soil characteristics inherited from highly erosive parent materials significantly increase the importance of any increase in groundcover

density. Qualitatively this alternative creates the greatest amount of logging slash over the entire alternative area, which becomes much-needed beneficial groundcover. Outside of logging slash, no other treatments are planned that might help create ground cover. The Canyon Creek area has merchantable volume, and the anticipated logging slash ground cover would exceed 30 percent. This material would help replenish burned organic debris, which is critically important to top soil formation, soil moisture retention, and nutrient retention.

Erosion and Sediment Transport

Logging slash would be almost immediately utilized to reduce soil movement on the steep slopes below the Mogollon Rim. It usually takes only one good rainfall event to wash soil into all potential soil storage spaces behind slash on a steep slope. Over the proposed 2,258 acres of logging, 30 percent ground cover could make a difference in helping to hold thousands of tons of soil on the slopes. As these soils are highly erosive, their ultimate endpoint is Canyon Creek or in one of its major tributaries, where it eventually could impact water quality in Canyon Creek as well as affect fish habitat.

Soil Quality

Soil quality is dominantly tied to ground cover, and is measured through the soil condition process which addresses ability to hold and release water, ability to resist erosion; and ability to accept, hold, and release nutrients. As most of the topsoil on such steep slopes is very thin, keeping it in place is even more important. Slash created from logging operations can be an important source of ground cover, especially when high or moderate severity burns have consumed all previous materials.

Direct and Indirect Effects of Alternative 2 on Hydrologic Resources

Watershed Condition

Logging slash would similarly enhance watershed condition of the Canyon Creek area, as it does soil quality. Runoff would be somewhat retarded and allowed greater time to infiltrate, dissipating some of its energy on the slash ground cover, and reducing its capability to erode soil. As helicopter logging has very low impact on the watershed in terms of roads and landings, the total impact of this type of operation is positive.

Stream Channel Condition

It is doubtful that around 30 percent ground cover on steep slopes will make a measurable difference in stream discharge, and ensuing stream channel condition. Although slash can help control soil movement, it would not noticeably change flow timing or total discharge of large rainfall events, especially in extremely steep watersheds with short concentration times. Alternative 2 would not measurably affect stream channel condition.

Post-Fire Flooding

Alternative 2 proposes the largest areas for harvesting, and as such can potentially create the most ground cover. However, the modeling results reflecting the positive impacts of the logging activity show little change in runoff between this and the other action alternatives.

Water Quality

The positive effects of increasing ground cover density with slash should also have a positive effect on water quality in Canyon Creek, an important fishery resource. However, the significance of this effect may not be measurable.

Road Systems

Alternative 2 would have minimal or insignificant negative impacts from the small areas needed for landings and temporary roads. Most helicopter operations minimize the need for roads, and in this case existing roads would be used. Thirteen log landings and three service landings (total of approximately 16 acres) would be required for this operation. This would not have a measurable effect.

Cumulative Effects of Alternative 2

In comparison to the impact of the fire on runoff and soil erosion, the impact of the proposed saw timber and small sale areas in Alternative 2 is insignificant. The added impact of the proposed salvage logging activities is minute and indistinguishable from the impact of the fire, while the positive effects of creating ground cover result in a net positive impact by reducing discharge and soil erosion when compared to the no action alternative.

Alternative 3

Direct and Indirect Effects of Alternative 3 on Soils

Productivity and Ground Cover

This alternative proposes salvage logging on slopes less than 40 percent and avoids highly erosive soils. Salvage logging would occur on 30,770 acres, removing the least sawtimber and specialty wood products of action alternatives considered. More of the largest trees would be retained to meet wildlife needs than proposed in Alternative 2. As a result, less ground cover would be created from activity slash and high soil erosion rates are expected to continue from these areas until natural ground cover re-establishes itself. If nothing is done to protect these slopes from erosion, they will lose their productive potential and it may not be possible for them to recover to their pre-fire vegetative densities. Avoiding treatment risks loss of production potential from many areas that currently have shallow soils over bedrock.

Erosion and Sediment Transport

High soil erosion rates and sediment transport are expected to continue until natural ground cover re-establishes itself. Soils lost from slopes or areas with shallow soils over bedrock results in permanent effects, as soil formation on bedrock is extremely slow, taking centuries to form. Ground cover is much more critical on steep slopes, than on flat areas.

Soil Quality

Soil quality, as addressed through soil condition, is heavily affected in burned areas that are on steep slopes as well as shallow soils. Ground cover is critical in maintaining soil functions such as nutrient storage, water absorption and release, and the ability to resist erosion. Leaving these soils in the Canyon Creek area devoid of ground cover will seriously impair their future potential.

Direct and Indirect Effects of Alternative 3 on Hydrologic Resources

Watershed Condition

Similar to Soil Quality, watershed condition is also dependent on ground cover. Without ground cover in the Canyon Creek area, these areas will shed water very quickly, generating massive quantities of eroded soil, exporting nutrients off site, and in areas of shallow soils, exposing more bedrock out crops. Discharge concentration times would remain at post-fire levels, resulting in channel erosion as well.

Stream Channel Condition

Stream channel conditions would be affected near any untreated steep slopes. Channels are expected to incise into gullies, forcing channels to re-build their floodplains over decades to come. Many ephemeral channels within the analysis area were not in pristine condition to begin with. However, leaving critical areas of the burn untreated would not help this situation. Riparian areas may be affected for similar reasons.

Water Quality

Without creating much-needed ground cover with logging slash, Canyon Creek is expected to carry significant sediment loads for a long period of time until ground cover becomes established enough to naturally stabilize the watershed. Water quality is not expected to be impacted over the remainder of the analysis area.

The direct and indirect effects to the remainder of the elements considered for hydrologic resources are the same as described in the Effects Common to Alternatives 2, 3, 4 and 5.

Cumulative Effects of Alternative 3

In comparison to the impact of the fire on runoff and soil erosion, the impact of the proposed salvage logging and small sale areas in Alternative 3 is insignificant.

The added impact of the proposed salvage logging activities is minute and indistinguishable from the impact of the fire, while the positive effects of creating ground cover result in a net positive impact by reducing discharge and soil erosion when compared to the no action alternative. The Tonto NF portion of the burned area is expected to maintain post-fire soil erosion and runoff rates until natural watershed recovery occurs.

Alternative 4

Direct and Indirect Effects of Alternative 4 on Soils

Productivity and Ground Cover

Alternative 4 does not propose any treatment in the Canyon Creek area but it does propose leaving the largest dead trees to meet wildlife needs at the same level as proposed in Alternative 3 over the remaining treatment areas. The requirement of leaving additional snags results in fewer trees harvested per acre. Depending on the area, the wildlife snag requirements vary from 2-5 per acre, while average harvested trees per acre varies from 21-28. This amounts to a 7 to 23 percent reduction in harvested trees, which equals approximately 10 to 34 percent ground cover after harvest. This high snag requirement has an impact on commercially harvested volume as well as the amount of slash this would normally generate. Alternative 4 would harvest fewer trees per acre and generate less slash per acre, and total treated acreage is the least in the small sale and

specialty products areas (6,903 acres). For this reason, Alternative 4 does not significantly stand out as different in effects to soils and watershed resources.

High soil erosion rates within the Canyon Creek area would remain at post-fire erosion rates until natural ground cover recovers. This is anticipated to take decades, considering steepness of topography and loss of fertility and topsoil. Soil productivity would be expected to decline in the long-term and resulting vegetation communities would reflect an earlier seral type and drier species mix representative of lower elevations.

Erosion and Sediment Transport

Higher soil erosion rates are expected to continue over more of the area, when compared to alternatives that harvest more volume. This impact would continue until natural ground cover re-establishes itself. Erosion in the Canyon Creek area would continue at post-fire erosion rates until natural recovery occurs.

Soil Quality

Soil quality would be slightly worse condition in Alternative 4, than in alternatives that harvest more trees and treat the burned areas near Canyon Creek. As soil condition is dominantly a function of ground cover, the overall ability to resist erosion and to accept and release water and nutrients is not as high because this alternative generates less ground cover.

Direct and Indirect Effects of Alternative 4 on Hydrologic Resources

Watershed Condition

Watershed condition may be slightly lower in Alternative 4 than in Alternative 5, which harvests more of the snags left for wildlife. However, differences in channel discharge, or in timing and duration of flows would be inconsequential.

Based on field observations and the estimated quantity of slash left, an EDA factor of 0.05 was added for each additional snag requirement. This reflects the reduction in additional slash that would be created, and this was then added into the overall EDA factor for the proposed treatment action. This then was used in the determination of new weighted runoff curve number and used in the hydrology model to quantify the impact of this alternative. Results are insignificantly different than other action alternatives.

The direct and indirect effects to the remainder of the elements considered for hydrologic resources are the same as described in the Effects Common to Alternatives 2, 3, 4 and 5.

Stream Channel Condition

It is doubtful whether or not stream channel conditions above the Mogollon Rim would be significantly different in Alternative 4, compared to other action alternatives. Alternative 4 may negatively affect Canyon Creek, as its watershed will not receive treatments.

Cumulative Effects of Alternative 4

In comparison to the impact of the fire on runoff and soil erosion, the impact of the proposed saw timber and small sale areas in Alternative 4 is insignificant. The added impact of the proposed salvage logging activities is minute and indistinguishable from the impact of the fire, while the positive effects of creating ground cover result is a net positive impact, reducing discharge and soil erosion when compared to the no action alternative. The Canyon Creek area of the burn is

expected to maintain post-fire soil erosion and runoff rates until natural watershed recovery occurs.

Alternative 5

Direct and Indirect Effects of Alternative 5 on Soils

Productivity and Ground Cover

Alternative 5 creates the greatest amount of ground cover from logging slash on all areas above the Mogollon Rim, and as such is expected to result in the least soil erosion from these areas. Alternative 5 does not propose any action in the Canyon Creek area and would produce high soil erosion rates from the Canyon Creek area, essentially maintaining post-fire erosion rates until natural ground cover recovery occurs. This is anticipated to take decades, considering steepness of topography and loss of fertility and topsoil. Alternative 5 proposes leaving dead trees to meet wildlife needs at the same levels as Alternative 2. Minimum snag retention has a significant impact because the EDA factor becomes more favorable for a sizable acreage. Due to the amount of salvage logging volume, this alternative creates slash at levels second only to Alternative 2 to enhance or maintain soil productivity. Soil productivity would be expected to decline in the Canyon Creek area in the long term and resulting vegetation communities would reflect earlier seral types, as well as reflecting a drier species mix representative of lower elevations.

Erosion and Sediment Transport

Alternative 5 would result in the least amount of erosion across the entire proposed activity area, and the greatest amount of sediment retention in the watersheds, based on total harvest volume. However, the Canyon Creek area would experience high post-fire soil erosion rates until natural recovery can stabilize the watershed.

Soil Quality

Soil quality would improve slightly under Alternative 5, except for the Canyon Creek area, which would receive no treatment. Ground cover is essential to all elements of soil quality, and this alternative maximizes ground cover generation from logging slash. As soil is essentially a non-renewable resource in terms of a human lifetime, maintaining soil quality should be priority.

Watershed Condition

Watershed condition would not improve in the Canyon Creek area, as no treatments are proposed in this area. Watershed condition is expected to remain in unsatisfactory condition, as the high erosion rates typical of the soils in this area will remain at post-fire potential erosion rates. Topsoil would form very slowly, in parallel to the natural healing processes that would take place over time.

Watershed condition above the Mogollon Rim is expected to improve at a faster rate, given the significant ground cover created by logging slash. Although time to concentration and flood durations may not significantly change during peak flow events, the ground cover would make a larger difference during normal or smaller rainfall events, capturing soil and promoting infiltration. Alternative 5 would be the most beneficial to watershed condition.

Stream Channel Condition

It is doubtful whether or not stream channel conditions above the Mogollon Rim would be significantly different in Alternative 5, compared to other action alternatives.

Post-Fire Flooding

Greater infiltration and reduced runoff produced by Alternative 5 would produce less downstream flooding. However, differences between all action alternatives are so slight, they are insignificant.

Water Quality

Without creating much-needed ground cover from logging slash, the Canyon Creek area is expected to carry higher sediment loads for a long time, until ground cover in the watershed recovers naturally.

Cumulative Effects of Alternative 5

In comparison to the impact of the fire on runoff and soil erosion, the impact of the proposed saw timber and small sale areas in Alternative 5 is insignificant. The added impact of the proposed salvage logging activities is minute and indistinguishable from the impact of the fire, while the positive effects of creating ground cover result in a net positive impact by reducing discharge and soil erosion when compared to the no action alternative. The Canyon Creek portion of the burned area is expected to maintain post-fire soil erosion and runoff rates until natural watershed recovery occurs.

Geology and Minerals

Introduction

The geology of an area influences surface resources including landform, soils, stream morphology, and economic mineral deposits. Due to the strong influence on characteristics of surface materials, geology also affects management activities such as road maintenance and control of sediment delivery, among others. Typically, mineral resources play an important role in meeting public needs for many types of building materials and rare elements. It is the intent of this section to describe the effects of the alternatives considered in detail on these resources.

Methodology Used for Data Collection and Analysis

Various geologic references were reviewed including technical reports covering the Mogollon Rim, county maps depicting surface geology, and aerial photos of the steeper portions of the burned area. The Terrestrial Ecosystem Survey (TES) of the Apache-Sitgreaves National Forests was used to assess potential hazards of mass wasting on steep slopes, as well as to reference potential soil erosion rates (Lang, et al., 1989). Terrestrial Ecosystem Survey information for the Tonto's portion of the analysis area is not available at the time of this publication.

This assessment of the mineral resources was derived from a study of geologic maps, the Bureau of Land Management (BLM) mining claim database, Forest Service land status records, and anecdotal accounts of past mining activities provided by long term residents.

Regulatory Requirements

The administration and management of mineral and geological resources on National Forest Lands are addressed by congressional acts, the Forest Service's regulations found at 36 CFR 228, and the Apache-Sitgreaves and Tonto's Forest Plans (USDA. 1987 and USDA, 1985). The primary congressional acts that apply to the lands in question are the General Mining Law of May 10, 1872, as amended, and the Materials Act of July 31, 1947. The Bureau of Land Management administers mineral rights. The Forest Service administers the surface resources of those claims occurring on National Forest System lands.

Forest Service regulations at 36 CFR 228 Subpart A provide direction for the management of locatable minerals (usually precious or strategic metals) and the regulations at Subpart C govern the use and disposal of mineral materials (usually sand and gravel).

The Apache-Sitgreaves' National Forest plan provides direction for mineral resource management on pages 16 and 86 thru 90 (USDA, 1987). Fundamentally the plan directs compliance with the applicable laws and regulations when responding to legitimate notices of intent to operate on a valid mining claim and provides guidelines for management of common variety minerals and leasable minerals. The Tonto's forest plan direction is found on page 45 (USDA, 1985).

Affected Environment

Information on the geology and minerals resources found within the analysis area is presented in the following subsections:

Geological Environment

Rim Gravels Formation

Within the burned area, no mineral deposits of economic value have been located other than sand and gravel. The "Rim Gravels" formation is the most common source for sand and gravel in the

area, covering the sedimentary soils on the west side of the project area (Kamilli and Richard, Wilson et al., 1998). This formation consists of rounded alluvium, which originated in the Painted Desert of northern Arizona, and was transported south in an extensive but relatively thin sheet, covering present day uplands as well as stream bottoms. After the Colorado Plateau shifted its orientation, uplifting the Mogollon Rim, water flowed north and the gravel was transported with it (Smiley et al., 1994).

Mineralogy of rim gravels consists of sedimentary rocks, some of which are metamorphosed such as conglomerates, quartzite, limestone and sandstone. In the past, extensive gravel mining has been practiced within some of the major drainages (Phoenix Park wash, Decker Wash, Black Canyon, etc.) in order to extract material to build State Highway 60. This has resulted in significant lowering of drainage base levels, causing head cutting in the order of six to 10 or more vertical feet and extending for miles above the extraction sites into the National Forest. Most of the gravel pits were located on adjacent private lands, however head cutting from these gravel pits affects forested lands to this day. Most impacts have centered on affecting width/depth ratios of active channels, reduction of floodplain widths, floodplain availability in terms of vertical accessibility, and floodplain erosion through bank sloughing. Such impacts affect the success rate of woody riparian plant establishment, as well as expected post-fire recovery rates of stream morphology (Subirge, T., personal communication, 2003).

Quaternary and Tertiary Volcanics

Surface geology of most of the burned area is dominated by two different formations. The east side of the analysis area, from Show Low Creek east, is covered with quaternary and tertiary volcanics in the form of basalt flows and aeolian cinder deposits (Wilson et al., 1960).

Basalt and cinders consist of the same material, but are formed differently. Basalt flows exude under very low pressure and flow out into large sheets of solid rock. Cinders form from molten lava sprayed out of a small orifice or vent under high pressure forming small particles that cool in the air and are distributed by wind and water. Due to the frothy nature of cinders, this material has a high surface area to weight ratio, and it can weather relatively quickly to form the volcanic soils found on the east side of the analysis area (Smiley et al., 1984).

These soils are dominated by smectitic clay mineralogy (specifically, montmorillonite) giving it a high shrink/swell ratio (Hendricks). This characteristic allows this soil to form deep wide cracks when dry, and upon wetting it can expel large rocks out of the soil through shrink and swell action. Ground cover in the form of organic litter helps this soil retain moisture and reduce the effect of heaving. Without ground cover, these fertile soils are challenging to revegetate (Subirge, T., personal communication, 2003).

Tertiary and Cretaceous Age Sedimentary Deposits

Most of the west side of the analysis area is dominated by strongly weathered sedimentary deposits of Tertiary and Cretaceous age. This includes everything west of Show Low Creek, and includes about three fourth of the analysis area. Formations include Kaibab limestone deposits that crop out on the extreme southwest side, some small slivers of Coconino sandstone, and various mixed deposits of weathered shale, sandstone and limestone that tend to grade in and out of each other at random.

The edge of the Mogollon Rim shows a sequence of rock formations with Kaibab limestone at the surface, followed by Coconino sandstone, and underlain by thick deposits of the Supai formation, which consists of highly weathered shales, sandy limestone and limy sandstone (Wilson et al.

1960; Kamilli and Richard, 1998). The deeper portions of the canyons in Canyon Creek reveal older Paleozoic limestones and Proterozoic quartzites. The Supai formation is prevalent on the steep south facing slopes of the Tonto National Forest portion of the burn, and is reputed to pose problems with slumping, sliding, and piping. Bright orange-red silty clay deposits that are highly erosive and contain significant amounts of montmorillonite clay characterize most of the Supai material. These soils are also difficult to revegetate due to high clay and lime content (Subirge, T., personal communication, 2003).

Minerals Environment

The analysis area is not characterized by significant mineralization primarily due to the geology of the area. Most parent materials are sedimentary deposits of sandstone, limestone rim gravels and extrusive volcanic (basaltic) materials. Mining in the area has been confined to working outcrops of coal seams in the area between Deer Springs and Clay Springs. In the early 20th century several parcels of private land in this area were patented under the Coal Lands Act of 1873. Most visible coal deposits are of low grade and contain a significant quantity of sulphur; consequently there is no active coal mining in the area. There is seasonal activity in an open pit clay mine located on 160 acres patented under the Coal Lands Act. Some of the adjacent patented coal lands have recently been subdivided into five-acre residential lots. The majority of these areas were burned at moderate to high severity levels (Green, F., personal communication, 2003).

There are some uranium deposits in the Christopher Creek area. These deposits are in very thin seams and have not been commercially developed.

Other known mineral activities revolve around manganese claims located in the post World War II era. These claims were patented in the mid to late 1950s and some active mining proceeded until the early to mid 1960s. The claims were then subdivided into one-acre lots and are now the community of Forest Lakes. There are some un-patented mining claims located in the analysis area just south of Forest Lakes, however no activity on these claims has been recorded in at least two decades.

Mining activity on the Forest Lakes claims was generally confined to the surface as small open pits to locate manganese nodes. Mining activity ceased as the market value of manganese dropped. While there is little evidence of any reclamation work of past digs, most visible signs of mining are confined to relatively small excavations that present no environmental or safety hazards at this time.

Other mineral activity in the burned area is confined to mineral materials used to improve forest development roads and public highways. These alluvial gravels have historically been removed from any of the several major drainages that cross the burned area. At present there is one active materials source located in Cottonwood Wash and one at Brookbank Point. These sources are operated sporadically as needed for material to place on forest roads during maintenance activities. Neither of these two sources would be utilized for road maintenance activities proposed in action alternatives.

There are no known oil or gas deposits within the analysis area.

Environmental Consequences

Effects Common to All Alternatives for Geology

None of the alternatives considered in detail will directly, indirectly or cumulatively impact the geology of the analysis area. Analysis of past, present and reasonably foreseeable future activities

revealed that there will be no cumulative effects to the geological features of the analysis area from implementation of any of the alternatives considered in detail. For a detailed analysis of possible effects to soils, see the Soils and Hydrologic Resources Section.

Effects on Minerals

Alternative 1

Direct and Indirect Effects

Road maintenance activities will continue to be carried out on county maintained roads accessing private lands within the analysis area. Some crushed aggregate from private land sources will continue to be used to spot surface roads. Quantities of this material that will be needed for these activities are unknown. There are no suitable sources available from National Forest system lands within the analysis area.

Because the no action alternative proposes no salvage logging, it would not require the transportation system maintenance levels anticipated in action alternatives (see Transportation section). Crushed aggregate and pit-run materials would not be needed for road maintenance in order to haul salvaged timber. However, roads damaged from rain events following the fire will continue to deteriorate in locations where culverts were removed. Only routine road maintenance to system roads would be provided. The maintenance backlog described in the transportation section would be greatly compounded and continue to worsen. Some crushed aggregate and pit-run materials would be needed from private land sources in conjunction with routine maintenance, however quantities and locations are unknown.

Cumulative Effects of Alternative 1

Past private and National Forest System road maintenance activities have required common variety minerals from sources in the proximity of the analysis area. Implementation of Alternative 1 would have no cumulative effects on these past maintenance activities.

Present activities such as the salvage of dead trees authorized in the three Decision Memo approved December 23, 2003 require the use of these common variety minerals for road maintenance activities. Implementation of Alternative 1 would have no cumulative effects to these materials or the sources from which they are obtained. Activities such as the reconstruction of Highway 260 through Overgaard, AZ has required large amounts of aggregate materials that have been transported in from as far away as Snowflake, AZ. Other present activities would not be cumulatively affected by implementation of Alternative 1.

Future reconstruction of Forest System Roads within the analysis area that were damaged by the Rodeo-Chediski Fire will require additional amounts of these common variety materials. The amounts and sources are unknown at this time. There would be no cumulative effects from implementation of Alternative 1 on these materials.

Alternatives 2, 3, 4 and 5

Direct and Indirect Effects

The action alternatives would not affect any active mineral operations nor would they preclude any opportunity for development of future mineral operations. Each alternative proposes different volumes of salvage logging to be hauled from National Forest System lands and attendant road maintenance activities commensurate with anticipated use levels (see Transportation Section). There have been no materials sources in the analysis area identified for use in road maintenance. Alternative 3 would require the least amounts of crushed aggregate and pit-run material from

private land sources than other action alternatives. Alternative 2 would require the most of these materials, followed by Alternatives 5 and 4 respectively (see Transportation Section). Actual volumes of these common variety materials and source locations are unknown.

Cumulative Effects of Alternatives 2, 3, 4 and 5

It is unlikely that any future mineral operation will be proposed on National Forest System lands by the private sector for coal or manganese.

Appendix A provides a listing of past, present and reasonably foreseeable future activities found within the analysis area. No cumulative effects to minerals resources found within the analysis area are anticipated from implementation of Alternatives 2, 3, 4 and 5. Common variety materials such as crushed aggregate and pit-run materials are available from private land sources adjacent to the analysis area.

Future reconstruction of Forest System Roads within the analysis area that were damaged by the Rodeo-Chediski Fire will require additional amounts of these common variety materials. The amounts and sources are unknown at this time. There will be no cumulative effects from implementation of alternatives 2, 3, 4, and 5 on these materials.

Vegetation

Introduction

This section describes the vegetative resources within the analysis area, presenting the current (post-fire) vegetative characteristics of the project area as well as an analysis of the effects on the vegetation resource from proposed management activities.

This section is a summary of more detailed analysis reports located in the project record. The fire and fuels report in the project record is an important companion document that, in tandem with the vegetation report, fully details the conditions of the existing vegetative environment.

Methodology Used for Data Collection and Analysis

Because of the magnitude of the area affected by the Rodeo-Chediski Fire, data for vegetative conditions was compiled from several different sources to best describe the current forest conditions and predict the environmental effects of the alternatives.

Two-thirds of the analysis area was field surveyed prior to the fire. These surveys delineated areas with similar tree characteristics into tree stands. Stands vary in size, depending upon their uniformity, from ten acres to several hundred acres. Tree size and characteristics were measured at sample points within each stand and entered into the FSVEG database, which uses a national standardized data storage protocol common to all Forest Service units. This data can be extracted for specified areas and summarized in a variety of region-specific formats for use in vegetation analysis.

The existing stand data for those areas on the Tonto and Apache-Sitgreaves National Forests included within the boundary of the Rodeo-Chediski Fire was extracted from the FSVEG database and processed through the Southwestern Region's RMSTAND program to generate a set of stand attributes used in the analysis. These attributes include forest type, vegetative structural stage (VSS), and average trees per acre by VSS for each stand with examination data.

The remaining one-third of the analysis area had no collected data, or data that is no longer valid due to the effects of the fire and recent vegetation management activities. This lack of data collectively involved a large area over 58,000 acres. Because the areas without stand data were distributed throughout the burn area and were often surrounded by areas that did have data, a computer modeling process called Most Similar Neighbor (MSN) analysis was used to assign stand characteristics to these sites for the purpose of this analysis.

Most Similar Neighbor analysis uses satellite imagery, spatial relationships, and topographic information to match a target site (a stand without data) to the nearest reference site (a stand with data) with the greatest similarity in vegetative characteristics. Tree data from the reference site is then assigned to the target site. Because some of the stand data is 15 years old or older, all of the collected data was first run through a tree growth model, the Forest Vegetation Simulator (FVS), to equalize all stand data to the year 2002. A more detailed description of this method of data analysis can be found in the vegetation report in the project record.

The MSN data was combined with the pre-fire data from two-thirds of the stands to produce average stand characteristics data prior to the fire. While that data is no longer valid in stands that experienced low, moderate, or high burn severity, it did provide a baseline for analysis that was used to project vegetative conditions after the fire. While it would be preferable to collect post-fire field data to establish the current condition, it is not feasible to do so on an area this large within the timeframe required to salvage merchantable material. Therefore, biological

assumptions about the effects of the fire on vegetation were classified by burn severity and then converted into mathematical models that were applied to the pre-fire conditions. This process estimated the average changes in stand conditions as a result of the fire. Details of the biological assumptions and models used to develop this data are located in the project record.

Regulatory Requirements

- The National Forest Management Act (NFMA) sets forth requirements for resource management on the national forests. These are described in the Code of Federal Regulations (CFR) in Title 36, Section 219.27.

A certification checklist of these elements for silvicultural treatments is included in the Project Record.

While federal laws like the NFMA establish regulatory requirements of forest management for federal agencies, the detailed direction that guides the project level vegetation analysis for the proposed action and alternatives are contained in the Land and Resource Management Plans (forest plans) for both the Apache-Sitgreaves and Tonto National Forests. These forest plans include the goals, objectives, direction, and Forest-wide Management Area standards and guidelines to which this analysis adheres.

The Apache-Sitgreaves National Forests Plan (USDA, 1987) includes forest-wide management goals and objectives to:

- integrate considerations for economics, water quality, soils, wildlife habitat, recreation opportunities, visual, and other values in project design;
- include Vegetation Management Practices for salvage harvest to capture volume from mortality in either suitable or unsuitable lands.

The Apache-Sitgreaves' Forest Plan also includes standards and guidelines to:

- make miscellaneous forest products and fuelwood available in timber management activities;
- minimize visual and road impacts and guide utilization and sale preparation practices in Management Area 1 (timberlands);
- balance personal use and commercial use in product availability; restrict timber harvest to slopes under 40 percent; and emphasize stand variety for visual management in Management Area 2 (woodlands);
- retain natural occurrence of dead standing trees and logs, and coordinate vegetation management with other resources in Management Area 3 (riparian).

Additional Forest Plan direction is provided but applies primarily to management of healthy forest stands and was not found applicable to areas burned at moderate and high severity levels proposed for treatment.

The Tonto's Forest Plan (USDA, 1985) also includes standards and guidelines to:

- design timber activities with considerations for water quality, soils, wildlife habitat, recreation opportunities, visual, and other values.
- guide utilization and harvest practice and road and haul limitations in Management Area 5D (Mogollon Rim-Sierra Ancha Area).

Management direction in both the Apache-Sitgreaves and Tonto National Forest Plans (USDA 1987 and USDA 1985, respectively) was amended in 1996 through a region-wide amendment of all forest plans in Arizona and New Mexico (USDA, 1996). Management direction for forested landscapes under this amendment incorporates the *Recovery Plan for the Mexican Spotted Owl* (USDI, 1995) and *Management Recommendations for the Northern Goshawk in the Southwestern United States* (Reynolds et al., 1992).

Elements of the Recovery Plan for the Mexican spotted owl and management recommendations for the northern goshawk relating to forest vegetation and salvage operations are located in the wildlife section of this chapter.

Affected Environment

Vegetative Cover Types

Stand data for the vegetative cover type that existed prior to the fire is presented in Table 14. While live trees are no longer present in many areas, these areas are now considered to be in the early successional stage of the same forest cover type.

Table 14 - Pre-fire vegetative cover type by acres

Vegetative Cover Type	Acres
Ponderosa Pine	140,888
Mixed Conifer	3,485
Pinyon-Juniper	20,810
Oak Woodland	5,090
Juniper Woodland	2,567
Mixed Hardwoods	238
“Tree” (unspecified species)	29
Private Land / Non-Forest	10,740
TOTAL	183,847

Ponderosa Pine

Ponderosa pine forests of the Southwest are found between 6,000 and 8,500 feet in elevation. It is an extensive forest type that traverses the entire state of Arizona. It generally occupies a wide zone between the drier woodland forests types and the more mesic mixed conifer forests found at higher elevations and in moist canyons. Ponderosa pine commonly grows in pure stands and is found in both even-aged and uneven-aged conditions. It also occurs as an early successional species in mixed conifer stands, where it gives way to more shade-tolerant tree species as succession progresses.

Gambel oak and alligator juniper are common associates of ponderosa pine in some stands, especially where it transitions with lower woodland or grassland types. Older ponderosa pines are resistant to ground fire because of thick bark, but younger trees are easily killed. It is adapted to a frequent, low-intensity fire regime. Ponderosa pine regenerates best on exposed mineral soil with the partial protection of a scattered overstory or in small openings. Densely stocked stands of small trees can stagnate, with individual tree growth and stand development nearly ceasing in stands commonly referred to as "dog hair thickets." The common name of "yellow pine" comes from the characteristically yellow, platy appearance of the bark of older trees.

Mixed Conifer

The mixed conifer forest type of the Southwest is typically a mixture of Douglas fir, white fir, southwestern white pine, and quaking aspen. Varying amounts of ponderosa pine and blue spruce may also be present. Engelmann spruce and corkbark fir can also be found at higher elevations or in colder microsites. Mixed conifer habitat occupies elevations from 8,000 feet to about 10,000 feet between the ponderosa pine zone on the low end and the spruce-fir zone on the high end. It can also be found at lower elevations on cool, north-facing slopes or in canyon bottoms and draws. Most of these species are shade-tolerant and multi-layered canopies are common. This cover type is classified as a mixed fire regime, having experienced a variety of fire return intervals and intensities. These forests constitute some of the more complex plant associations in the Southwest and exhibit great variation in species composition.

Woodland

This is a broad classification that includes the pinyon-juniper, juniper woodland, oak woodland, and mixed hardwoods cover types. While there are differences in the relative abundance of pinyon, juniper, and xeric hardwoods (such as oak and manzanita), as a group they represent the driest tree cover type found in the project area. They occupy foothill and mesa sites beginning at about 4,500 feet in elevation and extending into the lower elevational range of ponderosa pine where there can be considerable mixing of the two types. Some sites are thought to have been more open and savannah-like prior to European settlement. Today's denser over stories and under stories are a function of grazing history and fire exclusion. These relatively unproductive sites are slow to respond to disturbance and are often rich in archaeological resources.

"Tree" (unspecified species)

This classification comes from very broad level surveys, often by remote sensing or aerial photography, where no information on tree species is collected. This very minor category was included with the ponderosa pine cover type for this analysis.

Private Land/Non-Forest

There are numerous private landholdings scattered throughout the analysis area that are not included in the cover type divisions. Grassland areas are also common within the lower elevations and those large enough to be delineated were also excluded.

Vegetative Structural Stages

Vegetative Structural Stages (VSS) are used to describe the relative abundance of forest growth stages based upon the average diameter of the trees. Salvage volume and other measures of vegetative conditions used as evaluation criteria between alternatives are also characterized. There are six vegetative structural stages that apply to the predominant forest types represented in

the project area. These stages are described in terms of average diameter of the majority of live trees present and loosely represent successional stages of forest development as listed in Table 15.

Table 15 - Vegetative structural stage (VSS) chart

Class Code	Structural Stage	Diameter Range
1	grass-forb	< 1.0”
2	seedling/sapling	1.0” – 4.9”
3	young forest	5.0” – 11.9”
4	mid-aged forest	12.0” – 17.9”
5	mature forest	18.0” – 23.9”
6	old forest	24.0” +

Note: VSS class diameter breaks are lower for the woodland forest types, but follow the same concept of stages of successional development

Table 16 - Vegetative structural stages before and after the Rodeo-Chediski Fire

VSS	Pre-Fire Distribution	Post-Fire Distribution
1	1 percent	55 percent
2	5 percent	2 percent
3	61 percent	27 percent
4	19 percent	9 percent
5	11 percent	5 percent
6	2 percent	1 percent

Prior to the fire, the VSS distribution was approximately 1:5:61:19:11:2 in the woodland and mixed conifer/ponderosa pine cover types. These numbers indicate a prevalence of young forest vegetation that still characterizes much of the larger forest landscape outside the project area. During the fire, much of this VSS distribution changed. Currently, over half of the project area’s vegetation is now classified as VSS 1, grasses and forbs.

Vegetative Regeneration Capacity

Much of the regenerative capacity of the species that occupied these forests prior to the fire was destroyed. Seed and rootstocks in the upper soil surface were consumed or killed by the fire. Typically, some of this regenerative capacity for understory species survives in deeper soil layers and would be adequate to re-establish them. Over the next decade or so, these new understory plants would recover, mature, and replenish the soil seed bank. Should high intensity fire return before the soil seed bank is restored, there is a high likelihood that many of these species would no longer be represented in the future forest on those sites. This is particularly true in forests where the regenerative capacity of understory plants has already been weakened prior to the fire by competition from a dense tree overstory (Everett, 1995).

Ponderosa pine seeds; which do not store well in the soil because of heavy losses to rodents, birds, and fungi; rely upon the periodic seed production of nearby survivors for regeneration. These heavy seeds are adapted to the short dispersal range historically effective in a patch/gap disturbance regime, probably on a scale of openings one or two tree heights across (Schubert, 1974; Covington and Moore, 1994). Within the Rodeo-Chediski Fire perimeter, some areas burned at moderate or high severity levels measure thousands of feet across. Natural regeneration of openings of this size would require successive waves of regeneration—a few tree heights at a time—outward from fire survivors in adjacent low or unburned areas. This process could take several centuries, as successive waves of regeneration reach sufficient maturity to bear cones and produce seeds. Another high-intensity fire would only increase these distances.

The ecosystem's ability for self-renewal is dependent upon future disturbances staying within the range of natural variability for the genetics of the ecosystem components. Ponderosa pine, for example, is genetically adapted to a short return interval, low-intensity fire regime. This is evident even in this tree's anatomy. Large buds, thick bark, and long resinous needles that result in flammable litter are among those characteristics that indicate adaptation to low-intensity fire and a patch/gap regeneration strategy (Moore, et al., 1999).

Excessive amounts of dead material on the forest floor can reduce the abundance of understory vegetation, but the representation of species that comprise the successional stages of the new forest would not change under any alternative. Dead material on the forest floor can be beneficial in protecting new vegetation from temperature extremes and in providing a physical barrier against ungulate animals. The material proposed for removal under any of the action alternatives would still leave sufficient organic matter on site for nutrient cycling and ecosystem processes. None of the alternatives considered in this proposal are expected to be significantly different in terms of short-term vegetative composition and structure.

Areas of High Burn Severity

In areas of high burn intensity levels, vegetation responds to cycles of natural regeneration primarily from wind-delivered seed, seed stored in the soil, and sprouting of buried roots to slowly reoccupy denuded soil. Grasses and forbs would dominate in most areas. Some vegetation established prior to the fire, such as shrub species, Gambel oak, and alligator juniper, would re-sprout from rootstock below the charred surface of the soil. Other tree species would only regenerate over the next several decades from seed blown into the area from the nearest live seed source, except in areas where trees are planted. The successional pathway of dry, warm ponderosa pine habitats subjected to severe fire is to revert to grasslands (Morgan, 1994). It is expected that these sites would remain in a grass-forb-opening stage (VSS 1) for several decades. Some sites with manzanita, alligator juniper, and oak would also have a shrub component. These sites would remain at VSS 1 until trees reach a sufficient size and density to begin suppressing the understory.

The number of trees needed to reach that condition varies by diameter. Using the VSS formula from the RMSTAND program for ponderosa pine, this would require between 1,800 one-inch and 200 four-inch trees per acre. Once trees are re-established, it could take 10 to 30 years to reach VSS 2.

Areas of Moderate Burn Severity

Areas that burned at a moderate severity levels are very similar to high severity sites except that an estimated five percent of the larger trees would survive as scattered individuals or in small clumps of trees. These scattered survivors may provide sufficient seed source to shorten the decades-long natural tree regeneration process, but would not be present in sufficient numbers to alter the successional pathway or change it from the current VSS 1 condition. These sites would also remain as grass-forb-opening areas or brush fields, in some cases, for decades until trees more fully reoccupy the site.

Early successional regeneration as described for high and moderate severity sites would occur in the small openings created by the fire that are also part of the low burn severity characteristics. Because of the closer proximity to and greater number of seed sources, trees would more readily regenerate in lower burn severity areas than in the more severe classes. The stands that evolve from this severity class would be a mosaic of standing trees and downed logs in diverse clumps, retaining the pre-fire VSS.

Areas of Low Burn Severity

The distribution and percentage of surviving trees is extremely variable on sites that burned at low severity levels and would express a similar variety of vegetative responses over the next several decades. These sites still retain some elements of their pre-fire vegetation structure. They are less dense than they were before the fire in most cases and surviving trees would generally respond with increased vigor and growth rates due to decreased competition from dead trees. The exceptions to this scenario would be trees that were weakened significantly by the fire making them vulnerable to drought conditions or the increased bark beetle activity that is already occurring throughout the area. This type of mortality is expected to continue over the next three years from direct effects of the fire and beyond if the current drought cycle continues.

Unburned Areas

In areas that did not burn or were subjected only to ground fire, the overstory is still intact and only smaller trees were killed. Some areas escaped the fire entirely because of protected microsites, wind shifts, fuel gaps, or the hopscotch vagaries inherent to fast moving crown fires. These areas would remain essentially unchanged in forest composition and structure in the short-term and, barring additional disturbance, would maintain essentially the same successional trajectory as they did prior to the fire.

Snags and Downed Logs

Standing snags are an important forest structural element not only for wildlife habitat but also for overall ecosystem health. For example, snags help maintain cavity-nester wildlife populations at a level that helps keep insect pests at endemic levels (Hallet, et al., 2001; Ganey, 1999). This is important for long-term ecosystem function despite the current epidemic level of bark beetle mortality being observed across the Southwest. In both forest plans, snags are defined as dead trees that are at least 18-inches dbh, and downed logs are defined as 12 inches or larger at midpoint and eight feet long. Down logs and other woody debris provide important habitat for many prey species. They also provide favorable micro-sites for beneficial micro-flora/fauna and

function in long-term nutrient cycling. Their value in holding soil, especially after catastrophic fire, is widely recognized (McIver and Starr, 2000).

Analysis of the tree data under the mortality assumptions made by severity class indicates there are over 1.3 million fire-killed snags within the 173,000 acres of forest and woodland cover type. While numbers vary widely from stand to stand, there is an average of 7.6 snags per acre at the landscape scale.

Current quantities of large down logs are not known, but field observations support the assumption that essentially all large downed logs were consumed in the 97,582 acres that burned at moderate and high severity levels. Losses were much more variable in areas burned at low severity levels. In the short-term, the quantities of down woody logs and debris on the analysis area landscape are much less than what is needed for wildlife habitat, watershed protection, and soil productivity maintenance. This scenario will certainly change over the ensuing years as dead trees begin to fall with levels expected to exceed desired amounts within 5-10 years. The prospects of the large amounts of woody debris that would eventually be on the forest floor is a fuels loading concern with severe soil damage and forest succession implications should a reburn occur.

Old Growth

There are 324 stands within the project area comprising 26,546 acres designated for old growth management under previous decision documents. Some of these areas met specific criteria to be considered existing old growth as described under the Region 3 amendment to the forest plans (USDA, 1996). Other areas, considered suitable for future old growth habitat, were selected for management toward old growth conditions to achieve the goal of the forest plan, which is to have 20 percent of each forested ecosystem allocated to old growth management. Other areas outside the 26,546 acres mentioned previously have not undergone the necessary analysis to make those allocations. Table 17 lists the acres designated for old growth management by burn severity class (see maps 2 east and 2 west in Appendix G).

Table 17 - Designated old growth burned in the Rodeo-Chediski Fire by burn severity class

Burn Severity Class	Acres
High	9,315
Moderate	6,051
Low	4,604
Un-burned	6,576
Total	26,546

The 15,366 acres of designated old growth that burned at high or moderate intensity are no longer considered appropriate for old growth management. The defining character of these stands has been destroyed and they are now on the opposite end of the successional spectrum from the old growth characteristics for which they were chosen. Sites within the low and unburned classes are now the best candidates for meeting future old growth habitat needs. The 11,180 acres of

designated old growth areas that burned at less than moderate intensity would be managed for old growth characteristics and would not be treated under any of the alternatives. Additional areas would need to be evaluated during future area analyses to replace those old growth management areas lost in the fire. Mortality from the fire is expected to continue for up to three years (Ryan, 1993). That, coupled with the drought-induced bark beetle mortality, would continue to affect the live tree component of many of the low and unburned stands (the best remaining old growth candidates) for the next several years. This proposed action does not affect the suitability of any of the best remaining areas for old growth allocation.

Insects and Disease

Increased bark beetle activity over the past season is creating additional snags inside and outside the burn area at visibly significant rates. Several areas along State Highway 260, which traverses the burn area, are good examples. Places where the fire was stopped on the south side of the highway by suppression action appear now to have dead trees on both sides of the highway because of red-needled, beetle-killed trees now occurring on the north side of the highway outside of the fire perimeter.

The annual insect/disease aerial survey on the Apache-Sitgreaves National Forests (USDA, 2002a) conducted in the late summer of 2002 shows there were nearly 226,000 trees on over 110,000 cumulative acres, not including the Rodeo-Chediski Fire area, killed primarily by ponderosa pine *Ips* bark beetles. This compares with 755 acres of ponderosa pine bark beetle mortality mapped in the previous year (USDA, 2002b).

Prolonged drought and overly dense forests are the primary triggers of the bark beetle epidemic that is occurring throughout the Southwest. Bark beetle mortality is forecast to increase over the next few years even if drought conditions end. A cumulative increase in snags of all sizes is expected to occur within and adjacent to the project area regardless of alternative. Salvage that is confined to dead trees would not diminish bark beetle populations; therefore none of the action alternatives would alleviate continued bark beetle mortality more effectively than no action at all. Snag habitat is expected to increase with or without proposed treatment under any alternative and with or without provisions for retaining snags within harvest units. If no snags were retained within proposed harvest units, there would still be an average of 5.4 snags per acre at the analysis area scale for alternatives proposing to remove the highest volumes of dead trees without considering continued bark beetle mortality.

Threatened, Endangered and Sensitive (TES) Plants

See the Wildlife section for a discussion of TES plant species that may be affected within the analysis area.

Environmental Consequences

Table 18 - Comparison of vegetation management by alternative

Management Activity	Alternative 1 No-Action	Alternative 2 Proposed Action	Alternative 3	Alternative 4 Preferred Alternative	Alternative 5
Small Sale area acres	0	7,929	7,763	6,903	7,929

Management Activity	Alternative 1 No-Action	Alternative 2 Proposed Action	Alternative 3	Alternative 4 Preferred Alternative	Alternative 5
Total Salvage Acres	0	45,109	38,533	41,059	42,850
Sawtimber volume	0	84.0 mmbf	48.4 mmbf	68.3 mmbf	84.0 mmbf
Helicopter yarding volume	0	9.8 mmbf	0	0	0
Small Sale area volume including Specialty Wood Products and Sawtimber	0	11.8 mmbf	6.8 mmbf	7.5 mmbf	11.8 mmbf
Total Sawtimber and Specialty Wood Products Volume	0	105.6 mmbf	55.2 mmbf	75.8 mmbf	95.8 mmbf
Fuelwood Volume	0	9,900 cords (5 mmbf)	8,700 cords (4.4 mmbf)	7,300 cords (3.7 mmbf)	9,900 cords (5 mmbf)

Alternative 1

Direct and Indirect Effects

No trees would be harvested under this alternative. Because of this, no down woody material or salvage slash would be generated to control soil movement, although trees would start to fall in the next few years. Mechanized equipment used for salvage harvest can often help break up water-repellant soil layers in burned areas. However, it can also create erosion or compaction problems, depending on soil types. Because there would be no equipment used or harvest implemented under this alternative, ecosystem recovery and soil stabilization would proceed without management intervention.

Snags would be abundant across the analysis area, averaging 7.1 per acre. Downed logs would be deficient for the next several years but would gradually become abundant over the next 5-10 years as dead trees fall.

Cumulative Effects

In reviewing past, present and reasonably future foreseeable activities, there is no evidence of a cumulative effect to the composition and structure of the forest by not salvaging dead trees as proposed in alternative 1. While the pre-fire vegetative condition was very much a product of past stand management activities including timber harvest, the current vegetative condition is a product of the Rodeo-Chediski Fire. The forest structure and composition associated with those past activities were destroyed in areas that burned at moderate and high severity levels.

Implementation of alternative 1; when added to the effects of salvage logging that is now occurring under the authority of three Decision Memos approved December 23, 2002, and the Jersey Horse and Phelps Timber Sales; would not contribute to any cumulative effects to the existing vegetative structural stages within the analysis area. Standing snags would remain at an average density of 7.6 snags per acre at the landscape scale. Designated old growth stands destroyed by moderate and high severity level fire would not change, and areas that may provide potential old growth stands are not being treated by other activities occurring within the analysis area.

In the long-term, implementation of alternative 1 would have cumulative effects to coarse woody debris levels and future wildfire risks and effects (see also Fire and Fuels section). Levels of coarse woody debris would far exceed levels considered optimum, and fuel loading would become higher than it was at the time the fire occurred. Foreseeable future thinning and fuels reduction projects displayed in appendix A would offset risks to communities within and adjacent to the analysis area. However, implementation of alternative 1 would increase damages to soils and other resources (see also Soils and Hydrologic Resources section). There would be no cumulative effects to vegetation composition in the long-term.

Effects Common to Alternatives 2, 3, 4 and 5

Direct and Indirect Effects

Vegetation Composition and Structure

The stand-replacement crown fire has already stressed this ecosystem beyond its genetic capabilities to reproduce itself. Alternatives that reduce the cumulative risk of a repeat disturbance of this scale contribute to the ecosystem's future health and sustainability. In this regard, all of the action alternatives initiate management actions to reduce this risk, and are therefore considered more effective than Alternative 1 in contributing beneficial elements to cumulative ecosystem effects.

The effects of the Rodeo-Chediski Fire on vegetation eclipse those of any previous vegetation treatments implemented in the analysis area. Regardless of stand condition or successional status prior to the fire, 54 percent of the analysis area subjected to high and moderate burn intensity levels has reverted back to an early successional state (VSS 1). Within the remaining 46 percent that burned at a lesser intensity, effects of previous changes in vegetative composition and structure remain an influence in environmental conditions. While the amount and size of dead trees that remain on site would affect forest characteristics such as fuel loading and wildlife habitat quality, there would be no direct effect on the vegetative composition and structure of the future forest whether these trees are harvested or not.

Timber Volume

The scope of the proposed action and its alternatives limits salvage considerations to dead trees in areas that experienced moderate and high burn severity levels. While there are dead trees and marginal survivors that would die over the next several years within the low burn severity areas, harvest is limited to areas where dead trees exist in moderate and high burn severity levels, which are most likely to benefit from harvest activity.

Average volume derived from that analysis indicates there is approximately 285 mmbf (million board feet) of salvageable timber 12-inches in diameter and larger on the 97,582 acres of high and moderate burn severity in the analysis area. This estimate includes volume reductions for retaining snags and expected defect predicted to occur thorough the summer of 2003. While it is not realistic to assume all of that volume would reasonably be available for harvest due to resource coordination needs and terrain/access limitations, it does approximate the total volume available and establishes a baseline against which the alternatives can be compared. Actual timber volume projected for each alternative is summarized in Table 18, and included in the following alternative sections.

Fuelwood, specialty wood products, and other sawtimber would be harvested on an additional 7,929 acres of lands. These areas are termed "small sale" areas and are designed to offer smaller quantities of wood products to interested parties. All species of trees would be made available in these areas for a variety of products for local markets. Specialty wood products include furniture wood, posts and poles, vigas, latillas, novelty wood, chips, and fuel as well as sawtimber.

Old Growth

Changes in MSO habitat designations, VSS distributions, and old growth replacement would occur gradually over decades as tree regeneration occurs and forest succession progresses. Alternatives do not differ in these respects as salvage harvest objectives of proposed action alternatives do not include any activities directed toward changing these forest attributes.

Snags and Downed Logs

For all action alternatives, downed logs would be deficient over the next several years until dead trees begin to fall, but would gradually become abundant in five to 10 years. Harvest-associated activities such as cull logs left on site or non-merchantable trees knocked down in the course of felling and skidding would put more slash on the ground than what would fall by natural processes if no harvest occurred. This logging debris on the soil surface would act as a physical barrier to overland water flow and aid in the recovery and stabilization of fire-damaged soils. Possible impacts of salvage harvest to vegetation, such as removal of nutrients or minor soil disturbance, are acceptable tradeoffs to the benefits gained by having additional organic matter on the ground.

Cumulative Effects Common to Alternatives 2, 3, 4 and 5

Past activities

A listing of past activities that modified vegetation is displayed in appendix A. Vegetative recovery from those activities is one of the recovery factors used in this analysis. Additionally, by displaying the relative abundance of forest development stages over the analysis area, the pre-fire VSS distribution is an expression of the cumulative effect of past vegetation-modifying treatments up until the time of the Rodeo-Chediski Fire. Past activities that modified vegetation contributed to that VSS distribution. Those effects on vegetation were largely erased by the fire

and replaced by a new distribution of structural stages that was determined by burn severity. This new vegetative baseline includes the 45,000 acres of grass seeding completed as part of the emergency rehabilitation. None of the action alternatives included in the proposed action would change this new baseline.

Removing a portion of the dead trees in areas of moderate and high intensity fire, has no cumulative effect on future forest composition and development of other parts of the burn area that were unburned or burned at low intensity levels. It would, however, affect the dead tree component and is cumulative for past activities. Salvage harvest of dead trees meeting minimum requirements for snags on 934 acres from the Cottonwood Fire in 1991 affects landscape scale snag density within the project area. Estimates of snags reduced by that activity are included in the snag density baseline for this analysis. Past firewood removals are discounted because they are capped at diameters lower than required to meet the definition of snags used in this analysis. While there are some differences among the action alternatives in terms of areas harvested and numbers of dead trees removed, there is no significant difference between those alternatives in cumulative effects to the forest vegetation.

Fuel reduction and safety projects such as the three Decision Memos approved December 23, 2002, that are presently occurring within the analysis area (see project record for more information on these projects), focus on salvage logging in areas where a public safety hazard exists. These projects remove sawtimber and small diameter dead trees that would eventually fall to the ground and contribute to fuel accumulations in the project area. Salvage logging in these areas decreases the probability of future high severity fires by providing defensible fire-fighting zones along roads, trails, structures, and in the Wildland/Urban Interface areas.

Snag density resulting from the proposed action is the only vegetative characteristic with cumulative effects when combined with other ongoing activities. Adjusting post-fire total snags for the 9,672 acres currently being treated under the three Decision Memos approved December 23, 2002; two active timber sales (Jersey Horse and Phelps that cover 1,992 acres) already modified to include salvage harvest; and the Cottonwood Fire salvage noted above, leaves total fire-killed snags remaining within the project area at an estimated 1.2 million snags, averaging 7.1 snags per acre at the project area scale. These reductions in snag numbers are already included in the snag projections for the alternatives under this proposal and there are no significant differences in cumulative effects between them.

Salvage harvest on tribal lands adjacent to this project area will affect snag densities at the larger landscape scale. While specific data is not available to compute those differences, it is surmised that overall snag density would be less than those projected for this project area alone. This may be a concern for wildlife habitat connectivity, but there is no evidence that this difference would have a cumulative effect on the vegetative composition and structure of the future forest.

Additional future activities that involve treating trees over 18 inches in diameter have the potential to affect the landscape scale snag density. The snags currently in the project area will remain standing for a limited time and will begin to fall over the next two decades. Current and projected levels of bark beetle activity, however, will concurrently add snags to the landscape over time. Reasonably foreseeable future activities consist primarily of small diameter fuels maintenance work and thinning projects and do not have any cumulative effect on vegetative measures considered in this analysis and do not differ significantly between alternatives.

Alternative 2

Direct and Indirect Effects

Salvage Volume

Approximately 120.4 mmbf in volume would be offered for salvage harvest under this alternative. It includes 9.8 mmbf in volume that would be removed by helicopter in areas with steep slopes. The remaining volume would be removed by ground-based, conventional logging through a combination of sawtimber, miscellaneous forest products (poles, house logs, specialty products) and fuelwood sales. Net harvest area under this alternative is the most of any of the action alternatives and would include harvest on 45,109 acres of the forestland within the analysis area. Furthermore, this alternative does the most of all the action alternatives in converting the value of dead trees into revenue that can be re-directed to additional restoration work and provide economic opportunities to local and regional communities.

Snags and Downed Woody Debris

Snags 18 inch dbh or larger would be retained, averaging 1.7 per harvested. This snag average is lower than the 2 snags per acre forest plan requirement due to the lack of snags within some portions of the analysis area. In sum, there would be an average of 5.8 snags per acre after harvest areas across the analysis area. Downed logs would be deficient over the next several years, but would gradually become abundant over the next 5-10 years as dead trees fall down.

Cumulative Effects

No additional cumulative effects unique to alternative 2 were discovered beyond those disclosed in the Effects Common to Alternatives 2, 3, 4 and 5 discussion above.

Alternative 3

Direct and Indirect Effects

Salvage Volume

Approximately 59.6 mmbf of timber would be offered for salvage harvest under this alternative. Alternative 3, similar to Alternatives 4 and 5, would not include harvest of any trees by helicopter because no harvest activities are proposed on slopes over 40 percent. In addition, no harvest would occur in soil units classified as having severe soil erosion potential. All volume would be removed by ground-based, conventional logging through a combination of sawtimber, miscellaneous forest products (poles, house logs, specialty products), and fuelwood sales. Treatment would occur on 38,533 acres of the forested lands within the analysis area.

Snags and Downed Woody Debris

Volume estimates under Alternative 3 account for retention of the largest available dead trees for snag retention versus 18-inch trees that would be retained under Alternative 2. These snag retention requirements are two of the largest dead trees per acre in the ponderosa pine type and three per acre of the largest dead trees in the mixed conifer forest type. Buffer zones around certain goshawk and Mexican spotted owl habitat are also included in this alternative, within which five of the largest snags per acre would be retained. Snags retained would average 1.9 per harvested acre, and average 6.3 snags per acre across the analysis area after harvest under this alternative. Downed logs would be deficient over the next several years, but would gradually become abundant over the next 5-10 years as dead trees fall.

Cumulative Effects

No additional cumulative effects unique to alternative 3 were discovered beyond those disclosed in the Effects Common to Alternatives 2, 3, 4 and 5 discussion above.

Alternative 4

Direct and Indirect Effects

Salvage Volume

Approximately 79.5 mmbf of timber would be offered for salvage harvest under this alternative. It does not include harvest of any trees by helicopter because no harvest activities are proposed on slopes over 40 percent. However, harvest would occur on soils classified as having severe erosion potential. All volume would be removed by ground-based, conventional logging through a combination of sawtimber, miscellaneous forest products (poles, house logs, specialty products), and fuelwood sales. Harvest activities under this alternative would occur on 41,059 acres of the forested land within the analysis area. It differs from the other action alternatives by excluding several scattered and somewhat isolated small sales to reduce disturbance to wildlife.

Snags and Downed Woody Debris

Snag and downed woody debris requirements would be the same as those in Alternative 3. Snags retained would average 2.1 per harvested acre and would be the largest sizes available, resulting in an average 6.1 snags per acre across the analysis area after harvest under this alternative. Downed logs would be deficient over the next several years, but would gradually become abundant over the next 5-10 years as dead trees fall.

Cumulative Effects

No additional cumulative effects unique to alternative 4 were discovered beyond those disclosed in the Effects Common to Alternatives 2, 3, 4 and 5 discussion above.

Alternative 5

Direct and Indirect Effects

Salvage Volume

This alternative is essentially the same as Alternative 2, except the helicopter yarding would not occur. Approximately 95.8mmbf of timber would be offered for salvage harvest under this alternative. All volume would be removed by ground-based, conventional logging through a combination of sawtimber, miscellaneous forest products (poles, house logs, specialty products) and fuelwood sales. Harvest activities under this alternative would occur on 33,008 acres of the forested lands within the analysis area.

Snags and Downed Woody Debris

Alternative 5 maximizes volume recovery per acre by limiting snag retention to the minimum standards. It would leave snags on the minimum end of the size specification, like Alternative 2, rather than leaving the largest dead trees available as specified in Alternatives 3 and 4. It also would not leave additional snags beyond this minimum requirement within one-quarter mile of goshawk and Mexican spotted owl habitat. These snag retention requirements would result in an average of 6.0 dead trees greater than 18 inches harvested per treatment acre. Snags retained would average 1.7 per harvested acre and would be primarily of the minimum 18-inch dbh size due to the lack of larger trees over portions of the analysis area. In sum, there would average 5.9

snags per acre after harvest across the analysis area. Downed logs would be deficient over the next several years, but would gradually become abundant over the next 5-10 years as dead trees fall down.

No additional cumulative effects unique to alternative 5 were discovered beyond those disclosed in the Effects Common to Alternatives 2, 3, 4 and 5 discussion above.

Fire and Fuels

Introduction

Wildfires are a major natural disturbance to vegetative communities on the Apache-Sitgreaves and Tonto National Forests and adjoining forest and grasslands. They affect the composition, structure, and patterns of vegetation on the landscape. While natural disturbance such as fire is necessary to maintain diversity of biological processes, over a century of human disturbances such as livestock grazing, fire suppression, logging, road construction, predator control, and exotic-species introductions have altered ponderosa pine forests from conditions that had prevailed for thousands of years (Covington and Moore, 1994; Swetnam et al., 1999). These changes in vegetative conditions have made these forests more vulnerable to large, destructive crown fires, such as the Rodeo-Chediski Fire.

Area of Analysis

All National Forest System lands in the fire perimeter were analyzed for fire and fuel effects. Because the analysis area is relatively large in size; and landscape, vegetation, and fuel conditions are different across the burn area; the analysis area was divided into six analysis zones to better display the differences for fuels and fire potential that exist across the landscape. Map 11 displays the Analysis Zones.

Methodology Used for Data Collection and Analysis

Field reconnaissance of the analysis area revealed a spectrum of fire intensity from un-burned to areas that burned at high intensity levels. Due to the size of the fire, fire intensity was mapped aerially for the entire burn area. Because the burn area was mapped aerially, the maps can only reveal the extent of different fire intensities to a certain degree. The maps may not reveal small areas of unburned trees within larger areas of moderate or high intensity burns, and vice versa. Thus, ground conditions, and not mapping areas, will determine actual treatment areas.

In the un-burned areas, fuels were inventoried for weight of forest floor duff, forest floor litter and downed woody material (Brown et al., 1974 and 1982). Ocular estimates were made where actual measurements were not made (Anderson, 1982). Basal areas were determined utilizing a 10-basal area factor prism with points being taken both randomly, at each photo point and at each plot on all fuel inventory transects.

Stand information was taken from stand examination data available from the Tonto and Apache-Sitgreaves National Forests.

Fuel loading estimates for each analysis area were obtained by combining data sets from current stand examination records. These combined data sets were input into the Fuels Management Analyst Suite program to obtain fuel loading in tons per acre. Tree crown material was assumed burned in the fires of 2002 and was not included. Total loading for the burn area is a sum of all tree bole weights from 1-inch diameter breast height (dbh) through 11 inches dbh, and eighty percent of the trees above 11 inches dbh.

Fire Behavior and Fuel Loading Analysis

Expected fire behavior scenarios for fuel conditions following treatments were determined using the Forest Vegetation Simulator (FSV), Behave, Behave Plus, First Order Fire Effects Model (FOFEM), Fuels Management Analysis Plus (FMA), and NEXUS computer-based programs. A description of these computer models is presented in the project record. The effects of the Rodeo-

Chediski Fire were also analyzed by investigating the fire research literature, Fire Effects Information System, and Fire Behavior Analyst Handbook.

Surface fuels are categorized through fuel modeling, which assist in the description of different fuel profiles and is used in fire behavior prediction models. The Fire Behavior Prediction System (FBPS) (Andrews, 1986) provides a basis for these fuel models. The FMA model was used to estimate the amount of slash created by removing 16-inch dbh and larger dead trees with 12-inch tops in addition to trees or portions of trees that could fall to the ground due to decay. Stands that had previous stand exam plots were selected for use in modeling surface fuels in the project area.

Fuel models categorize forest and wildland surface fuels. Fuel models provide information used for describing different fuel profiles and are used in fire behavior prediction models. Fuel conditions are defined by quantity and arrangement and have been categorized into 13 standard descriptive fuel models. Fuel models are used as one of the inputs in the BEHAVE, BEHAVE PLUS, and FMA computer programs. Depending on the fuel model, simulated fires burn differently under the same weather conditions. Therefore, each model was run using the same environmental factors.

In general, fuel models can be associated with vegetation types. The following fuel models are found in the Rodeo-Chediski Fire analysis area:

- **Fuel Model 2** – This model describes the fine herbaceous fuels, either curing or dead with a conifer overstory. This herbaceous material, in addition to a light litter load and dead and downed stem wood from the timber overstory primarily results in surface fires. Total fuel loading (both live and dead) is approximately 4.0 tons per acre and includes a fuel bed depth of one foot.

- **Fuel Model 5** – This model describes areas where shrubs are young, ground cover has little dead material, and foliage contains little volatile material. Fire is generally carried in the surface fuels that are made up of litter cast by the shrubs and the grasses or forbs under the brush. Total fuel loading (both live and dead) is approximately 3.5 tons per acre and includes a fuel bed depth of two feet.

- **Fuel Model 6** – This model describes the pinyon-juniper shrub lands. Forward spread rates may be over predicted except at high wind speeds (20 miles per hour at 20 foot above canopy level). Total dead fuel loading is approximately 6.0 tons per acre and includes a fuel bed depth of 2.5 feet.

- **Fuel Model 8** – This model describes areas of short needle conifers with closed canopies. Needle layer is often compact (firmly packed) with occasional twigs. Slow spread rates for fire occur and short flame lengths are typical, although heavy fuel concentration may cause fires to flare up. Total dead fuel loading is approximately 5.0 tons per acre and includes a fuel bed depth of 0.2 feet.

- **Fuel Model 9** – This model describes stands of long needled pines such as ponderosa pine. Litter is not as compact as Fuel Model 8 and fire spreads faster and has longer flame lengths. Concentrations of down material contribute to tree torching, spotting, and crowning. Total dead fuel loading is approximately 3.5 tons per acre and includes a fuel bed depth of 0.2 feet.

- **Fuel Model 10** – This model describes old growth Douglas fir stands with heavy ground fuels. Fires burn with a greater intensity in this model than the other fuel models.

Torching, spotting, and crowning in this fuel situation leads to potential fire control problems. Total fuel loading (both live and dead) is approximately 12.0 tons per acre and includes a fuel bed depth of one foot.

- **Fuel Models 11, 12, and 13** – These models describes a fuel bed created from timber cuttings or from natural or un-natural events that create large amounts of dead woody material that is lying horizontally on the ground. Fuel model 13 contains the largest amount of dead, down, woody material (58 tons/acre) and fuel model 12 (35 tons/acre) and model 11 the least (11.5 tons/acre). Fires burn in these models with a rapid rate of spread and a high fire intensity under moderate to dry weather conditions. If standing trees are present crowning, spotting, and torching of individual trees can be expected.

Fuel models 2, 8, and 9 could be used to describe areas with low burn severities. Fuel models 2 and 9 can be used for fire behavior calculations in moderate burn severities until dead needles drop from trees and only where seeding occurs. There are no fuel models that describe fire behavior in high burn or moderate burn severity areas where fine fuels are absent.

See the fire behavior and fuel loading analysis in the project record for a complete description of fire behavior and fuel loading.

In this analysis, fire behavior is described in the following terms (Rothermel, 1983):

- **Surface fire:** A surface fire is one that burns only in the surface fuel bed.
- **Passive Crown Fire:** A passive crown fire is traditionally referred to as "torching." It is a small-scale fire that consumes single or small groups of trees or bushes. This stage of a crown fire acts as a catalyst to spread the fire, by spotting ahead, but the main fire spread is still the surface fire.
- **Active Crown Fire:** An active crown fire is associated with a "pulsing" spread. After a surface fire ignites a crown and fire spreads through the canopy, the crown fire weakens after a distance due to lack of reinforcing surface heat. When the surface fire catches up to where the crown fire died, the surface fire intensity again initiates a crown fire "pulse."

Weather

Knowledge of how weather elements, such as wind, temperature, and the relative amount of moisture in the air, influence wildland fire behavior is essential in understanding the fire and fuel conditions in the analysis area.

The fire season in the Southwest tends to have two distinct periods. The first fire season begins in early April and continues to mid-July (spring). Early July is the normal time that the monsoon season starts. The second fire season begins in early September and continues until the end of October. Large wildfires can occur outside of these two periods. A common occurrence in the Southwest is the springtime phenomenon called the four corners high, where a high pressure becomes firmly entrenched over the four corners area and blocks the invasion of Gulf or Pacific air masses for many days, resulting in long periods of clear, dry weather. As this high pressure persists, days and nights become warmer, resulting in low relative humidity. Needles of living conifers are very dry during this period until new growth begins. The atmosphere is relatively unstable during the spring, and winds across Arizona are strongest during late winter through May. With the passage of intense fronts and associated upper level disturbances, wind velocities can easily reach 30-40 mph with gusts much higher (Pennington, 2000). These winds generally blow from the south-southwest towards the north or northeast. Crown fires are possible when

high winds are present, combined with dry cold front passages and low moisture content in the needles and other fuels. These conditions set the stage for large wildland fires in May and June.

In early July, monsoon rains combined with new vegetation interrupt the fire season and normally provide enough moisture to stop most small fires from developing into large fires. Fires in the summer require a longer drought and more severe fire weather than spring fires to continue burning. Summer and early fall are normally the heaviest rainfall periods of the year. Generally, only in years of extreme drought, such as 2002, do large fires occur in the summer or early fall. The onset of significant rains can extinguish a wildland fire. In some cases, it can slow the spread of the fire so management actions can be effective and safer. In areas with heavy slash (>50 tons/acre), it is estimated that it will take 1.5 inches of rain over a five-day period to extinguish fires. The probability of a fire-ending rain event in these slash fuels is significantly less than in normal forest fuels, meaning fires can burn for longer periods of time in these slash fuels. The following table displays the 20-year average total precipitation by month in inches received at Heber, AZ.

Table 19 – Twenty year average total precipitation by month in inches received at Heber, AZ

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heber	1.63	1.30	1.44	0.80	0.62	0.40	2.81	2.98	1.97	1.54	1.25	1.79	18.61

It was assumed that the future incidents would occur in spring or summer at the 95th percentile of most severe fire danger days (fire danger extreme). Weather parameters from the 95th percentile were used as input to the Fire Behavior Prediction System (FBPS). Weather data was collected from Fire Weather data stored in Forest Service Computers at Kansas City, Kansas. Weather data used for input into these computer models is shown in Table 20.

Table 20 – Environmental factors used for input into the fire behavior prediction system. Values displayed are fuel moisture percentages that are commonly experienced in the analysis area during severe fire danger days.

Environmental Factors	75 – 90 Percentile Severe fire danger	90 -95 Percentile Extremely severe fire danger
1 Hour Fuel Moisture (1)	2 percent	1 percent
10 Hour Fuel Moisture (2)	3 percent	2 percent
100 Hour Fuel Moisture (3)	6 percent	5 percent
1000 Hour Fuel Moisture (4)	9 percent	8 percent
Herbaceous Fuel Moisture (5)	75 percent	60 percent
Woody Fuel Moisture (6)	100 – 124 percent	85 – 99 percent

Environmental Factors	75 – 90 Percentile Severe fire danger	90 -95 Percentile Extremely severe fire danger
Foliar Moisture (7)	130 percent	110 percent
20-Foot Wind Speed Avg. (8)	11mph	17 mph

(1) One hour fuels are dead fuels 0-.25.inches in diameter.

(2) 10 hour fuels are dead fuels.25-1 inch in diameter.

(3) 100 hour fuels are dead fuels 1-3 inches in diameter.

(4) 1000 hour fuels are dead fuels 3-8 inches in diameter.

(5) Herbaceous fuels are grasses, forbs, and ferns.

(6) Woody fuels are plants that develop persistent woody tissue.

(7) Foliar moisture is the moisture in conifer needles.

(8) 20 foot wind speed is wind speed 20 feet above the forest canopy.

Fire Severity and Fire Intensity

The terms “fire severity” and “fire intensity” are commonly used interchangeably, but these terms do refer to different aspects of wildfire analysis.

Fire severity is an important factor in shaping the vegetation in a forest. Fire severity refers to the degree to which a site has been altered or the success ional processes disrupted by fire and largely depends on the amount and condition of fuels available for burning, fire behavior, and when the fuels are burned. In this analysis, three levels of fire severity are recognized: low, moderate, and high (Agee, 1993). Fire severity describes an ecosystem’s response to a wildfire’s effects on soil and water, flora and fauna, the atmosphere, and the human environment (Simard, 1991).

Fire intensity is a term that is used to describe the rate at which a fire produces thermal energy and refers to the amount of energy released from fuels (Pyne et al., 1989). Byram (1959) states that fire line intensity is the heat energy released per unit time from a one-foot wide section of the fuel bed extending from the front to the rear of the flaming front. Fire line intensity is influenced by the amount of fuel available for burning and the amount of moisture available in the fuel particle. The limiting factor of fire intensity is the amount of energy stored in the fuel. As a consequence, the greater the fuel loading, the more intensely a fire is likely to burn (Debano et al, 1998). The greater the amount of fuel the greater the fire line intensity (Rothermel, 1983). Thus, it is reasonable to predict that if available fuel is reduced, there is a reduction in fire line intensity.

Fire line intensity is directly related to flame length, which can be easily measured or estimated in the field (DeBano et al., 1998) using Byram’s (1959) fire intensity equation. Flame length can be easily measured and directly related to vegetation mortality as in the First Order Fire Effects Model (FOFEM). Vegetation mortality can be used as an indirect measure of fire intensity. Notably, ground-based firefighters are only able to safely work next to flame lengths less than 4 feet (Table 21).

Table 21 – Fire suppression capabilities by flame length

Flame Length	Fire Suppression Capability Interpretation
0 to 4 Feet	Fires generally can be attacked directly at the head or flanks by firefighters using hand tools. Use of hand tools should be able to the fire.
4 to 8 feet	Fires are too intense for direct attack at the head of the fire by persons using hand tools. Fireline constructed using only hand tools is not generally effective. Equipment such as tractors, fire engines, and aerially delivered fire retardant can be effective in control efforts on the fire.
8 to 11 feet	Fires may present serious control problems as the following can be expected in forests: torching of trees, initiation and spread via a crown fire, and the occurrence of spot fires up to one mile in front of the main fire. Control efforts at the head of the fire are usually ineffective.
Greater than 11 feet	Fire usually spreads via rapid runs in surface fuels and crown fires in timber stands. Major fire spread and spotting 1 to 2 miles in front of the main fire is expected. Control efforts at the head of the fire are usually ineffective.

Wildland fire intensity varies and is influenced by fuels, fuel moisture, winds, topography, time of day, and the direction of fire spread. Fires burning through the night normally have a lower intensity than fires burning during daylight hours. These conditions lead to the mosaic patterns that are often seen on wildfires.

Fuel Level Effects on Fire Behavior

Contrary to the authors of the Beschta Report (Beschta et al., 1995) who state that they "are aware of no evidence supporting the contention that leaving large dead woody material significantly increases the probability of a re-burn," there are other scientists whose research indicate that heavy accumulations of dead and down material can increase the probability of future fire events (Ice, 1995; Brown et al., 1993; Rothermel, 1991). These fuel accumulations can contribute to very high and extreme fire intensity, extreme fire behavior, fire persistence, high resistance-to-control, and longer burnout time. In some cases, dead or damaged timber from a wildfire can provide a source of insect infestation which can lead to stress on adjacent stands, predisposing them to wildfire (Ice, 1995). The effects of a reburn vary according to initial fire severity and post-fire treatments (Brown et al., 2001).

The possibility of a reburn in areas burned at moderate and high severity levels for 10 years is low. This is because large woody fuels would still be accumulating through fall-down and they would not have decayed enough to support prolonged smoldering combustion. In areas burned at moderate severity levels where not all of the foliage was consumed, a thick layer of scorched needles will accumulate and provide a carrier for any fire ignition. Grasses and shrubs will be starting to re-establish and will provide a discontinuous fuel bed.

The possibility of a reburn in areas burned at moderate and high severity levels increases between 10 and 30 years after most of the trees have fallen down with some decay to support prolonged burning. Grasses and shrubs intermingled with the downed woody material provide a fire carrier.

At 30 to 60 years the chance of a reburn is greatly increased. Large woody fuels are mostly rotten. Large amounts of grasses and shrubs are present to provide a continuous fire carrier. Severe

burning is possible with a high resistance to control and the possibility of greater soil damage than from the original fire.

Re-burn potential in the short-term is less significant than in the long-term. As shown from research, long-term re-burn situations after severe wildfires have the potential for extreme soil degradation. Omi and Martinson (2002) stated, "Our results unanimously indicate that treated stands experience lower fire severity than untreated stands that burn under similar weather and topographic conditions. Correlations between fire severity indicators and measures of crown fire hazard and fire resistance are generally good, but individual sites provide unique lessons that illustrate the importance of treating fuel profiles in their entirety." Projected rates of spread in the moderate and high severity burn areas are four to ten times greater than the pre-burn due to increased fuel loading, a lack of shading from the sun, and reduced sheltering from the wind versus pre-burn conditions. Many factors other than fuel loading determine whether or not a large fire will occur. For example, weather and topography play an important role in fire behavior and fire size.

Regulatory Requirements

Throughout the 20th century, fire management policy has evolved in response to land and resource management needs, growing knowledge of the natural role of fire, and increased effectiveness of fire suppression. During the early years of wildland fire management (i.e. 1930s), conventional wisdom dictated that aggressive and total suppression was the best solution to limit widespread, damaging fires. As knowledge of wildfire principles expanded, it became increasingly obvious that complete fire exclusion was not the best management direction for supporting a balanced resource management program. This has led to the development of current Forest Service fire policy.

National Fire Plan (2000)

In August 2000, the President directed the Secretaries of Agriculture and Interior to develop a plan to respond to severe wildland fires, reduce their impacts on rural communities, and assure sufficient firefighting capacity in the future. *Managing the Impact of Wildfires on Communities and the Environment: A Report to the President in Response of the Wildfires of 2000*, also known as the National Fire Plan, outlined a plan of action that federal agencies, in cooperation with state and local communities, should take to reduce immediate hazards to communities in the wildland-urban interface (WUI) and to ensure that land managers and fire management personnel are prepared for extreme fire conditions in the future (Machlis et al., 2001).

Federal Wildland Fire Management Policy (2001)

The Federal Wildland Fire Management Policy or Federal Fire Policy is a single, comprehensive federal fire policy for the Department of Interior and Agriculture, as well as programs and activities in other federal agencies that support or otherwise affect federal wildland fire management activities. The 2001 Federal Fire Policy reaffirmed the guiding principles and policy outlined in the prior 1995 Federal Wildland Fire Management Policy. This policy guides the philosophy, direction, and implementation of fire management planning, activities, and projects on federal lands.

Code of Federal Regulations

The Code of Federal Regulations (CFR) is a codification of the general and permanent rules published in the *Federal Register* by the executive departments and agencies of the federal government. Title 36, Part 219.27 of the CFR sets forth the minimum specific management

requirements to be met in accomplishing goals and objectives for the National Forest System. With consideration to integrated resource management, most of these regulations pertain in some manner to managing resources in the wildland-urban interface. The requirements from section (a) Resource Protection, listed below are those that most directly pertain to fire management. All management prescriptions shall: conserve soil and water resources and not allow significant or permanent impairment of the productivity of the land; be consistent with the relative resource values involved, minimize serious or long-lasting hazards from flood, wind, wildfire, erosion, other natural physical forces unless these are specifically excepted; and be consistent with maintaining air quality at a level that is adequate for the protection and use of National Forest System resources, and that meets or exceeds applicable federal, state and/or local standards or regulations.

Apache-Sitgreaves and Tonto National Forests Land and Resource Management Plans

The Apache-Sitgreaves and Tonto National Forest Land and Resource Management Plans include forest-wide management goals to suppress all wildfires at minimum cost in a manner consistent with resource objectives that first considers firefighter and public safety, and benefits and values to be protected (pages 107–112 and 160, respectfully) (USDA, 1987and USDA, 1985).

Arizona Department of Environmental Quality

The Arizona Department of Environmental Quality (ADEQ) is mandated to protect the health and welfare of Arizona citizens from adverse impacts due to air pollution (Clean Air Act, Sec.118; Arizona Revised Statues (ARS) 49:5011).

Affected Environment

Historical Conditions

Human influence resulted in changes to the Apache-Sitgreaves and Tonto National Forests landscapes prior to the Rodeo-Chediski Fire. These changes influenced how the fire would burn on the forest landscape. European settlement brought human fire suppression and fire exclusion. Historically (1700 to 1900), most forests in the Southwest were young and even-aged and were not very susceptible to severe fire damage. Lightning-ignited fires were a regular feature of theses forests, burning the light surface fuels at intervals usually averaging less than 10 years and as often as every 2 years (Dieterich, 1980). This frequency maintained ponderosa pine forests in an open, park-like appearance with little undergrowth (Biswell, 1973), with vigorous and abundant herbaceous vegetation. Torching or candling of individual trees occasionally occurred. An active or independent crown fire was uncommon. Cooper (1960) found no evidence of a crown fire before 1900.

After the turn of the century, removal of forest products for lumber, fuelwood, and railroad ties resulted in removal of much of the old-growth ponderosa pine. Livestock brought into the area in the same time period resulted in overgrazing grass and other forage species. These two events removed the fuels that supported frequent low-intensity fires. The resultant bare soil created a favorable seedbed supporting the establishment of dense stands of ponderosa pine reproduction. Most of these areas are now characterized by second growth ponderosa pine, generally under 16-inches in diameter at breast height (dbh). Ponderosa pine is the dominant tree species in the burned area, compromising 75 percent of the burn area (BAER, 2002). The remaining 25 percent of the burn area comprises Douglas fir, juniper, pinyon pine, and oak species.

In the early twentieth century, the Forest Service adopted a policy of full fire suppression, resulting in further removing fire from its role in maintaining pre-settlement vegetative

conditions. During the ensuing years, fuels have built up to a point where forest conditions can sustain devastating wildfires. According to Covington and Moore (1994), fire suppression practices and policies have resulted in the following adverse effects:

- Overstocked patches of saplings and pole sized trees
- Reduced tree growth and increased mortality
- Decreased decomposition rates
- Stagnated nutrient cycles
- Decreased herbaceous forage quality and quantity
- Higher fuel loads
- Increased vertical fuel continuity due to dense sapling and pole patches
- Greater canopy closure and landscape homogeneity
- Higher severity and destructive potential of wildfires
- Decreased stream flow and onsite water balance
- Less wildlife habitat for species dependent on herbaceous vegetation
- Lower esthetic values

Vegetative structural changes along the Mogollon Rim have also shifted the fire regime in ponderosa pine dominated ecosystems from frequent, low-intensity surface fires to infrequent, high-intensity fires that often result in crown fires.

The combined effects of forest management practices and generally warmer and moister conditions has led to substantial increases in the quantity, and changes in the arrangement of, live and dead fuels. Data from the early twentieth century is not available to test this assertion; it is based on numerous comparisons with early conditions inferred from numerous historical documents. There is documented fire history and tree-ring history verifying this theory (Weatherspoon and Skinner, 1995).

The twentieth century has clearly demonstrated the futility of attempts to eliminate fire from natural landscapes. “Society must learn to live with fire and the détente can be realized only through the medium of fuel treatments” (Omi et al, 2002). Materials called “slash fuels,” consisting of dead and down materials on the ground, are projected to increase to a range of 50 to 100 tons per acre over the next five to 10 years. This increase in material will allow any ignition to develop into a high intensity fire with a high spread rate that will be difficult to control. There will be an increased potential for wildfire to threaten public safety and property, and federal, State, and county lands.

Current Conditions

The Rodeo-Chediski Fire, like many wildfires, burned in a mosaic pattern. Some areas within the fire’s perimeter did not burn, others were lightly under-burned, and still other large areas were burned at moderate or high severity levels. Part of the future fire behavior in the area can be determined by the overall landscape of treated or untreated fuels.

Fuel loading estimates for each analysis zone were obtained by combining data sets from current stand examination records. Currently, all analysis zones contain an array of burn intensities, ranging from un-burned to areas that burned at high severity levels. Continuing observations also verify that stands of trees in low burn severity areas are reaching extreme mortality levels—up to 100 percent in many areas. Many of these low intensity burned areas would normally be expected to survive; however, due to the severe moisture stress initiated by continuing long-term drought, vegetation in these areas may not survive even low intensity burning conditions. As a result, the Rodeo-Chediski Fire affected portions of all of the analysis area. Table 22 displays acres by burn intensity and analysis zone for the analysis area.

Table 22 – Summary of national forest lands by burn severity in each analysis zone of the project area

Analysis Zones	I	II	III	IV	V	VI	Totals
Unburned	2,843	2,341	2,730	2,248	2,047	233	12,442
Low	9,518	7,659	15,776	18,254	14,057	2,907	68,171
Moderate	4,128	3,998	10,487	12,239	12,572	2,651	46,075
High	4,042	4,650	11,258	13,283	10,586	4,644	48,463
Totals	20,531	18,648	40,251	46,024	39,262	10,435	175,151

Totals displayed in this table do not include private lands or lands that were unclassified.

Each analysis zone has similar vegetation and mostly consists of ponderosa pine or mixed conifer species, although each zone has different stand densities and dead fuel loads. For example, Analysis Zone VI (Show Low South) has small trees with a large amount of brush. Further west, tree size increases in diameter and height and the brush load decreases. Analysis Zones II, III, and IV have some of the largest trees above the Mogollon Rim.

Currently, extreme or erratic fire behavior scenarios are very rare within areas burned at moderate and high severity levels because most of the ground fuel was consumed during the Rodeo-Chediski Fire. As trees blow down or fall down over the next few years, however, the large amount of residual fuel loading greatly increases the chance for another large fire in these areas. In addition, stands of trees in areas that burned at low severity levels or areas that did not burn retain varying amounts of foliage and vegetation, both alive and dead. These areas have the potential to support extreme fire behavior if future wildfires occur.

Un-burned Areas and Areas with Low Burn Severity Levels

In low burn severity areas, ground litter and duff are usually scorched and most grasses have burned in a mosaic pattern. Scattered individual trees have torched and have no crown remaining. Crown scorch greater than 50 percent is evident in numerous trees. Many of these trees will die in one to three years following a fire (Burns and Honkala, 1990), adding to existing fuel loads. However, most standing trees are green with less than 50 percent crown scorch. Most of the forest canopy is unburned, although some understory shrubs and grasses have been consumed. The surface duff layer is charred by fire but not removed. Duff, crumbled wood, or other woody debris is partly burned and large logs are not deeply charred.

Figure 6 - Low Severity Burn from the Rodeo-Chediski Fire. Photo taken in September 2002.

In the analysis area, low severity fires thinned tree stands and removed undergrowth and susceptible fir and pine stems. Many of the trees in these low intensity burned areas would normally be expected to survive. However, due to severe moisture stress caused by long-term drought in the area, some vegetation in these areas did not survive even under low intensity burning conditions.

Fuel Levels Occurring In Un-burned Areas and Areas with Low Burn Severity Levels

Fuel conditions in these areas are similar to those of pre-fire conditions. The current stand conditions in the unburned areas within the fire perimeter are at the high end of fuel loading and the far end of the natural range of variability due to past fire suppression. These areas will continue to change as conifers grow in the under-story and species less adapted to fire such as Douglas fir increase (Arno et al., 1995). Most stands are overstocked and exhibit a basal area of 100-200 square feet per acre. Ponderosa pine reproduction occurs in dense dog hair thickets. Stand exam surveys show that standing fuels (especially understory ladder fuels) are outside the range of natural variability. In some areas, the number of trees in these dog hair thickets exceeds 3,000 stems per acre (stand exams, 1/5 acre plots and ocular estimates). These standing fuels in unburned stands continue to present a fire hazard in the short- and long-term. The following table displays the average fuel loadings in tons per acre by size class in unburned areas.

Table 23 – Average fuel loadings in tons per acre by size class in unburned areas

Analysis Area	Duff Depth	0 to 0.25" (Tons/acre)	0.25 to 1" (Tons/acre)	1 to 3" (Tons/acre)	>3" (Tons/acre)	Total
I	1.25	0.27	0.96	1.15	16.47	18.85
II	1.25	0.10	1.00	2.50	10.20	13.80
III	1.50	0.10	1.60	4.20	9.70	15.60
IV	2.00	0.10	2.20	4.40	9.70	16.40
V	2.50	0.04	1.50	4.90	20.30	26.70
VI	2.00	0.20	2.00	3.60	14.30	20.10

Standing fuels in unburned or low burn severity stands will continue to present a fire hazard. A lack of fire hazard reduction could make extreme fire behavior more common. Ladder fuels would allow a fire to climb from the ground into the overstory creating a stand replacement fire, similar to the Rodeo-Chediski Fire. Old-growth ponderosa pine stands would not survive crown fires (Arno et al., 1995).

Because 80 percent of all larger trees fall down within the first 10 years post-fire they were included in the sum total fuel loading (Harrington, 1996). Utilizing this methodology, Table 24 lists the projected fuel loading on the ground within 10 and 20 years for each analysis zone.

Table 24 – Average fuel loading predicted in 10-20 years for each analysis zone by size class

Analysis Zone	Foliage	0 to 0.25" (Tons/acre)	0.25 to 1" (Tons/acre)	1 to 3" (Tons/acre)	>3" (Tons/acre)	Total
I	0.00	1.56	8.66	7.73	43.68	61.64
II	0.00	0.78	4.59	4.97	49.90	60.23
III	0.00	0.73	4.69	4.54	38.14	48.11
IV	0.00	0.54	4.13	5.87	44.72	55.26
V	0.00	0.85	5.39	9.12	70.06	85.41
VI	0.00	0.59	4.40	10.20	75.88	91.07

There is a continuous stand of timber (mostly ponderosa pine) with a grass and shrub under story (Fuel Model 2), in the fir dominated stands (Fuel Model 8), the pine dominated stands (Fuel Model 9), and light slash (Fuel Model 11). In Fuel Model 2, fire behavior estimates under typical summer fire season conditions show rapid rates of spread (approximately 74 feet per minute) and flame lengths of near 10 feet, which is too intense or dangerous for direct suppression by people or equipment. There will be a high probability of torching or candling and an active crown fire.

Fire behavior in fuel models 8 and 9 will have a slower rate of spread (between four and 18 ft/min) and could be suppressed with direct attack by ground forces if torching and crowning of trees does not occur. In fuel model 11, fire behavior estimates show a moderate rate of spread (13 ft/min). Flame lengths will be near six feet, which is out of range for direct attack by hand tools, however engines with water and aerially delivered retardant effectively suppress fires occurring under these conditions.

In the long-term (>20 years) Fuel Models 2, 8, 9 and 11 will persist on low intensity burn areas. The short-term overall fuel hazard rating would be low/moderate. Table 25 displays the fire behavior estimates under typical spring and summer fire season at the 95th percentile for the unburned areas.

Table 25 – Predicted fire behavior by analysis zone for unburned areas at the 95th percentile of most severe fire danger days

Analysis Zone	Rate of Spread Ch/hr	Rate of Spread Ft/min	Heat per Unit Area Btu/ft2	Fireline Intensity Btu/ft/s	Flame Length Ft	0 to 3" Fuel Loading Tons/acre
I	13.6	15.0	160	40	2.5	2.38
II	16.1	17.7	373	110	3.9	3.60
III	21.7	23.9	735	292	6.1	5.90
IV	24.7	27.2	720	327	6.5	6.70
V	9.8	10.8	337	61	3.0	6.44
VI	23.4	25.7	599	257	5.8	5.80

Flame lengths of less than four feet are predicted for Zones I, II, and V. More than likely, initial attack with hand tools will be successful in these areas. Zones III, IV, and VI have flame lengths of six feet. Initial attack will have to be supplemented with engines and or aerially delivered retardant.

Areas with Moderate Burn Severity Levels

In moderate burn severity areas, sixty to ninety percent of the trees are killed with most trees retaining their dead needles. Crown scorch greater than 50 percent is visible in 90 percent of the remaining trees. Litter and duff are charred and large amounts of mineral soil are visible. Duff, rotten wood, or partially consumed woody debris may be deeply charred but mineral soil under the ash has not appreciably changed in color. A mosaic of burned and unburned duff exists in many areas. Because much of the tree mortality is due to super-heated air, many of the needles are still attached to branches. Many of these stands will continue to experience mortality for one to three years following the fire. Trees in this area will be highly susceptible to bark beetle invasion and future mortality will be high.

Figure 7 - Moderate severity burn from Rodeo-Chediski Fire, September, 2002. Note dead needles on trees.

In these moderately burned areas, the threat of fire is presently low, since most of the surface fuels were consumed. With no ladder fuels present, the threat of a crown fire is very low. However, in the next six months, burned leaves, needles, and branches will be removed from standing stems by wind, rain, snow, and gravity and begin to cover the soil (Brown, 1985). Where the fire did not consume the foliage there will be a thick layer of scorched needles and small branch-wood resulting in fuel loading of 3 to 4 tons per acre, much like Fuel Model 9. When this occurs, the chance for a surface fire is greatly increased. However, as the needles fall from dead trees, the chance of a crown fire will be greatly reduced. Until the dead needles fall off and only where grass seeding has occurred can Fuel Model 2 be used for fire behavior calculations. There is no fuel model to describe the condition where fine fuels are absent or discontinuous enough not to carry a fire. Where torching of individual or groups of trees has occurred, openings have been created and sites for new regeneration have been prepared since the fire has consumed most of the litter and the upper duff layer. A mosaic of burned and un-burned duff exists in many areas.

Areas with High Burn Severity Levels

In high burn severity areas, all of the vegetation has been killed. All litter, duff, and surface fuels are totally consumed, leaving a bed of ash, and 100 percent of the mineral soil is exposed. The top layer of mineral soil is significantly changed in color and the next one-half inch is blackened from organic matter that charred through heat conduction. This category is considered a stand replacement fire. Any reburn or other type of fire is unlikely for 10 to 20 years. This is due to the absence of any continuous surface fuels and lack of needles on standing trees. In some areas,

grasses distributed by the BAER team have begun to sprout, but vegetation is still discontinuous and would pose no any immediate fire threat. No sprouting of oak, ceanothus or manzanita has occurred. No fuel model describes this condition.

Figure 8 – High Severity Burn from the Rodeo-Chediski Fire. Photo taken in September 2002. Note bare soil and no surface fuels.

In areas burned with moderate and high intensity fire, there are many acres with standing dead trees. Over the next several decades these standing dead trees will eventually fall over and accumulate as surface fuels. A study by Harrington (1996) found that 80 percent of the trees that died in the first year fell within 10 years, and that smaller diameter trees fall faster at an annual rate than larger diameter trees. This research documented a post-fire sequence of events where trees were initially damaged or killed by wild-land fire. The study recorded the time frames for fall-down, impacts on soils from re-burn, and any benefits derived from fuel removal through salvage.

Environmental Consequences

This analysis describes the effects of the proposed action and its alternatives on short- and long-term fuel hazards and fire behavior.

Alternative 1

Direct and Indirect Effects

There would be no reduction or modification of fuels under alternative 1. Without treatment, total fuel loading for the analysis areas was predicted for a time period of 20 years post-fire. Currently, extreme or erratic fire behavior scenarios are unlikely within areas that burned at moderate and high severity levels because most of the ground fuel was consumed during the fire. The large amount of residual fuel loading that will be created on site due to blow-down and fall-down of the standing material over the next few years poses the most immediate concern to future fuel loading and fire behavior.

Approximately 95,000 acres that burned at moderate or high severity levels within the analysis area would show an increase in fuels as trees fall down. The amount of area that would burn and the associated fire intensity would likely be greater than areas treated under the action alternatives. Since future fires have the potential to be larger due to the presence of continuous heavy fuels across large landscapes, fire suppression activities would most likely occur more often, more intensively, and be more expensive (e.g. use of more aerial retardant) under alternative 1.

Under this alternative, the risk of a catastrophic fire will also increase over time. Lightning could ignite more fires because of the increased number of dead and dying trees serving as lightning rods compared to other alternatives. These fires would burn together more frequently, creating larger fires and threatening the remaining residual tree stands.

In areas burned at moderate and high severity levels, alternative 1 would have little effect on the short-term (2 – 5 years) fuel hazard. In the moderately burned areas there are not enough surface fuels to carry a fire. Until there is a needle cast and trees start to fall down there is no immediate fire hazard. There are no surface or crown fuels to burn in areas burned at high severity levels.

Natural change will occur as an inevitable and natural consequence of ecosystem processes. Grasses and shrubs will start to re-establish themselves. By year 5, fine fuels will start to increase and be available as a carrier, and some larger trees will start to fall down, becoming surface fuels. By year 10, there will be an increase of herbaceous and shrub fuels and 80 percent of the standing trees will be falling down increasing the fuel load and fuel bed depth. By year 20, there will be a high fuel load with a continuous fine fuel carrier, with some rot in the smaller debris occurring. This natural increase in vegetation and downed woody debris will increase the possibility that future fires will be high intensity and involve large areas. In addition, these fires will threaten the residual stand, be extremely resistant to control, compromise firefighter safety, and threaten private property. Reduced staffing for safety will result in increased air support and thus increased suppression costs. Longer residence time from the large fuels will increase soil damage, and make mop-up more difficult.

Cumulative Effects

Appendix A provides a listing of past, present and reasonably foreseeable future activities occurring within the analysis area that may have cumulative effects resulting from implementation of alternative 1.

Past fuels reduction projects and timber stand thinning projects that are remaining in unburned areas or areas burned at low intensity levels would be at risk of an escaped fire starting within the analysis area in the long-term. Higher fuel loading levels, greater rates of spread and damages to residual soils would result from an escaped wildfire.

Current projects such as the Show Low South fuels reduction project and actions approved in the three Decision Memos signed December 23, 2002 would not be as effective in protecting the public and communities because of long-term fuel loading predicted to occur under this alternative.

Likewise, reasonably foreseeable future fuels reduction projects planned within and immediately adjacent to the analysis area would be placed at higher risk by implementation of alternative 1 in the long-term due to higher fuel loads within the analysis area. This would result in projects being less effective in protecting the public and communities they are designed to protect.

Reasonably foreseeable future fuel treatment projects immediately adjacent to the Rodeo-Chediski Fire are summarized in Table 26. These outside treatments will help to reduce the risk of wildfires escaping the fire perimeter, and reduce the risk of damage if fires do escape, providing more safe and effective locations from which firefighters can initiate fire suppression actions.

Table 26 – Fuel treatment projects planned immediately adjacent to or within the Rodeo-Chediski Fire perimeter

	Treatment Type			
Project Name	**Broadcast Burn (Acres)**	**Pile and Burn (Acres)**	**Mechanically Treated (Acres)**	**Total Acres**
Larson	3,390			3,390
Wiggins	3,277			3,277
Hidden Lake	2,353			2,353
Brook Bank	8,775			8,775
Chevelon Work Ctr.	67			67
Deep Tank		166	262	428
Show Low South	7,759*	1,538	240	9,537
Total Acres planned near the Fire Perimeter	25,621	1,704	502	27,827

***Partially accomplished in 2002**

Alternatives 2, 3, 4 and 5

Direct and Indirect Effects

Alternatives 2, 3, 4 and 5 would have similar effects on fuel loading and future fire potential. In the short-term (two years), harvesting of dead trees would increase fuel loads above current post-fire levels. Leaving 12-inch tops from harvest activities would increase fuel loads for fine, medium and large fuels. These woody fuels would not present a hazard until fine herbaceous fuels provide a carrier for ground or surface fires. Slash created in all alternatives would be lopped or crushed to a two-foot height to greatly reduce this hazard.

Smaller diameter dead trees would be removed for fuelwood and specialty products in areas designated for small sales. Fuel loading would be less in these areas than those designated for commercial sawtimber sales because more potential fuels would be removed from on site. Slash from these treatments would also be lopped to a two-foot height or crushed to reduce the fire hazard from activity fuels.

Brush is not a short-term risk (five years or less) while it is green and healthy or when live fuel moisture is high. However, in the long term (10–30 years), as some of the brush becomes decadent and dies back, it will add to the overall fuel hazard.

The long-term benefits from salvage harvest would be the reduction of large woody fuels over a large area, and subsequent reduction in future fire intensity and severity. The long-term benefit of removing large trees is much greater than the short-term fuel loading associated with salvage-generated slash. Removing large fuels and treating the slash would lower the fire risk compared to not harvesting in the area. Without logging it would take approximately five to 10 years to reach pre-fire fuel load levels at the expected rate of fuel accumulation.

Most of the effects analyzed relate to the abnormal fuel loading that would occur five to 10 years from now and become a threat in 20 to 25 years. Slash fuels will increase from 5-20 tons per acre to 50-90 or more tons per acre in that time period. Snags left for wildlife habitat would begin to fall with the majority falling to the ground in the next 10 to 20 years. This increase in woody material on the forest floor would support ignition, development, and a rapid spread of high intensity fires.

Reducing large fuels would decrease fire line intensity and result in an increase in fine fuels as grasses and forbs re-establish naturally. The regeneration of grasses, forbs, and shrubs would lead to higher rates of spread, depending on the size of fuel particles and retention of live fuel moisture (shrubs tend to retain fuel moisture longer in the season and can act as a heat sink and slow fire growth) (Agee et al., 2000). This increase in fine fuels is inevitable and desirable from an ecological standpoint.

In the long term (10+ years) wildfires in areas burned at moderate and high severity levels would have a high resistance to suppression and control due to the amount of fuels on the ground. Fires would be more difficult to control because of inaccessibility to areas (down trees across roads and trails) and greater flame lengths and fire intensities predicted in the moderate and high burn severity areas. This condition would produce an unsafe situation for fire-fighting personnel, and make suppression costs higher from increased use of aerial retardant. Table 27 lists the projected fuel load on the ground in 2 and 5 years after the fire by alternative.

Table 27 – Predicted fuels accumulations at year 2 and 5 for each alternative

Analysis Zones	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
Years after Fire	2 yrs	5 yrs	2 yrs	5 yrs	2 yrs	5 yrs	2 yrs	5 yrs	2 yrs	5 yrs
I	0.40*	12.0	5.6*	16.4	6.5*	14.7	3.9*	15.9	5.6*	16.4
II	0.36*	13.7	7.0*	20.3	10.1*	17.6	4.2*	17.5	7.0*	20.3
III	0.34*	15.5	5.5*	20.6	6.9*	20.7	3.8*	18.9	5.5*	20.6
IV	2.1*	22.2	5.8*	34.9	9.7*	35.1	4.2*	33.2	5.8*	34.9
V	4.0*	38.5	23.4	43.5	27.5	44.2	21.1	39.9	23.4	43.5
VI	4.4*	32.4	8.7*	36.7	12.6	35.9	6.2*	34.1	8.7*	36.7

Fuel loading is Tons/Acre and includes all fuel sizes, 0-8 inches.

***Fuels are discontinuous and will not support fire spread.**

As displayed in Table 27, Alternatives 2, 3, 4 and 5 would all increase fuel accumulations in the short-term from a low of 6.2 tons/acre in alternative 4, 8.7 tons/acre in alternatives 2 and 5, and 12.6 tons/acre in alternative 3 which is the highest predicted fuel loading. Alternative 1 displays a predicted fuel loading of 4.4 tons/acre. The action alternatives increase the alternative 1 fuel load of 4.4 tons/acre by 1.8 tons/acre to a high of 8.2 tons/acre (a total of 12.6 tons/acre), all well within the range of desirable levels for coarse woody debris.

Table 28 and Table 29 provide estimates of wildland fire spread rate and flame lengths for wildland fires after 5 years for all alternatives by analysis zone.

Table 28 – Estimates of rate of fire spread (feet/min) anticipated at year 5 in each analysis zone by alternative

Analysis Zones	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternativ 5
I	16.4	25.3	21.0	24.4	25.3
II	20.5	23.0	22.1	22.1	23.0
III	21.9	23.2	23.2	22.4	23.2
IV	18.0	21.7	22.0	20.6	21.7
V	18.0	22.6	22.7	21.2	22.6
VI	16.5	21.9	19.4	17.3	21.9

Alternatives 2 and 5 would produce the highest rate of spread at year 5 followed by alternatives 3 and 4 respectfully with alternative 1 producing the least in the short-term. Increasing rates of spread range from 0.8 feet/minute to a high of 5.4 feet/minute, which is considered an insignificant increase.

The following table displays predicted flame lengths anticipated in treatment areas in the short-term, by alternative.

Table 29 – Estimates of flame lengths (feet) anticipated at year 5 in each analysis zone by alternative

Analysis Zones	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
I	3.8	7.0	5.7	6.3	7.0
II	4.8	6.8	6.2	6.1	6.8
III	5.0	6.7	6.7	6.2	6.7
IV	5.0	7.2	7.3	6.5	7.2
V	5.6	7.7	7.7	6.9	7.7
VI	5.2	7.4	6.8	5.8	7.4

Alternatives 2 and 5 should produce the greatest flame lengths, followed by alternatives 3 and 4 respectively. Because higher numbers of large trees are retained for wildlife in these alternatives, less activity slash would be created. The increase over alternative 1 ranges from 0.6 feet to a high of 2.2 feet, which is considered an insignificant increase.

Flame lengths above four feet in length are considered too dangerous to attack with hand tools. It is doubtful that an initial attack crew using hand tools without additional equipment (engines or dozers) and delivery of aerial retardants could successfully control a wildfire in any of the analysis zones at year 5.

Salvage logging would not be expected to reduce short-term fire risk or hazard in areas burned at moderate or high severity levels because the fine fuels have already been reduced. In the short-term, salvage logging would not decrease the risk of fire ignitions and spread. Salvage harvest would decrease the intensity of future fires (especially under drought conditions), and the resultant soil damage by reducing the number of large dead trees that would fall and increase fuel loading. Anticipated effects of all action alternatives in areas that are unburned and those that burned at low severity levels would be the same as in alternative 1 because no salvage logging would occur in these areas.

Slash created by salvage logging activities in the moderate to high burn severity areas would be lopped or crushed to a 2-foot height. Harvest in these units would not produce many fine fuels and would pose no short-term risk. Unharvested, severely burned areas would pose a threat in 10 to 20 years when the large dead trees fall and grass and shrubs become established. Because of

the dry climate, large down fuels would decay slowly and likely remain on the landscape until it burns again.

In unburned areas, individual stands would continue to change as species less adapted to fire, such as white fir and Douglas fir, increase in numbers. Without treatment (broadcast burn, pile and burn, etc.) these ladder fuels would continue to increase in under-stories. Standing fuels would continue to present a fire hazard in the short- and long- term. Fuel conditions would produce fires exhibiting increased rate of spread, resistance to control, and severe fire behavior similar to the stand replacement burns of the Rodeo-Chediski Fire. Fuel loading would increase and change the fire behavior and intensity, which would also increase the cost of future fire suppression. The resulting fuel conditions would make extreme fire behavior more common, with added risk to firefighters, possible property loss, and damage to resources. In all of the action alternatives, timber sales and mechanical treatment of activity created slash would reduce fuel loading and disrupt the continuity of large fuels.

Cumulative Effects Common to Alternatives 2, 3, 4 and 5

The proposed treatments of the action alternatives only occur in areas that burned at moderate to high severity levels. Within these areas, the fire destroyed past fuels reduction projects and thinning treatments. However, those projects that occurred in the unburned or low intensity burn areas are undamaged. Long-term benefits of removing as much fuels as possible reduces the risk to remaining fuels reduction projects and timber stand thinning projects in unburned areas and areas that burned at low severity levels.

The aerial seeding completed by the BAER team on approximately 48,000 acres created a light layer of grass in several of the large continuous high intensity burn areas. After these grasses cure each year, these fine fuels will build up in amounts sufficient enough to support a fast spreading wildfire. This type of wildfire may be lethal to some seedlings (both planted and naturally generated) over a large area. Surviving seedlings would overcome competition from grasses in approximately five to 10 years. Grass would continue to be a fine fuel hazard for up to 30 years, but it is likely that a 15-year old ponderosa pine could survive some low intensity fires (with flame lengths of one to two feet). In the low intensity burn areas, perennial grasses and shrubs would return, and in some cases, in amounts greater than pre-burn levels.

Fuel treatments included in the Categorical Exclusion documents approved December 23, 2002, upon completion, would further break up the fuel continuity and reduce the fuel loading in the fire area and provide a safer area for firefighter safety and prevention efforts.

Reasonably foreseeable future fuel treatments listed in appendix A would break-up the continuous fuel bed and allow a defense zone for the firefighters and to protect WUI. However, future NEPA documents must consider impacts of management-ignited fires in unburned and burned areas. No cumulative effects from implementation of actions proposed in Alternatives 2, 3, 4 and 5 are anticipated to occur from this project.

Air Quality

This section describes existing air quality in the Rodeo-Chediski Fire analysis area and the anticipated effects of the proposed action and its alternatives on air quality.

Area of Analysis

All lands in the fire perimeter were analyzed for effects to air quality. Sensitive sites that could be adversely affected by smoke have been identified in the cities and communities of Show Low, Pinetop and Lakeside, Forest Lake Estates, Heber, Overgaard, Aripine, Clay Springs, Pinedale and Linden. There are no Class 1 areas or non-attainment areas within or adjacent to the analysis area wherein air quality will be impacted by activities proposed in this project.

Methodology Used for Data Collection and Analysis

The First Order Fire Effects Model version 5 (FOFEM5), is a computer program developed by the USDA Forest Service Intermountain Fire Sciences Laboratory in Missoula, Montana to meet the needs of resource managers, planners, and analysts in predicting and planning fire effects. First-order fire effects are associated with the direct or immediate consequences of fire, including consumption, smoke production, and tree mortality. These first-order effects form the basis for predicting secondary effects such as tree regeneration, plant succession, and changes in site productivity.

FOFEM5 is used throughout the nation and includes default-loading information for specific vegetative cover types found in various regions of the United States. Geographic regions and cover types are used as part of an algorithm selection key used to determine fuel consumption for standing live and dead wood, and down woody fuel and litter.

Regulatory Requirements

The Clean Air Act

The Clean Air Act (CAA), passed in 1970 and amended in 1990 and 1999, requires the Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The NAAQS were limits established to protect public health, including the health of sensitive populations of people such as asthmatics, children, and the elderly. They were also established to protect against decreased visibility and damage to animals, crops, vegetation, and buildings.

The EPA set NAAQS for six principal pollutants referred to as criteria pollutants. These pollutants are lead, sulfur dioxide, nitrogen dioxide, ozone particulate matter less than 10 microns in diameter (PM_{10}), and carbon monoxide. In 1999, the EPA issued a standard for 2.5-micron size (one micron equals one millionth of a meter) particulate matter ($PM_{2.5}$). The EPA's air quality policy on wildland and prescribed fires addresses public health and welfare impacts caused by wildland and prescribed fires that are managed to achieve "resource benefits." The primary indication of adverse impacts on human health would be an ambient concentration that is greater than the NAAQS for particulate matter less than 2.5 microns in aerodynamic ($PM_{2.5}$) and particulate matter less than 10 microns in aerodynamic diameter (PM_{10}). Smoke from wildland fire is not subject to the ambient air quality standards. There is no prescribed burning proposed on this project. The only threat to NAAQS would be engine exhaust, which does produce $PM_{2.5}$. Table 30 lists the ambient air quality standards for the seven criteria pollutants.

Table 30 – EPA National Ambient Air Quality Standards for Criteria Pollutants

Pollutant	Time Period Average	NAAQS
Carbon Monoxide (CO)	One hour	35 ppm
	8-Hour	9 ppm
Lead (Pb)	Calendar Quarter	1.5 ug/m^3
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	0.053 ppm
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	0.03 ppm
	24-Hour	0.14 ppm
	3-Hour	0.50 ppm
Ozone (O_3)	8-Hour	0.12 ppm
	Hourly	0.08 ppm
PM_{10}	Annual Arithmetic Mean	50 ug/m^3
	24-Hour Average	150 ug/m^3
$PM_{2.5}$	Annual Arithmetic Mean	15 ug/m^3
	24-Hour Average	65 ug/m^3

Notes: ppm =Parts per million. Ug/m^3 = Micrograms of pollutant per cubic meter of air. Arithmetic mean = the sum of set of n terms, divided by n.

Prevention of Significant Deterioration

The Prevention of Significant Deterioration (PSD) provisions of the CAA provides measures "to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreation, scenic, or historic value." Stringent requirements are therefore established for areas designated as Class I areas. PSD applies only to major stationary sources or modifications to major stationary sources of pollution. PSD does not apply to mobile sources (such as vehicles) or this project.

There are no Class I areas within the Rodeo-Chediski Fire perimeter. However, there are nearby Class I areas that must be considered and protected. With the prevailing south-southwest winds, these areas should not be affected by dust, engine exhaust or smoke. These air sheds are listed in Table 31.

Table 31 – Class 1 areas in relation to the analysis area

Class 1 Areas	Proximity to Analysis Area
Mazatzal Wilderness	37 air miles to the west of the west flank of the burn
Mt. Baldy Wilderness	37 air miles to the east of the east flank of the burn
Sierra Ancha Wilderness	30 air miles south of the south flank of the burn

Air quality within the analysis area is excellent. No facilities or activities that would impact air quality exist. The only non-attainment area in proximity to the analysis area is Payson, AZ, located approximately 25 air miles to the west of the analysis area. Since there are no non-attainment areas in the analysis area, general conformity regulations do not apply. A list of non-attainment areas is available from the web at http://www.epa.gov/airs/nonattn.htm.

Visibility Protection

Visibility is an important public consideration because of its importance to visitor enjoyment of the outdoors (EPA, 1998). Clear views of forests, mountains, lakes, and streams within national forests are considered part of a satisfying experience for many forest users.

Congress, through the CAA, declared as a national goal, "the prevention of any future impairment of visibility, and the remedy of any existing impairment of visibility in mandatory Class I federal areas in which impairment results from manmade air pollution" (Section 169a). Federal regulations further define visibility impairment as "any humanly perceptible change in visibility (visual range, contrast, coloration) from that which would have existed under natural conditions" (40 CFR 51.30).

Arizona Department of Environmental Quality

The Arizona Department of Environmental Quality (ADEQ) is mandated to protect the health and welfare of Arizona citizens from adverse effects of air pollution (CAA, Sec.118; Arizona Revised Statutes (ARS) 49:5011). The State Implementation Plan describes how the State carries out its responsibilities under the CAA. This project will comply with the State Implementation Plan.

The White Mountain Smoke Management Group

The White Mountain Smoke Management Group was formed in 2001. This cooperative program between the Apache-Sitgreaves and Tonto National Forests, the White Mountain Apache Tribe, Bureau of Indian Affairs (BIA), and ADEQ was formed to assess, monitor, and minimize the amount of smoke entering local airsheds. The group also serves as a point of contact for questions, comments, and concerns regarding air quality.

EPA Interim Air Quality Policy

The EPA's *Interim Air Quality Policy on Wildland and Prescribed Fires* (1998) addresses public health and welfare impacts caused by wildland and prescribed fires that are managed to achieve resource benefits (e.g. hazard fuels reduction and wildlife habitat improvement). The interim policy integrates two goals: (1) allow fire to function, as nearly as possible, in its natural role of maintaining healthy wildland ecosystems, and (2) protect public health and welfare by mitigating the impacts of air pollutant emissions on air quality and visibility. The interim policy identifies

the responsibilities of federal land managers to coordinate activities, minimize air pollutant emissions, manage smoke from wildland and prescribed fires, and establish emergency action programs designed to mitigate unavoidable impacts on the public.

Affected Environment

The affected environment includes those areas that would or could experience degradation in air quality as a result of actions implemented within the burned area. Areas identified as sensitive receptor sites are included in the affected environment and listed below and displayed in Table 3. The entire analysis area currently meets air quality standards for the seven criteria pollutants. The desired condition for the air resource in the project area is maintenance of air quality standards and protection of air quality values

The area within and surrounding the project area typically has good air quality conditions (EPA, Office of Air and Radiation, AIRS Database). Show Low and the communities of Pinedale, Clay Springs, Aripine, Heber, Overgaard, and Forest Lakes Estates do experience occasional temporary air quality degradation from wood burning stoves, road dust, and motor vehicle emissions. This degradation occurs mainly in the fall, when a high-pressure system becomes firmly entrenched in the four corners region of the southwestern United States.

The primary pollutants produced during combustion of organic material, such as wood burning include carbon dioxide (CO_2), PM_{10}, $PM_{2.5}$, nitrogen oxides (NO_2), and hydrocarbons. Lead (Pb), ozone, and sulfur dioxide (SO_2) are other possible by-products but are mostly found in smaller amounts. Wood smoke consists of dispersed airborne solids and liquid particulates, most of which are short lived.

Wood smoke contains pollutants including tiny particles called particulate matter (PM). Of the six NAAQS criteria pollutants, PM_{10} and $PM_{2.5}$ are of the greatest health concern. (Particle size is measured in microns, one micron equals one millionth of a meter). Carbon monoxide is another major product of wood smoke. As a gas, it quickly dilutes in the atmosphere. Carbon monoxide is a concern to firefighters and other individuals who work close to smoke sources. Particulate matter has the potential to impair human health. PM_{10} causes eye, nose, and throat irritation. Because of its relatively large size for particulate matter, it tends to remain in the upper respiratory system. $PM_{2.5}$, smaller in size, travels to the lungs and can cause more serious health impairments.

In addition to health concerns associated with particulates and other emissions, high levels of particulate matter can impair visibility; which can lead to vehicle accidents on state, county, and forest roads; and impair scenic and vista overlooks.

Sensitive sites and/or receptors are areas that could be adversely affected by smoke. Sensitive sites or receptors are Class I areas (designated Wilderness), recreation areas, cites, communities, hospitals, airports, schools, nonattainment areas, popular vitas, highways and businesses. Sensitive receptors identified and considered for the analysis area are listed in Table 32.

Table 32 – Identified sensitive receptors

Sensitive Receptors	Location
Cities	Show Low, Pinetop and Lakeside
Communities	Forest Lake Estates, Heber, Overgaard, Aripine, Clay Springs, Pinedale and Linden.
Recreation Areas	Fool Hollow, located north of Show Low.
Campgrounds	Canyon Point, Black Canyon Rim, Black Canyon Lake, Lewis Canyon and Gentry.
FS Lookouts	Gentry, Deer Springs and Juniper Ridge.
FS Work Centers	Heber and Pinedale.
State Highways	Highway 60, 260 and 277.
Other	Black Mesa Ranger Station and Compound at Overgaard and all private property within and adjacent to the burn perimeter.

Environmental Consequences

No prescribed burning activities are proposed in any of the alternatives considered in detail. Without any prescribed burning treatments, there would be no impact to air quality or human health from smoke in the short-term. However, without salvage logging and some fuel treatment (mechanical) in selected areas, there would be an increase in the potential for future wildfire and smoke.

In the event of a large wildfire, the amount and dispersal of smoke could not be controlled. The amount of smoke from such a fire would contain large amounts of pollutants that would likely exceed Federal air quality standards for particulate levels. The fire would probably produce significant adverse effects to air quality within a large perimeter around the fire. This was evidenced during the Rodeo-Chediski Fire of 2002.

Analysis was completed using the modeling program FOFEM5 to determine the quantity of pollutants discharged into the air from a wildfire in comparison to salvage logging or no action. Because the analysis area is relatively large in size; and landscape, vegetation, and fuel conditions are different across the burn area; the analysis area is divided into six analysis zones to better display the differences for fuels and fire potential that exist across the landscape (see Appendix G, Map 11).

Each analysis zone has much the same vegetative cover, ponderosa pine or mixed conifer. However, each zone has a different stand density, tree diameter size, and dead and down fuel loading. For example, analysis zone VI (Show Low South) has small diameter trees with a large amount of brush under-story. Going on west, the tree diameter increases and the brush under-story decreases. Analysis zones II, III, and IV have the larger timber size above the Mogollon Rim.

Table 33 shows the difference in pollutant production from a wildfire between harvested and unharvested areas by analysis zones (See Apendix G, Map 11 for location of Analysis Zones in Fuels section).

Table 33 – Estimated emissions of $PM_{2.5}$ and PM_{10} from wildfire in harvested and unharvested areas by analysis zone.

Analysis Zones	Areas Not Harvested Alternative 1		Areas Harvested Alternatives 2 thru 5	
	$PM_{2.5}$ Lbs/acre	PM_{10} Lbs/acre	$PM_{2.5}$ Lbs/acre	PM_{10} Lbs/acre
I	1,410	1,664	223	263
II	1,808	2,134	322	380
III	1,325	1,564	373	440
IV	1,585	1,870	1,090	1,111
V	2,510	2,961	802	946
VI	2,700	3,186	2,187	2,581

Effects Common to all Alternatives

Direct and Indirect Effects

No prescribed burning is proposed in any of the alternatives, therefore no direct impacts to air quality would occur in the analysis area from smoke.

Cumulative Effects Common to all Alternatives

No cumulative effects common to all alternatives would occur to air quality resulting from any of the alternatives considered in detail.

Alternative 1

Direct and Indirect Effects

This alternative does not propose to conduct any harvest activities to reduce current and future heavy fuel loading. Consequently there would be no effect on air quality or human health in the short term. However, in the long-term, this alternative is expected to produce the greatest amount of wildland fire activity and create the most emissions. Future fires would create varying levels of smoke that could affect any or all of the identified sensitive receptors. Depending on the amount of smoke or emissions produced, air quality and visibility could be adversely affected.

Cumulative Effects

There would be no cumulative effects on air quality by implementing Alternative 1.

Alternatives 2, 3, 4, and 5

Direct and Indirect Effects

In the short-term, particulate matter would be produced by engine emissions and dust associated with salvage logging activities. Dust and emissions created by trucks, loaders, skidders, power saws, and other logging equipment will be short-term, somewhat localized, and the amounts produced would be insignificant. The volumes and levels of particulate matter expected from implementation of action alternatives would be in direct relationship to the amount of sawtimber and specialty products removed and number of acres within each treatment area. Dust created by vehicles would be mitigated by keeping portions of the roads watered or treated with dust abatement chemicals, depending on road and traffic conditions. Mitigation measures are in place to reduce dust created during harvesting activities (see Table 7, ROADS-M-1).

Table 34 – Comparison of acres treated and harvest volume by alternative

Management Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Total salvage acres	0	45,109	38,533	41,059	42,850
Total sawtimber and specialty wood products volume	0	105.6 mmbf	55.2 mmbf	75.8 mmbf	95.8 mmbf

Alternative 2 has the potential to create the greatest volume of particulate matter, followed by Alternative 5, then Alternative 4, with Alternative 3 creating the least amount.

Indirect effects would include any smoke produced from future wildfires within and adjacent to the analysis area. High intensity wildfires are likely to occur in the future without treatment in areas that experienced low, moderate and high severity levels, as well as unburned areas, producing smoke and causing temporary degradation of air quality. With high intensity fires, fuel consumption would create more smoke with higher total emissions. Removal of dead trees in areas that burned at moderate and high severity levels would reduce future fuels should a wildfire occur within the analysis area. Implementation of Alternatives 2, 3, 4, 5 would lower impacts to air quality commensurate with the volumes of sawtimber and specialty wood product displayed in Table 5.

The Fire and Fuels section describes in detail the long-term (20 years post-burn) fuel loading expected to occur within the analysis area. The more material removed from a given treatment area, the less potential fuels would be available to burn during a future high intensity wildfire. The indirect effects of implementing action alternatives would then follow in the same order as described above for direct effects in reducing total emissions in the event of a future wildfire.

Cumulative Effects of Alternatives 2, 3, 4, and 5

Appendix A displays a listing of past, present and reasonably foreseeable activities considered during cumulative affects analysis of possible impacts to air quality that would occur as a result of implementing action alternatives. Dust and emissions created during salvage logging activities are insignificant and would quickly dissipate over space and time, with no cumulative effects expected. Timber hauled across National Forest System lands from the Fort Apache Indian Reservation authorized by a road use agreement with the Tribe was largely completed by June 2003 (see Transportation Section). There would be no cumulative effects from this past activity to air quality by action alternatives proposed for this project.

Wildlife, Fisheries and Aquatic Resources

Introduction

This section describes the existing conditions of the analysis area as well as the potential effects of the proposed management activities to wildlife habitat and species composition, abundance, and distribution. This section discloses potential effects to threatened, endangered, sensitive, and proposed species, in addition to management indicator and big game species. Only two perennial streams were affected by the fire and many of the species associated with riparian and aquatic habitats discussed in a wildlife section are the same as would be discussed in a separate section for fisheries and aquatic resources, therefore potential effects to fisheries and aquatic resources were combined into this section.

Area of Analysis

The area being analyzed is National Forest System lands within and adjacent to the perimeter of the Rodeo-Chediski Fire. The analysis area encompasses approximately 186,000 acres and is larger than the home range of any species analyzed.

Methodology Used for Data Collection and Analysis

Most Similar Neighbor Analysis

The Most Similar Neighbor (MSN) Analysis computer program was used to impute vegetative stand attributes measured in one stand to another stand without vegetative data. Approximately 65 percent of stands had stand data and the MSN analysis was used to provide data for the rest of the analysis area. After a review of outputs, it was determined that the accuracy was as high as 95 percent, depending upon the scale at which the information was used. For more detailed information about the MSN analysis, see the vegetation section in this chapter.

Habitat Relationships Modeling

The "Habitat Quality Index Model," (HQI), version 18h, developed by the Forest Service Southwestern Region, was used to evaluate the habitat capability of the analysis area for pre- and post-fire conditions and salvage treatments proposed in each of the alternatives.

The modeling approach employed for the HQI program is very simple and has been used for almost two decades. The idea behind the model is that a particular habitat type, ponderosa pine, mixed-conifer, desert grassland, etc., in each season has a certain value for cover and for forage for a specific species. Habitats are described as homogenous patches (polygons, stands) within a landscape matrix (project area) that can be classified as having a single habitat type, forested or non-forested, with a particular vegetative structure. Habitats are then aggregated across a project area.

Forage and cover values assigned are called habitat quality indices, and range from zero to one. The model combines index values across a landscape or project area, with the result that higher index values represent higher quality habitat. It is important to understand that these indices are not absolute "truth" values but should be interpreted as relative values for comparing differences among management alternatives, differences between time periods, or differences between landscapes. Although the HQI model provides index values, the habitat sensitivity to management actions is best described using the model's subjective ratings of high, moderate, and low habitat quality.

ArcView, a geographical information system (GIS) program, was used extensively in tandem with the HQI model to analyze various habitat attributes both spatially and quantitatively.

Because the Rodeo-Chediski Fire altered the overall distribution of wildlife habitats across both forests, the following assumptions were made:

- For those stands or portions of stands that were unburned or with low burn severity levels, the forest cover type and the vegetative structural stage (VSS) remained the same as pre-fire conditions. See the vegetation section in this chapter for a complete discussion of VSS classes.
- For those stands or portions of stands with moderate and high burn severity levels, the forest cover type remained the same but the VSS changed to VSS 1.
- For snag dependent species, the HQI model used VSS classes 4, 5, and 6 as surrogate estimates for potential snag numbers within moderate to high severity burned stands. Burned stands were identified and provided the same or higher habitat value for snag dependent species as their unburned counterpart.

Threatened, Endangered, and Proposed Species (TEP)

Threatened, endangered, and proposed (TEP) species within the analysis area were analyzed in detail in the Biological Assessment and Evaluation (BA&E). The process used for conducting BA&Es is outlined in FSM 2670 and in the southwestern region standards and guidelines. The main steps in the process are:

1. Develop a complete understanding of the project and how it would be implemented.
2. Develop or use existing knowledge of a species and its habitats range-wide and within the analysis area.
3. Develop quantitative knowledge of the topography, vegetative composition/structure, hydrology, and any other physical/structural characteristics of the land within the analysis area.
4. Recognize and describe direct, indirect, interrelated, interdependent, and cumulative effects from management actions.
5. Integrate the effects into an effects determination for each species.

Data analysis tiers to Forest Plans and both Forests' management indicator species assessments (Klein et al., 2002; Myers et al., 2002).

Regulatory Requirements

Apache-Sitgreaves National Forests Land and Resource Management Plan

Forest-wide objectives for wildlife include:

- Manage threatened and endangered animal, fish, and plant habitat to achieve declassification in a manner consistent with the US Fish and Wildlife Service (USFWS) and the Arizona Game and Fish Department (AGFD).
- Habitat management for federally listed species would take precedence over unlisted species.
- Implement threatened and endangered species recovery plans.

- Cooperate with the AGFD to determine the need and identify sites for transplants of Rocky Mountain bighorn sheep, desert bighorn sheep, and small game species.
- Manage animal damage in cooperation with AGFD and cooperators to prevent or reduce damage to other resources.

Forest-wide standards and guidelines for threatened and endangered species include:

- Prohibit disturbing activities in the vicinity of essential peregrine falcon nesting habitat between March 1 and August 15.
- Monitor management practices within occupied and potential peregrine falcon, Apache trout, bald eagle, loach minnow, and Little Colorado River spinedace habitat and evaluate impacts. Monitor management practices within occupied and potential habitat for listed plants, state sensitive animals, or on the Regional Forester's sensitive species list. Manage sensitive species to sustain viability and prevent the need for listing as threatened or endangered.

For a complete list of all standards and guidelines, see each Forest Plan.

Management Area Direction

Forest Plans assign Management Areas (MA) to regions of the forests to guide forest management. Each management area has different standards and guidelines for wildlife management. The Apache-Sitgreaves National Forests Plan (USDA, 1987) includes four MAs: Forest Land (MA 01), Woodland (MA 02), Riparian (MA 03), and Water (MA 11). Management area direction for each of these Management Areas is extensive and may be found in the Forest Plan for each of the areas listed above. A summary of the management direction for each area is presented in Chapter 2.

Tonto National Forest Land and Resource Management Plan

Forest-wide objectives are found for management indicator species in Appendix K, Table 11, page 269, and displays population trends predicted for year 2030 for a number of species (USDA, 1985).

Applicable Forest-wide standards and guidelines for the analysis area include direction to create or sustain as much old growth as possible over time at multiple scale levels; habitat requirements for Mexican spotted owls and goshawks by habitat types, direction for surveys and monitoring of these species and bald eagles, along with coordination requirements with the USFWS and AGFD (pp. 40, 40-1 through 40-13, 41 and 42).

Management Area Direction

The Tonto National Forest has only one MA in the analysis area. Specific standards and guidelines related to the wildlife in MA 5D include direction to meet habitat requirements for hiding cover for deer, retention requirements of various stand types, and to locate and analyze Peregrine Falcon habitat (pp. 153-154).

Mexican Spotted Owl

In addition to the standards and guidelines listed in the Apache-Sitgreaves and Tonto National Forest Plans for wildlife management, there are specific standards and guidelines for management of the Mexican spotted owl (MSO). Both Forest Plans were amended in 1996 with a Record of

Decision (ROD) for Forest Plan Amendments to Southwestern Region National Forests. The ROD was designed to be consistent with the management recommendations of the U.S. Fish and Wildlife Service Mexican Spotted Owl Recovery Plan. The recovery plan included recommendations for the protection of Mexican spotted owl (MSO) habitat in southwestern forests. Standards and guidelines from the 1996 ROD include:

- Provide three levels of habitat management – protected, restricted, and other forest and woodland types to achieve a diversity of habitat conditions across the landscape.
- Survey all potential spotted owl areas within an analysis area plus the area ½ mile beyond the perimeter of the proposed treatment areas.
- Establish a Protected Activity Center (PAC) at all MSO sites.
- Allow no timber harvest except for fire risk abatement in established PACs. For PACs destroyed by fire, windstorm, and other natural disasters, salvage timber harvest or declassification may be allowed on a case-by-case basis in consultation with USFWS.
- Allow no timber harvest in mixed conifer and pine-oak forest on slopes >40percent where no harvest has occurred within the last 20 years.
- Limit human activity in PACs during the breeding season.
- When conflicts with other TEP species arise, consult with USFWS.
- Monitor changes in owl populations and habitat needed for de-listing.

Management Indicator Species

Both Forest Plans were prepared under planning regulations issued in 1982 under the Code of Federal Regulations (CFR) 36 Part 219. The Forest Service is required to address management indicator species (MIS) in compliance with various regulations and agency policy which are, themselves, tiered to the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA), as amended by the National Forest Management Act of 1976 (NFMA). Appendix E lists species considered in this analysis.

FSM 2620, 2621, and 2630 provides specific direction for management of MIS species, which tiers to the requirements of CFR 219.9. The analysis used direction from FSM 2634.1 to evaluate all MIS species. Additional information, such as population and habitat trends, for each of these species is available in the forest wide MIS analysis for each Forest (Klein et. al., 2002; Myers et al., 2002). Based on direction from FSM 2634.1, post-fire conditions become current conditions for analysis of impacts.

Forest Service Sensitive Species

Management direction in both Forest Plans and FSM 2672 require that sensitive species be managed to sustain their viability and prevent the need for listing as threatened or endangered. This policy tiers directly to the National Forest Management Act of 1976 (NFMA). A complete list of Threatened, Endangered, Proposed, and Sensitive species is included in Appendix D.

Endangered Species Act

The Endangered Species Act (ESA, PL 93-205), direction provided in FSM 2670, and forest plan standards and guidelines require National Forest System lands to be managed for both conservation and recovery of endangered, threatened, and proposed (TEP) species. FSM 2670

directs forests to manage habitats to achieve recovery of TEP species and to avoid the need to implement special protection measures under the ESA.

ID team biologists met repeatedly with the U. S. Fish and Wildlife Service (USFWS) throughout the development of the proposed action, alternatives, and mitigation measures to reduce potential impacts to these species.

Migratory Bird Treaty Act

Executive Order 13186 (January 10, 2001) requires federal agencies to consider management impacts to migratory birds. Birds considered for this analysis were selected from the North American Conservation Initiative Bird Conservation Regions (USDI, 2002), and the determination of possible impacts that would occur should any one of the alternatives be implemented is disclosed in this summary. Further details are available in the wildlife technical report located in the project record.

Affected Environment

Introduction

Ponderosa pine ecosystems historically burned under a low intensity, high frequency fire regime. Stand-replacing fires in ponderosa pine during pre-settlement times were rare (Smith, 2000). Because of the severity and large expanse of the fire, there is general agreement among resource specialists that passive management of the fire area as recommended in the Beschta Report (1995) would not result in restoration to pre-settlement conditions even if a re-burn does not occur (Evers, 2002).

Bunchgrasses such as blue grama (*Bouteloua gracilis*), muttongrass (*Poa fendleriana)*, bottlebrush squirrel tail (*Elymus elymoides*), and pine dropseed (*Blepharoneuron tricholepis*) were historically the main understory plants in most of the area historically. Abundant grasses under a patchy canopy of large trees provided habitat needs, both in terms of forage and cover, for the wide array of species discussed here. Shrubs such as manzanita (*Arctostaphylos pringlei* and *A. pungens*), buck brush (*Ceonothus fendleri*), and Arizona rose (*Rosa arizonica*); and small trees such as juniper (*Juniperus* spp.), gambel oak (*Quercus gambeli*), and New Mexican locust (*Robinia neomexicana*) were also common understory species. These plants also provided food and cover for wildlife species.

The introduction of domestic livestock and the resulting changes to ponderosa pine and pinyon-juniper habitats is well documented in the literature (Covington and Moore, 1994). The resulting decrease in ground cover and change in grass species composition has implications for vegetative, and thus wildlife habitat, recovery post-fire. Natural seed sources are no longer available in many areas because seeds of common bunchgrasses are not long-lived (Smith, 2000) and many areas that burned at moderate to high burn severity levels consisted of younger pole stands with little to no understory. In addition, ponderosa pine seeds are heavy, and do not tend to travel more than a few hundred feet from trees; thus seed sources for natural pine regeneration may not be adequate to supply seeds for future re-growth in some areas. Active management of the area would help reinvigorate the moderate to high severity burned areas.

Plant communities within the analysis area include pinyon-juniper, pine-oak, ponderosa pine, mixed conifer, grassland, aspen, meadow, and riparian. Ponderosa pine habitats encompass the majority of the burned area and are the main focus of this analysis. Prior to the fire, shortages of large diameter (>18 inches dbh) tree structural stages existed as a result of past overstory

prescriptions. Cattle grazing and fire suppression increased stand densities, contributing to large areas of pole-sized structural stages lacking more open canopies. In addition, juniper became much more common and dense in the transition zone between ponderosa and pinyon pine stands for the same reasons.

Canyon Creek and Mule Creek are the only perennial streams within the analysis area; all other drainages are intermittent and ephemeral. Some wet-meadows exist along the northwest corner of the fire's perimeter. All are within the Canyon Creek watershed, which is a sub-watershed of the Salt River. All other watersheds within the fire perimeter eventually flow into the Little Colorado River. Earthen stock tanks are located throughout the burned area, but rarely provide enough structure for aquatic forms of wildlife. Pierce Seep consists of a series of three holding ponds that maintain perennial water. Black Canyon Lake (71 acres) is the only lake within the fire perimeter and is managed as a recreational fishery (see fisheries and aquatic resources discussed later on in this section for analysis of effects to aquatic invertebrates and fish species).

Human activity within the analysis area consists of widely scattered development west of Forest Road 107 and more concentrated areas east of there. Private lands total 8,696 acres, creating a highly integrated Wildland Urban Interface (WUI) situation throughout the eastern half of the analysis area. Wildlife habitats within the WUI are fragmented to varying degrees by the private developments. The primary human activities in the area outside of private lands are hunting, fuelwood cutting, camping, and hiking.

Livestock grazing on private lands is outside the scope of this analysis. All domestic livestock were removed from the analysis area after the Rodeo-Chediski Fire. Due to the severity of the fire and lack of allotment fences, cattle will not be permitted back in most areas of the burn until range managers are satisfied that the area has adequately recovered and allotment fences are reconstructed. It is estimated that a minimum of three to five years of recovery would be required in areas burned at moderate and high severity levels within the analysis area.

Effects of the Rodeo-Chediski Fire on Wildlife Habitat

The Rodeo-Chediski Fire was not a typical fire for the ponderosa pine type and was well outside the normal range of variability; both in terms of acres burned and burn intensity and severity. Due to the vastness of the fire, the overall distribution of wildlife habitats was altered across the analysis area. A new baseline for assessing effects to wildlife species has been established in accordance with Forest Service direction.

Wildlife habitat resources were impacted to varying degrees as burn intensity and severity varied across the landscape. Approximately 94,538 acres experienced moderate to high severity burn levels, and 80,613 acres were either lightly burned or unburned. Table 35 and Table 36 provide comparisons of pre-fire and current habitat characteristics.

Table 35 - Pre-fire and existing conditions by vegetation structural stage (VSS) classes and canopy cover within the analysis area

Vegetation Structural Stage			Canopy Cover	Pre-fire Condition		Current Condition	
Description	Class	DBH		by %	by acres	by %	by acres
Grass-forb/shrub	1	0 to 0.9 "	n/a	1.1%	1,567	54.7%	77,084
Seedling/Sapling	2a	1.0 to 4.9 "	10-40%	1.0%	1,435	0.8%	1,123
	2b		41-70%	0.8%	1,147	0.2%	241
	2c		>70%	3.5%	4,908	1.7%	2,327
Young Forest	3a	5.0 to 11.9 "	10-40%	7.4%	10,402	4.0%	5,655
	3b		41-70%	21.7%	30,555	9.8%	13,859
	3c		>70%	38.2%	53,861	16.0%	22,608
Mid-aged Forest	4a	12.0 to 17.9"	10-40%	2.5%	3,529	1.3%	1,851
	4b		41-70%	5.9%	8,368	2.9%	4,086
	4c		>70%	7.9%	11,062	3.3%	4,618
Mature Forest	5a	18.0 to 23.9"	10-40%	1.5%	2,169	1.1%	1,503
	5b		41-70%	2.1%	2,948	1.0%	1,380
	5c		>70%	3.5%	4,992	1.7%	2,330
Old Forest	6a	> 23.9 "	10-40%	0.6%	817	0.4%	602
	6b		41-70%	1.2%	1,668	0.5%	768
	6c		>70%	1.0%	1,452	0.6%	847
TOTALS				99.90%	140,880	100.00%	140,882

As the above table displays, the largest changes from pre-fire conditions to current conditions occurred in VSS 1 and 3.

Table 36 - Pre-fire and existing canopy closure conditions within the analysis area

Canopy Cover		Pre-Fire Conditions		Current Conditions	
Class	Canopy Closure	Acres	Percent of Forested Area	Acres	Percent of Forested Area
A	10-40%	18,352	13.2%	10,734	16.8%
B	41-70%	44,686	32.1%	20,334	31.9%
C	71-100%	76,275	54.7%	32,730	51.3%
TOTALS		139,313	100.0%	63,798	100.0%

Areas of high burn severity levels experienced 90 to 100 percent vegetation mortality. These are areas where no needles or leaves are left on the trees and the ground fuels are totally consumed. These areas will have little to no food and cover resource value for wildlife in the next one to five years (AGFD, 2002). Areas that burned at high severity levels cover large expanses in some locations. These intensely burned areas would not likely provide suitable habitat for many species of wildlife for several decades. These large openings may disrupt travel and dispersal corridors for both big game, such as turkey and many small mammal species, such as tree squirrels, for 20-50 years.

Between 60 and 90 percent of all vegetation in areas burned at moderate severity levels was killed by the fire. In most of these areas immediately after the fire, needles remained on the trees even though the trees were dead. Thus, needles and leaves were available to provide ground cover as soon as they began falling. Because ground cover was quickly restored, these areas are already experiencing some growth of grasses and forbs. Areas that received hay mulch in addition to seeding under BAER activities are also recovering well and in some areas now have more grass cover than they had before the fire. These areas should recover in terms of forage production within about three years. Recovery means that soils would have a minimum of 55 percent ground cover when combining basal herbaceous vegetation and litter one-half inch thick. Also, vegetation must be rated in fair range condition, when assessed by standard condition assessments (FSH 2209.21), before an area would be considered recovered.

Areas that burned at low severity levels resulted in removal of some of the duff layer with little effect on the grasses, forbs, shrubs and trees. The majority of these areas still have live tree canopies. Because of the response of grasses and forbs in those areas, wildlife habitat values remain the same as pre-fire or have improved. No treatments are proposed within areas that burned at low intensity levels and unburned areas.

Big Game Species Habitat

The following species, found within the analysis area, are considered big game in Arizona: mule deer (*Odocoileus hemionus*), rocky mountain elk (*Cervus elaphus nelsoni*), pronghorn antelope (*Antilocapra americana*), Merriam's turkey (*Meleagris gallopavo merriami*), black bear (*Ursus americanus*) and mountain lion (*Felis concolor*).

Vegetative conditions and wildlife habitat quality and quantity are closely related because vegetation provides both food and cover for all wildlife species. Thus, impacts to vegetation are

also impacts to wildlife habitats. Forage and hiding cover declined after the fire for big game species such as deer, elk, and turkey, compared to pre-fire conditions in areas that burned at moderate to high-severity levels. Long-term, these areas could provide high quality forage habitat for big game, although some species such as turkey would only use edges of these openings. On many forested ranges, fire enhances grass/forb growth and shrubs such as *Ceanothus spp.*, mountain mahogany *(Cercocarpus spp.)* and other hardwood species. Thus, low-intensity fire is considered desirable for deer and elk habitat (Grifantini, 1991). Deer would use areas closer to cover more than elk (Smith, 2000). Most (54percent) of the moderate to high-density deer and elk habitat burned under low intensity fire and should benefit habitat for big game.

High severity burn areas that were not mulched after the fire during Burned Area Emergency Rehabilitation (BAER) activities would have little to no habitat value in the short-term (1-5 years) for providing food resources because the grasses and forbs are still very sparse. The Arizona Game and Fish Department (2002) found that 46 percent of moderate to high-density elk habitat burned under moderate to high severity levels. Thus the foraging capacity for deer and elk declined in the short-term in respect to pre-fire conditions.

Current Conditions in Big Game Habitat

Vegetation changes resulting from the fire changed ratios of forage to cover for big game herbivores, and thus changed the distribution of habitats throughout the analysis area. All of the big game herbivores require a diverse grass, forb, and shrub community for forage. Antelope require open areas. Mule deer and elk prefer a forage to cover ratio of 60:40 (Thomas et al., 1979), and turkey prefer more cover with small openings of less than two acres (Wakeling 1991). Table 37 lists effects of the fire on mule deer habitat.

Table 37 - Acreage (percentage) burned in each fire intensity category in relation to mule deer population densities within the analysis area

Fire Intensity	Mule Deer Density			
	Scarce (<1/mi^2)	Low (1-4/mi^2)	Moderate (5-9/mi^2)	Total
High	2,143 (1.9%)	49,849 (30%)	777 (9%)	52,763 (28%)
Moderate	1,192 (11%)	33,285 (20%)	1,659 (20%)	36,136 (19%)
Low	5,185 (46%)	40,406 (24%)	1,907 (22%)	47,498 (26%)
Underburned or unburned	2,660 (24%)	42,735 (26%)	4,149 (49%)	49,544 (27%)
Total	11,180	166,275	8,486	185,941

(AGFD, 2002)

Approximately 47 percent of mule deer habitat within the analysis area was burned at moderate to high severity levels. Mule deer are Management Indicator Species (MIS) for both Forests. Table 38 displays changes in the habitat quality index for mule deer.

Table 38 - Summary of pre-fire and existing Habitat Quality Index for mule deer

	Pre-Fire			Current		
Summary Item	Acres Analyzed	HQI	Habitat Quality	Acres Analyzed	HQI	Habitat Quality
Summer Forage HQI	172,836	0.3	LOW	172823	0.7	HIGH
Summer Cover HQI	172,836	0.8	HIGH	172823	0.4	MODERATE
Winter Forage HQI	172,836	0.3	LOW	172823	0.7	HIGH
Winter Cover HQI	172,836	0.8	HIGH	172823	0.3	LOW
Forage HQI	184,102	0.3	LOW	184092	0.7	HIGH
Cover HQI	184,102	0.8	HIGH	184092	0.4	MODERATE
Project HQI	184,102	0.5	MODERATE	184092	0.5	MODERATE

Elk habitat and distribution were also affected. The Arizona Game and Fish Department (AGFD) maps elk habitat by average density based on aerial surveys. Burn intensity levels in the following table display elk population density zones.

Table 39 - Acreage (percentage) burned in each fire intensity category in relation to elk population densities within the analysis area

	Elk Population Density Zones					
Fire Intensity	Very Scarce (<0.5/mi^2)	Scarce (<1/mi^2)	Low (103/mi^2)	Moderate (3-6/mi^2)	High (6-10/mi^2)	Total
High	39 (2%)	808 (13%)	6,412 (29%)	30,919 (32%)	14,583 (25%)	52,761 (28%)
Moderate	162 (6%)	1,532 (25%)	4,564 (21%)	17,536 (18%)	12,341 (21%)	36,135 (19%)
Low	440 (17%)	1,518 (25%)	6,696 (30%)	22,456 (23%)	16,387 (28%)	47,497 (27%)
Unburned	1,890 (75%)	2,295 (37%)	4,482 (20%)	25,448 (27%)	15,427 (26%)	49,542 (27%)

	Elk Population Density Zones					
Fire Intensity	Very Scarce (<0.5/mi^2)	Scarce (<1/mi^2)	Low (103/mi^2)	Moderate (3-6/mi^2)	High (6-10/mi^2)	Total
Total	2,531	6,153	22,154	96,359	58,738	185,935

(AGFD, 2002)

The following table displays changes in mule deer and elk forage and cover habitat between pre-fire and current conditions, with percentages of total habitat found within the analysis area shown in parentheses.

Table 40 - Change in elk and deer forage and cover habitat by acres

Habitat by Acres	Pre-Fire Habitat	Current Conditions	Change (acres)
Total Forage	26,450 (18%)	95,511 (64%)	69,061
Total Cover	123,241 (82%)	54,186 (36%)	(69,055)

Although little pronghorn antelope habitat exists within the perimeter of the fire, the amount of pronghorn habitat increased north of Highway 260, at least in the short-term, because about 56 percent of the pinyon-juniper habitat within the fire perimeter burned at moderate to high severity levels, creating more open forest conditions. About one-third of this area is proposed for small sale salvage harvest, which would remove a majority of the dead trees. Grasses should regenerate quickly in these areas because most of the areas are long, narrow burns that should have sufficient adjacent seed sources to replenish them fairly rapidly. Pronghorn require the open habitats that often result from fire. Pronghorn numbers may increase slightly in the next few years based on the increase of open habitats.

The HQI model showed increases in forage and decreases in cover, which resulted in no change in current turkey habitat quality, rated at moderate quality (50 percent). However, the model did not take into account the large size of the openings. Turkey will not use large openings and seldom are found more than 100-200 yards away from tree cover. Forest-wide, turkey habitat is well distributed, but turkeys travel corridors within the analysis area are now disrupted, especially within the Black Canyon 5th code watershed.

Black bear and mountain lion need a diversity of habitats plus large amounts of cover reflected in Table 37, Table 38, Table 39, and Table 40.

Snags and Down Logs

The importance of large, standing dead trees (snags) and fallen dead trees (logs) as critical habitat components for small mammals, birds (Carey et al., 1991) and amphibians (Bury et al., 1990a; Corn and Bury 1991b) cannot be overstated. They provide shelter and escape cover, nesting sites, food storage sites, and microhabitats for a variety of small mammals such as chipmunks, ground and tree squirrels, mice, and voles. In turn, these small mammals are important prey species for carnivores and raptors. Snags and logs also provide nesting and foraging sites for a wide variety of birds, which help control insect levels and small mammal populations. Coarse woody debris

also provides important micro-sites for establishment of primary vegetation, providing wildlife food sources such as grasses, forbs, and fungi.

Snags are defined as standing dead trees at least 18" diameter at breast height (dbh) and 30 feet tall. Large down logs are at least 12" mid-length diameter and 10 feet long. These important habitat features were generally lacking across the analysis area before the fire and were below levels specified in standards and guidelines of both Forest Plans. Pre-fire snags numbered about 0.4 snags per acre in ponderosa pine habitats and about 1.2 snags per acre in mixed conifer habitats. Currently, snags are abundant in burned areas, and across the analysis area average 7.6 snags per acre. Snags and logs are still deficit in the low severity and unburned stands. Snag densities are increasing in these areas, however, because of increased insect activity. Both coarse woody debris (small wood 3-12" diameter) and logs were mostly consumed and are now almost completely lacking within areas burned at moderate to high severity levels.

Threatened, Endangered, Sensitive and Proposed Species (TESP)

The four threatened and endangered species addressed in the TESP analysis are the Colorado pikeminnow, Chiricahua leopard frog, bald eagle, and Mexican spotted owl. Both forests provided lists of all potential Forest Service sensitive species including vertebrates, invertebrates, and plants that might be present within the analysis area. These lists were refined based on records of species with known and/or expected ranges within Arizona, and consultations with biologists and species experts. The American peregrine falcon and northern goshawk are two of the sensitive species discussed in this section.

A total of 88 TESP species were considered in this analysis. Many fish, snail, and aquatic insect species were not present. Most sensitive plant species were also not known or expected to be present within the analysis area. All TESP species and final determinations of the management impacts to them by alternative are listed in Appendix D.

Colorado pikeminnow (Ptychocheilus lucius)

Colorado pikeminnow were once common throughout the Colorado River basin, and were an important source of food for the Native Americans who lived along the lower Colorado and Gila rivers. Until about 1911, the species was so abundant that hundreds of pikeminnow were pitchforked out of irrigation ditches onto the banks for use as fertilizer. Commercial fishermen operated in the lower Salt River until about 1910, catching pikeminnow to sell in adjacent towns (Minckley 1973). The last pikeminnow taken in the Gila River system was captured at Roosevelt Lake in 1937. It is now found in small numbers only in limited portions of the upper Colorado basin in Colorado, Utah, and New Mexico. It now occupies only about 25 percent of its former range (USFWS, 1991).

During the 1980s, well over 100,000 pikeminnow were stocked in the Salt River above Roosevelt Dam, in Cheery Creek and in Canyon Creek (Hendrickson 1993). The reintroductions were designated as experimental, non-essential populations. Given the predilection of this species for rivers with high silt content, warm water, and turbulence (AESFO 2002), if any remain in Canyon Creek, they would not likely occur much above its confluence with the Salt River over 50 miles downstream from the analysis area. The most recent documented occurrence of this species within the analysis area occurred in Canyon Creek in the late 1980s. These were of individuals from the stocking effort that occurred in the mid-1980s (Minckley and Deacon, 1991; Hendrickson, 1994).

Chiricahua Leopard Frog (Rana chiricahuensis)

This aquatic frog is chiefly found in mixed pine-oak and oak woodlands in natural or artificial (earthen stock tanks) habitats providing permanent water with at least some emergent and submergent vegetation. It prefers deep, rock-bound pools. Historically, this species was found in the Little Colorado River system and its upstream tributaries within the analysis area. No sightings of this species have been documented during surveys conducted by the Arizona Game and Fish Department and the Forest Service. The nearest locations for Chiricahua leopard frogs are about 1.5 miles southwest of the fire perimeter and another 1.0 mile west. The frog has not been documented within Canyon Creek or Mule Creek, although suitable habitat is present.

Habitat suitability within the analysis area is now low, due to ash and sediment flows that occurred after the fire. All perennial waters are considered potential habitat until species-specific surveys confirm its presence or absence. Limited surveys in 2003 resulted in no Chiricahua Leopard frog findings within the analysis area, but most of the potential habitat is yet to be surveyed to protocol standards established by the U. S. Fish and Wildlife Service in 2003.

Bald Eagle (Haliaetus leucocephalus)

Mid-winter surveys to document winter use and distribution of bald eagles began within the analysis area in January 1992 (Beatty and Driscoll, 1996a) and have been conducted annually through January 2003. Roost identification and protection is an ongoing priority. Roosts have been located within the burn area near Cottonwood Wash and Canyon Creek. Suitable roosting locations are still present within the fire perimeter. Extensive surveys for nesting bald eagles have been conducted by the Arizona Game and Fish Department, Forest Service personnel, and other researchers (Beatty and Driscoll, 1996). There are no bald eagle nesting sites on National Forest System lands within or adjacent to the analysis area. Bald eagles may nest on Fort Apache Indian Reservation lands within the fire perimeter, but no site-specific information is available at this time.

Mexican Spotted Owl (Strix occidentalis lucida)

All of the ponderosa pine/Gambel oak and mixed conifer habitats within the analysis area could be considered potential Mexican spotted owl (MSO) habitat. Much of the pine-oak habitat, however, would never provide the complexity of both vertical and horizontal structure required for nesting areas by this species (William Block, personnel communication, 2003). All 59,988 acres of pre-fire mixed conifer and pine-oak habitat within the analysis area was analyzed for current protected, restricted, and threshold conditions. About 12,096 acres are located within protected activity centers (PACs). The other 47,892 acres with pre-fire and current conditions is shown in Table 41.

MSO Restricted, Threshold, and Protected Habitat

Twenty protected activity centers (PACs) have been established within the analysis area on National Forest System lands. Monitoring of these spotted owl PACs occurred before the fire. Extensive inventory and monitoring surveys in 2003 revealed owls in eight of the 20 PACs. No new PACs are known to have been established.

The recovery plan for the Mexican spotted owl (USDI, 1995) defined areas of forestland that are to be managed for owl habitat. They are considered key habitat because of their vegetative characteristics regardless of owl presence. These are termed “restricted” and “threshold” stands. “Protected” habitat is an additional designation that consists of several habitat types. The only protected type included in the analysis area outside of PACs are forest stands that meet restricted habitat definitions and occur on slopes over 40 percent where timber harvest has not occurred in

the past 20 years. The other two protected categories are: actual or historical nest/roost locations and associated territory in PACs (see below); and lands reserved in Wilderness and Research Natural Areas, of which there are none in the project area.

Restricted habitats are subdivided as pine-oak or mixed conifer habitat types. These stands need to be of certain plant associations (USDA, 1997) and/or have certain proportions and sizes of certain tree species (Recovery Plan, Vol. 1, p. 55-56). Prior to the fire, timber stands comprising 46,462 acres met these specifications for restricted habitat outside of PACs and steep slope protected habitats. It is assumed that the unburned or low burn severity portions of the pine-oak stands would still meet these criteria. Portions of the pine-oak stands subjected to moderate or high burn severity levels would not. This results in 20,031 acres outside of PACs and steep slope protected habitat that currently meet specifications for pine-oak and/or mixed conifer restricted habitat.

Threshold habitats are likewise divided into pine-oak and mixed conifer habitat types. While these stands must first meet the definition for restricted habitat, they also must meet additional requirements of tree size and density to make them candidate stands for nest/roost habitat (Recovery Plan, Vol. 1, p. 92). In the Upper Gila Mountain Recovery Unit, which includes the project area, the recovery plan calls for 25 percent of the mixed conifer restricted habitat and 10 percent of the pine-oak restricted habitat in a threshold condition, or managed to become such (designated as target threshold).

Prior to the fire, timber stands comprising 411 acres met threshold condition outside of PACs and steep slopes, equal to approximately 1 percent of the pre-fire restricted habitat. It is assumed that portions of threshold stands that experienced low burn severity levels still meet the requirements of restricted habitat, but no longer have sufficient density to be designated as threshold habitat. Only unburned stands still meet threshold definitions. Areas that experienced moderate or high burn severity levels no longer meet specifications for either restricted or threshold. Applying these assumptions across the project area results in only 40 acres outside of PACs and steep slopes that still meet threshold criteria at this time, which is only one-fifth of one percent of the remaining restricted habitat. There are also 186 acres of former threshold habitat that burned at low severity levels that are still included as restricted habitat, but are no longer dense enough to be threshold habitat, so they are designated as target threshold habitat.

Table 41 - MSO pre-fire and existing habitat classifications

*Habitat	Pre-Fire Acres	**Acres currently meeting:		
Category	(Outside of PACs)	Restricted	***Threshold	>40% Protected
Mixed Conifer	2,638	1,240	NA	NA
Pine Oak	42,152	17,857	NA	NA
Mixed Conifer-Pine Oak	1,673	707	NA	NA
subtotal	****46,462			
Mixed Conifer -Threshold	324	178	30	NA

*Habitat	Pre-Fire Acres	**Acres currently meeting:		
Category	(Outside of PACs)	Restricted	***Threshold	>40% Protected
Pine Oak -Threshold	87	48	10	NA
Subtotal	**411**			
MixCon>40% slope	97	NA	NA	35
PineOak>40% slope	721	NA	NA	390
MixCon/PineOak>40%	201	NA	NA	27
Subtotal	**1,019**			
Total	**47,892**	****20,031**	**40**	**452**

***Some stands meet the definitions of mixed-conifer and pine-oak habitat; hence the categories that show "Mixed Conifer-Pine Oak…" versus those stands that just meet one or the other.**

****Restricted, threshold and steep-slope protected habitat located within PACs take on the protected habitat classification of a PAC and are not included in acre computations for their stand-alone classification.**

***** Threshold is a sub-set of restricted, i.e. threshold acres are also counted as restricted acres.**

****** Totals were computed by spreadsheet using decimal portions for acres in each category, so totals marked with asterisks do not agree with totals using only the figures rounded to the nearest acre as displayed here.**

NA Not Applicable

Pine-oak and mixed conifer restricted habitat on slopes over 40 percent that have had no timber harvest in the past 20 years are classified as protected habitat, which has the same protection as PACs. Prior to the fire, there were 1,019 acres of pine-oak and mixed conifer forest on steep slopes outside of PACs. Portions of these stands burned at high or moderate severity levels and no longer meet the specifications for pine-oak or mixed conifer habitat; therefore, only the portions of these stands that did not burn or that burned at low severity levels are still considered protected habitat under these definitions. Under those assumptions, a total of 452 acres of steep-slope protected habitat outside of PACs remains within the analysis area. While Alternative 2 proposes treatment within PACs, no other MSO habitat is proposed for harvest under any of the alternatives.

American Peregrine Falcon (Falco peregrinus)

The peregrine falcon was listed by Region 3 as a sensitive species in 1988. Peregrine falcons usually nest on cliffs in mountainous areas or near rivers or lakes (USFWS, 1984). On August 25, 1999, the US Fish and Wildlife Service delisted the American peregrine falcon. This falcon was designated as a delisted taxon, recovered; and is being monitored for the first five years in its entire range. Occupied eyries in Arizona are limited to tall cliffs. Nests are usually situated on potholes or open ledges in the cliff face (USFWS, 1984). Peregrines nest at any elevation up to about 9,000 feet.

Birds are the principal prey food source of the peregrine falcon. Preferred hunting areas support abundant bird life and include cropland, meadows, river bottoms, marshes, and lakes. Peregrines strike their prey from above at speeds up to 60 mph. and take a wide variety of bird species. Blackbirds, shorebirds, jays, doves, swallows, and small songbirds are common prey. Areas within 10 miles of nesting cliffs are believed to supply the majority of the peregrine falcon's food source (USFWS, 1984).

Within the analysis area suitable habitat exists in the vicinity of Canyon and Mule Creeks. In this area, the steep rocky cliffs that form the Mogollon Rim provide nesting habitat for peregrine falcons. Surveys conducted by the Forest Service in 2000 and 2001 resulted in the discovery of a pair of peregrines using the broken cliffs above Mule Creek. Current monitoring (2003) indicates that peregrines have continued to use the area, and had three nestlings. Fledging was not confirmed.

Northern Goshawk (Accipiter gentilis)

The northern goshawk is primarily a resident of ponderosa pine and mixed conifer forests. It is uncommon but widespread throughout the analysis area. Twenty-six post-fledgling family areas (PFAs) have been established for management purposes within or immediately adjacent to the area.

Northern goshawks are habitat generalists and use all vegetative stages within forests. The species is often associated with nesting in more mature or larger trees, although only a small patch of this type of habitat (about 30 acres) may be needed for successful reproduction in forests where a mosaic of age and size classes are present (USFWS, 1998).

Reynolds et al., (1992) identified 14 prey species (or similar groups of species) that are particularly important in the goshawk diet in the southwest. These species include a variety of forest birds and small mammals that reside mainly on the ground and in lower portions of the tree canopy.

Small mammal species vary in response to stand replacing fires. Species such as deer mice, ground squirrels, and pocket gophers often increase after stand-replacement fires (Ream, 1981; Kaufman et al., 1982). Others such as rabbits, red squirrels, and voles generally avoid recently burned areas (Ream, 1981; Biswell, 1989). Many species of cavity nesting birds increase after fire, but recovery of mammalian and bird populations may take as long as 3-5 years (Ream, 1981; West, 1982).

The current HQI modeling for goshawk foraging habitat is at 80 percent of its potential, compared to 70 percent pre-fire. This is due to an increase of 28 percent in high quality foraging habitat created by the fire on 117,185 acres, based on the opening of forested stands. Fires favor raptors by reducing hiding cover and exposing prey. Raptor populations may increase when more food is available within an area; thus the results from the model are consistent with other studies showing raptors are unaffected by or respond favorably to burned habitat (Smith, 2000).

The fire reduced the availability of good nesting cover by 48 percent, from 36,183 acres to 17,574 acres. The resulting current HQI for goshawk nesting habitat is at about 10 percent of its potential, compared with 30 percent pre-fire. Overall, HQI value within the analysis area is now at 30 percent. The low HQI value suggests that the continued presence of reproducing goshawks within the analysis area may be uncertain according to the model estimates. Even with the reduction in the amount of nesting cover, biologists agree that some goshawk nesting activity will continue within the analysis area.

Among the 24 PFAs located completely within the analysis area, 20 were revisited in 2003 as of the end of July. Three active nests were found. One new PFA with a nesting pair was established within the burn area, bringing the total number of PFAs within the fire perimeter to 25, with two additional territories straddling the perimeter. It should be noted that goshawk nesting was low throughout the analysis area in 2003.

Management Indicator Species

This group of species is chosen to help assess the effects of forest management activities on the MIS species and others with similar habitat requirements. Ideally, MIS species should be those species most sensitive to habitat changes and by implementation of forest activities. A total of 22 MIS were examined for impacts from the alternatives being considered in detail. Several are discussed in other sections, such as the big game section. Mexican spotted owl and northern goshawk are discussed under TESP. Analysis of effects for the other species is briefly summarized here. For a summary of the management impacts to all MIS species by alternative, see Appendix E.

Tree Squirrels

Within the analysis area, the Abert's squirrel (*Sciurus aberti*) is currently limited to the low severity or unburned ponderosa pine forests. The HQI model indicates current habitat capability at 60 percent of its potential. It is well distributed across Arizona within ponderosa pine habitats. The red squirrel (*Tamiasciurus hudsonicus*) is confined to areas that burned at low severity levels and unburned mixed conifer habitats. Its HQI habitat capability is currently at 50 percent. The Arizona gray squirrel (*Sciurus arizonensis*) is found in riparian areas below the Mogollon Rim, confined to the steeper portions of Canyon Creek watershed. Because of the severity of burn within that area, it is no longer expected to occur within the analysis area.

Birds Indicating Coniferous Forest and/or Cavity Nesting Habitat Trends

Pygmy nuthatch, hairy woodpecker, red-naped sapsucker, violet-green swallow and western bluebird all nest in cavities and inhabit coniferous forests. Although the analysis area now contains many more snags, other ecological requirements for these species may not be present. Red-naped sapsuckers nest almost exclusively in aspen stands, and are mostly found outside the analysis area and will not be discussed further in this analysis. The violet-green sparrow, western bluebird and the western wood peewee are also management indicator species found within the analysis area. All these species are frequently found in relative abundance in post-fire cover types. Western bluebird and hairy woodpecker habitat is currently rated at about the same quality as pre-fire, with an HQI of 0.4. Impacts to nesting habitat for these species from the alternatives considered in detail are addressed under the Snags and Down Logs section.

The nuthatch is considered a primary cavity nester, with both sexes digging the cavity during nesting near the top of a ponderosa pine snag. Occasionally, the will use natural cavities or those created by other birds. The pygmy nuthatch also relies heavily on large snags as winter roost sites. Snags used for winter roosts in an Arizona study (Hay and Guntert 1983) averaged 28.8 inches dbh and 76 feet tall. Sydeman and Guntert (1983) found over 160 birds using a communal roost in Arizona in 1983, and that some of the birds traveled as far as two kilometers nightly to reach this communal roost snag.

Within the analysis area prior to the Rodeo-Chediski fire, the HQI model established the habitat capability for pygmy nuthatch at about 20 percent of its potential. The HQI Forest-wide, including the analysis area, was estimated at 40 percent of its potential based on 1996 forest stand data.

Currently, based on the MSN data set and coefficients, the HQI model identified 66,053 acres of year-round habitat that provide some value for foraging and cover by the species. The habitat quality index (HQI) generated by this model indicates that within the analysis area currently, overall habitat capability is at about 30 percent of its potential for pygmy nuthatch. This indicates an improvement over pre-fire conditions, based primarily on the amount of new snag habitat.

Fisheries and Aquatic Resources

The Rodeo-Chediski Fire affected riparian habitat, especially within the Canyon Creek and Black Canyon watersheds. Management indicator species for these riparian habitats may be temporarily displaced from that watershed until recovery provides adequate foraging, hiding, and nesting habitat. Such species include common black hawk, western wood peewee, warbling vireo, yellow-breasted chat, and Lincoln's sparrow. Forest-wide and outside the fire area, they are well distributed and generally considered to have stable populations.

Aquatic macro invertebrate populations provide important food resources for fisheries, as well as being indicators of aquatic habitat quality. They are considered as management indicator species for Management Area 3, Riparian, in the Apache-Sitgreaves Forest Plan, and for Management Area 5D, Riparian >3000 feet elevation in the Tonto Forest Plan. A forest-wide report for the Apache-Sitgreaves National Forests found that approximately 70 percent of the cold water streams on the forest were in a downward trend (Ward, 2003). Information for that portion of the analysis area occurring on the Tonto National Forest is not available. The Arizona Game and Fish Department has monitored Canyon Creek watershed before and after the fire.

Canyon Creek and Mule Creek are the only perennial streams within the analysis area; other drainages are intermittent. Pierce Seep consists of a series of three holding ponds that maintain perennial water and some wet-meadows exist along the northwest corner of the analysis area. Stock tanks can be found throughout the burned area but rarely provide enough structure for aquatic forms of wildlife. The entire upper portion of the Canyon Creek watershed and Black Canyon watershed are considered affected environment for aquatic resources, including aquatic macroinvertebrates.

For current conditions of streams and washes in the analysis area, see the soils and hydrologic resources section.

Migratory Birds

Twenty-five species of migratory birds were considered to determine if they are present during nesting or over-winter within the analysis area. A complete list of birds considered is found in Table 44. Summer resident cavity nesting species are the only species subject to potential impacts from the proposed actions, and are addressed in the snags and down logs section.

Environmental Consequences

Big Game Habitat

Direct and Indirect Effects to Big Game Habitat under Alternative 1

It is expected that areas burned at moderate or high severity levels would be avoided by big game species until grass and forb production resume. Leaving all dead trees would not enhance recovery of vegetation (forage) short-term (See vegetation section), and thus this alternative would not enhance large ungulate habitat. While salvage logging would disturb soils, it would enhance water infiltration, and logging slash would provide sites for grass and forb

reestablishment. Thus, under Alternative 1, recovery of forage for big game would be slower compared to the action alternatives in stands that burned at moderate and high severity levels.

Alternative 1 would be less favorable for antelope compared to action alternatives because natural recovery would take longer in pinyon-juniper stands that burned at high severity levels without removal of the dense, small dead trees. As a primarily forb-eating species with strong requirements for open grasslands, pronghorn antelope are favorably influenced by the increase in herbaceous species and reduction of shrubs after fire (Higgins et al., 1989). Higher protein and mineral levels and reduced levels of indigestible materials have been reported in re-sprouting grasses and shrubs (Daubenmire, 1968; Kindschy et al., 1978). Nutritional benefits of fire on forage may last up to four years post-fire with an increase in primary productivity for a longer period, depending upon plant species (USDI, 1966).

Turkeys avoid large openings, thus keeping all dead trees may provide enough cover to allow them to use these areas to forage, if grasses and forbs are available. Because recovery of grasses and forbs is expected to take longer in areas that burned at moderate and high severity levels under this alternative, Alternative 1 would have both positive and negative impacts to turkeys. Some of the larger openings, such as in the Ross Watershed, have the potential to alter the distribution of turkeys within portions of the analysis area for several decades, regardless of which alternative is selected.

Cumulative Effects to Big Game Habitat under Alternative 1

Cumulative effects include past, present and reasonably foreseeable future activities potentially affecting wildlife species habitat on all lands, including private, throughout the analysis area. Past effects, including the fire, have been discussed at length, and are now included in the current conditions. Future treatments include salvage sales, fuels treatments such as thinning six-inch diameter and smaller trees, piling and burning, and broadcast burning. Cumulatively, these projects would provide both beneficial and negative impacts to big game. These types of treatments result in a more open understory that can provide more grass and forbs for forage, although hiding cover would be reduced until grasses and shrubs recover.

Salvage logging activities that are currently occurring under authority of three Decision Memos signed in 2002 has been considered in this analysis of cumulative effects. Salvage logging can speed recovery of vegetation and forage over natural recovery. In areas where there are no treatments, recovery of grasses and forbs in high severity burn areas would likely take up to ten years, given the current soil condition, lack of seed sources, and the large areas. In areas burned at moderate severity levels, recovery may occur within three to five years, depending on the size of the area and whether they were seeded during the BAER activities. Development of hiding cover from trees is expected to take longer under this alternative because of the lack of seed sources and because no tree planting is planned within the next five years.

Other future projects are aimed at opening the forest by thinning from below, conducting fuels treatments, and broadcast burning. These types of projects should add nutrients to the soil, reduce competition of trees, and lead towards a more open understory historically found in ponderosa pine and Pinyon-juniper stands. These types of projects will help increase the forage base for big game species. Forest Plan standards and guidelines for maintaining and/or providing large logs and coarse woody debris will help ensure sufficient decaying matter contributes to more healthy understories and provides cover and microsites for grass and forb establishment after treatments. Therefore, cumulatively, future treatments should benefit big game species.

Direct and Indirect Effects to Big Game Habitat Common to Alternatives 2, 3, 4 and 5

Each action alternative proposes to remove dead trees in moderate to high burn severity areas and only dead trees ≥ 12" dbh are proposed for harvest. All of the action alternatives would promote recovery of the soils and wildlife habitats by providing additional ground cover in the form of logging debris (see the soils and hydrologic resources section). It should be noted that logging would take place in one or two cutting units at a time, rather than the entire analysis area being logged simultaneously. This means that disturbance to wildlife would be confined to one or two areas within a timber sale boundary at a time, not the entire analysis area.

All action alternatives are addressed under this section for big game because the HQI model indicated no changes in existing habitat quality from salvage regardless of which action alternative (2, 3, 4, or 5) is considered, when modeling deer, elk, or turkey. None of the action alternatives would alter existing deer and elk habitat because the existing ratio of forage to cover would not be altered through salvage harvest. The vegetative structural stage (VSS) class would remain the same after salvage logging activities, compared to current conditions. Turkeys would avoid the more open areas, while mule deer, elk, and in the more northern areas antelope, would use them extensively. Shortcomings in the assumptions of the model in the case of turkeys were discussed earlier. No change would occur in antelope habitat for the reasons addressed under mule deer and elk, and the percent of antelope habitat within the analysis area compared with habitat available forest-wide is insignificant (less than 1 percent).

Although some soil compaction from equipment could occur, action alternatives should allow for faster recovery of forage, especially within those areas that burned at high severity levels. Salvage logging can help break up surface crusted soil layers to increase infiltration of water, and allow faster establishment of grasses and forbs through site disturbance. Logging slash can help prevent excess runoff of water and prevent massive soil loss by providing additional ground cover. Logging slash can also provide micro-sites for grass and forb establishment. Seeding temporary roads or those Level 1 roads to be re-opened and roads closed after logging can provide more rapid recovery compared to the same area without salvage logging.

By providing greater amounts of forage and browse, early successional vegetation in salvage-logged areas would provide a positive response that benefits big game herbivore species. Action alternatives would also provide more habitat diversity for large ungulates than Alternative 1 because 39 to 51 percent (depending on the alternative selected) of areas burned at moderate to high severity levels would be salvage logged, producing a more open habitat in a shorter period of time than would leaving all burn areas in their current condition.

The loss of most large and some of the small trees, which would be knocked down during salvage operations or removed in small sale areas, would decrease effective hiding cover while increasing forage growth (grasses, forbs, and shrubs). Forest plan standards and guidelines for forage to cover ratios for big game specify cover should be between 60:40 and 70:30. Pre-fire ratios of 18:82 did not meet these guidelines. All live tree cover was destroyed in areas that burned at moderate to high severity levels and the stands reverted to VSS 1 (grass and forb stage). Thus, the current forage:cover ratio is 64:36, and it remains the same after salvage because only dead trees are removed. The forage to cover ratio is currently consistent with forest plans standards and guidelines.

All action alternatives propose road maintenance activities; construction of temporary roads, and opening currently closed roads for temporary use. All temporary roads and previously closed roads that are opened and used for harvest activities would be closed (or decommissioned) and

reseeded after use. Salvage harvest activities would not change current open road densities within the analysis area.

Water can be a limiting factor for big game species. Big game obtain the majority of their water needs from stock tanks in the analysis area. Action alternatives would not treat areas adjacent to stock tanks or any other water sources and therefore would not affect the water availability for big game. Most species would avoid the treatment areas during harvest due to noise and human presence. Harvesting activities occurring within any one area would be relatively short (2-3 weeks).

Cumulative Effects to Big Game Habitat Common to Alternatives 2, 3, 4 and 5

The following list of cumulative effects was considered in all wildlife sections. Past activities affecting wildlife habitat within the analysis area include livestock grazing, logging, road construction, water development and diversion, historic fires, farming and housing development on private lands, recreation and recreation development, utility corridors, fuels treatments, fuelwood collection, and hunting throughout the analysis area. A comprehensive listing of all past, current and reasonably foreseeable future activities is found in Appendix A.

The Rodeo-Chediski Fire burned almost 470,000 acres within and south of the analysis area. Burned Area Emergency Rehabilitation (BAER) treatments covering about 46,000 acres were completed in 2002 on National Forest System lands. Other BAER treatments covering an unknown number of acres were completed on the Ft. Apache Indian Reservation.

Present activities within the analysis area include salvage logging on approximately 28,000 acres, including along roads, trails, fences, and utility corridors; around administrative and recreation sites; and within one-half mile of private property bordering the forest within the analysis area. Those actions are being carried out under authority of three Decision Memos approved December 2002. Increasing insect activity is adding to the number and density of dead and dying trees within the analysis area.

There are no state lands within the analysis area except for 23 acres located at Bear Springs that are controlled by the Arizona Game and Fish Department. On the 8,696 acres of private land in the action area, the landowners will probably treat approximately 85 to 90 percent of the lands affected by the fire. The landowners are in the process of clearing all or most of the dead trees. The progression of this work is somewhat unpredictable because the landowners are highly dependent on external sources of funding. The Natural Resource Conservation Service and the Navajo County Extension Service are actively assisting the landowners.

Foreseeable future actions include fuel reduction projects (e.g. thinning from below, thinning and chipping and prescribed burning) on about 23,000 acres and approximately 1,600 acres of salvage across the analysis area over the next five years. In addition, there are also some long-term rehabilitation treatments being considered in the analysis area, but these are not yet firm enough to qualify as foreseeable actions. The acres of prescribed treatments are not cumulative because the effects are separated by distance and/or time. Many successive activities may occur on the same acre within the analysis area.

Impacts to big game habitat from the Rodeo-Chediski Fire, and thus species composition and distribution, as well as abundance, were far more severe than any impacts from post-fire salvage logging are predicted to be. Salvage logging adds important ground cover to help retard soil

movement and provide microsites for grass and forb establishment, especially on severe burn intensity sites.

Other future projects are aimed at opening the forest by thinning from below, conducting fuels treatments, and broadcast burning. These types of projects should add nutrients to the soil, reduce competition of trees, and lead towards a more open understory historically found in ponderosa pine and Pinyon-juniper stands. These types of projects help increase the forage base for big game species. Forest plan standards and guidelines for maintaining and/or providing large logs and coarse woody debris would help ensure sufficient decaying matter contributes to more healthy understories and provides cover and microsites for grass and forb establishment after treatments. Therefore, cumulatively, future treatments should benefit big game species.

Snags and Down Logs

Direct and Indirect Effects to Snags and Down Logs under Alternative 1

Current snag density is estimated to be 7.6 snags per acre across the analysis area, which is at the high end of the range providing maximum density of cavity nesters (Raphael, 1983). In addition, all snags would be available to cavity nesting species, meaning that both density and diversity of bird species would be at their maximum numbers. The snag habitat would also persist longer than in Alternatives 2 and 5 because the largest snags generally remain standing longest. Therefore, Alternative 1 provides the largest amount of short- and long-term habitat for cavity nesters. Benefits and impacts to other species (non-cavity nesting species) from retaining in their current conditions areas burned at moderate and high severity levels are discussed in respective wildlife sections.

Cumulative Effects to Snags and Down Logs under Alternative 1

Currently across the analysis area, about 54 percent of the area is classed as having been burned at moderate to high severity levels where most or all trees are dead. Large expanses of fire-killed trees would provide habitat for cavity nesting birds and small mammals that use burn areas. Snag and log density would remain high. Slower recovery to more open conditions would benefit some cavity species such as the pygmy nuthatch, but other species such as hairy woodpecker, violet green swallow, and western bluebirds prefer more open conditions, and may be less abundant under this alternative than the action alternatives.

Other future projects are aimed at opening the forest by thinning from below, conducting fuels treatments, and broadcast burning. These types of projects should add nutrients to the soil, reduce competition of trees, and lead towards a more open understory historically found in ponderosa pine and pinyon-juniper stands. Forest plan standards and guidelines for maintaining and/or providing large snags, large logs and coarse woody debris would help ensure sufficient decaying matter contributes to more healthy understories. Such actions would also provide for insects and other decay mechanisms upon which many cavity nesting species forage. As long as forest plan standards are followed, species depending on snags and logs should benefit cumulatively from the present and future projects.

Direct and Indirect Effects to Snags and Down Logs Common to Alternatives 2, 3, 4 and 5

Down logs and coarse woody debris are almost totally lacking in areas that burned at moderate to high severity levels. The only downed material is that which has fallen in the last year. The potential number of large logs (>12” dbh) from dead standing trees would decrease under all action alternatives because most large trees would be removed. Down log density would become

adequate across the analysis area despite salvage logging due to mitigation measures specified for retention of down logs and snags. Additional large logs may become available due to the passage of time since the fire. It is unknown how many of the 12”-14” trees will be commercially viable by the time on of the action alternatives is implemented. If these trees are no longer viable, they will not be removed for commercial use and will rot and fall to the forest floor within two to five years (Harrington, 1996).

Balda (1975) found that maintaining average diversity and densities of cavity nesting bird species required at least 1.73 snags per acre, but recommended maintaining a density of 2.68 snags/acre to increase both densities and species diversity. Raphael (1983) found that maximum densities of cavity nesters are found at 6 to 8 snags per acre. Little increase in cavity nester numbers was recorded with increased numbers of snags above those levels. Bull et al., (1997) concluded that large-diameter snags provide nest habitat for the greatest variety of cavity nesters and remain standing longer than smaller diameter snags. Currently, forested stands in unburned and low severity areas are deficient in large snags. Insect activity should continue to add to snag recruitment in the future in those areas. Some green stands logged in the past will have limited recruitment of snags until they reach maturity.

Many cavity nesters such as hairy woodpecker, violet green swallow, and western bluebirds feed in open areas. Other cavity nesters such as the flammulated owl (see migratory birds) prefer dense stands of younger trees near more open areas. Lewis’ woodpecker prefers large snags near or adjacent to water, and would not be affected by any of the action alternatives. All these species rely more on snag and downed log availability for nesting and foraging than any other habitat features. Maximum use of burned forests by cavity nesting birds occurs between 5 and 40 years after a fire (Taylor and Barmore, 1980; Raphael, 1983; and Raphael and White, 1984). Fire-killed snags do not become suitable for nest drilling by primary cavity nesters until some decay sets in, which varies among tree species (Raphael, 1983; Raphael and White, 1984).

No additional large snag recruitment from green trees is expected for about 75 years in areas burned at moderate and high severity levels. Additional recruitment in low burned and unburned areas is increasing with a large number of trees being killed by insects in the analysis area. All action alternatives would leave standing snags and large down logs at forest plan minimum standards, with Alternatives 3 and 4 leaving more snags and logs. Table 42 shows snags per acre when all treatment acres are considered, including those where no large snags are available. Alternatives that provide higher snag densities would provide higher quality habitat for cavity nesting birds and small mammals that use burned areas.

Table 42 - Post-treatment snags per acre by alternative

Characteristic	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Sum of Net Acres Treated*	0	34,926 (45,109)	23,316 (38,533)	31,794 (41,059)	33,008 (42,850)
Sum of Acres not Treated (includes cumulative effects)	80,911	45,985	57,595	49,117	47,903
Average Snags/Acre in Treatment Areas	8.2	1.7	1.9	2.1	1.7

Characteristic	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Average Snags/Acre**	7.6	6.3	6.8	6.6	6.4
Cumulative Effects Average Snags/Acre	7.1	5.8	6.3	6.1	5.9

*** Treatment areas include harvest units from which dead trees would be removed. Within the harvest units, the acres shown are actual acres of moderate and high severity burn areas to be entered for salvage logging activities. Acres in parenthesis are gross acres within harvest unit boundaries.**

**** Average snags per acre across the Analysis Area after Alternative is implemented. Snags per acre would be reserved from trees in the 18" dbh class for Alternatives 2 and 5. In Alternatives 3 and 4, reserve snags would be marked in the largest two-inch size class available over 18 inches dbh.**

Cumulative Effects to Snags and Down Logs Common to Alternatives 2, 3, 4 and 5

In addition to the potential cumulative effects from actions already mentioned under the big game section, firewood cutting may affect snag and log density. Forest Service fuelwood permits are available for juniper, oak, and pinyon pine. They limit the diameter to be cut to a maximum of 12" dbh for all species except pinyon pine, which rarely reach that diameter in the analysis area. The local public rarely uses pine for firewood, thus firewood permits for that species are rare. Large snags under the forest plans are defined as being larger than 18" dbh, so would not be impacted by fuelwood permits. Snag numbers would remain near the range needed for maximum density of cavity nesters (6-8 snags per acre, see above) after all cumulative effects are considered. Bark beetle activity is increasing and will most likely increase the number of snags in the analysis area. Most bark beetles tend to attack the largest trees first (Dr. Ann Lynch, pers. comm.). All action alternatives would provide sufficient snag densities to keep high densities of cavity nesters within the analysis area until natural snag recruitment begins in the treated acres, although snag longevity would vary among alternatives.

Other future projects are aimed at opening the forest by thinning from below, conducting fuels treatments, and broadcast burning. These types of projects should add nutrients to the soil, reduce competition of trees, and lead towards a more open understory historically found in ponderosa pine and pinyon-juniper stands. Forest plan standards and guidelines for maintaining and/or providing large logs and coarse woody debris will help ensure sufficient decaying matter contributes to more healthy understories and provide sufficient large logs and snags across the analysis area. Therefore, cumulatively, future treatments should benefit those wildlife species needing snags and/or logs as part of their life history requirements.

Direct and Indirect Effects to Snags and Down Logs Unique to Alternatives 2 and 5

These alternatives would leave an average of two snags per acre in the 18" dbh size class in ponderosa pine habitat and three snags per acre in mixed conifer habitats throughout the treatment areas. While the mitigation measures provide minimum requirements for leaving snags, there are some areas that do not have current snag densities that meet these requirements. This is why the 1.7 snags per acre average shown in Table 42 is below the minimum requirements. Alternatives 2 and 5 leave the lowest average snags per acre among the alternatives. Within the treatment areas, this average of snags is slightly below the 1.73 snags per acre recommended to provide average

diversity and density of cavity nesting birds (Balda 1975). After treatment, the analysis area average snag density would be 6.3 to 6.4 snags per acre.

Approximately 43,000-45,000 acres that burned at moderate and high severity levels would be salvage logged under these alternatives. Because larger snags last longer than smaller ones (Taylor and Barmore, 1980), the snags retained in Alternatives 2 and 5 would not remain standing as long as the larger snags retained in Alternatives 1, 3 and 4, and thus would not provide habitat for cavity nesters for the same time periods. Fewer down logs would be present compared with Alternative 1, once trees begin falling. These alternatives would provide less habitat for those species dependent on small and large woody debris than Alternative 1, such as small mammals.

Log densities are addressed under effects common to alternatives 2, 3, 4 and 5. Diversity of wildlife habitats would be enhanced compared with Alternative 1, where all moderate and high severity areas would remain in the same condition. About one-half of those areas that burned at moderate to high severity levels would be salvaged, immediately providing more open areas to enhance foraging habitats for those cavity-nesters that prefer more open areas.

Cumulative Effects to Snags and Down Logs Unique to Alternatives 2 and 5

There are no unique cumulative effects anticipated to occur as a result of implementing Alternatives 2 or 5. All other cumulative effects of these alternatives have been disclosed in Effects Common to Alternatives 2, 3, 4 and 5.

Direct and Indirect Effects to Snags and Down Logs Unique to Alternatives 3 and 4

Alternative 3 would treat 38,533 acres and Alternative 4 would treat 41,059 acres. These alternatives would leave more snags per acre within the analysis area (6.6-6.8) than Alternatives 2 and 5 because at least five snags per acre would be reserved within a ¼ mile buffer strip around Mexican spotted owl PACs and northern goshawk PFAs. These raptors of special concern commonly prey on cavity nesters and small mammals using snags and logs. These areas of additional snag retention would increase those snags left in treatment areas to an average of 1.9-2.1 snags per acre (Table 42). The actual snag density may be higher because snags can be left in clumps of 2-6 snags, which may compensate for a lack of large snags in other areas. These densities provide more than the 1.73 snags recommended by Balda (1975) to maintain average densities of cavity nesting and would provide more snags compared with the other action alternatives. In addition, because snags would be left from the largest diameter classes of trees on site, these snags should remain longer and provide better quality cavity nesting habitat than Alternatives 2 and 5.

Between 38,500 and 41,000 acres is proposed to be salvage logged under these alternatives. Salvaging this amount, approximately 41 and 44 percent, respectively, of areas burned at moderate to high severity levels, would provide a more diverse array of habitat conditions than Alternative 1, which does not leave any areas in the more open condition preferred by some cavity nesters such as western bluebirds and hairy woodpeckers.

Cumulative Effects to Snags and Down Logs under Alternatives 3 and 4

There are no unique cumulative effects anticipated to occur as a result of implementing Alternatives 3 and 4. All other cumulative effects of these alternatives have been disclosed in Effects Common to Alternatives 2, 3, 4 and 5. No additional cumulative effects would be anticipated under Alternatives 3 and 4.

Threatened, Endangered, Sensitive, and Proposed Species (TESP)

Anticipated effects to Mexican spotted owl (MSO), bald eagle, Chiricahua leopard frog, northern goshawk (NOGO) and peregrine falcon are summarized here due to public interest in these species. No additional threatened, endangered or proposed species would be adversely affected by the proposed actions. Some other sensitive species may have individuals impacted by the proposed actions. Impacts to sensitive species are expected to be slight because no green habitat (areas burned at low severity levels or un-burned) would be altered. A summary of expected impacts to all TESP species is displayed in Appendix D.

Mexican Spotted Owl (Strix occidentalis lucida)

Direct and Indirect Effects to MSO under Alternative 1

Alternative 1 does not propose salvage logging and would emphasize natural recovery of the analysis area (see the vegetation section for successional patterns). Natural recovery in grassland areas (former ponderosa pine habitats) would take several decades within areas burned at moderate and high severity levels before trees become large enough to change the structural stage to VSS 2. Brush fields or grassy areas with widely scattered pockets of trees in areas burned at moderate severity levels would also require decades to recover. In areas burned at moderate to high severity levels, recovery to suitable nesting habitat should take a minimum of 100 years, but is likely to take 200+ years under this alternative (see vegetation section).

Leaving large expanses of untreated burned areas would not necessarily benefit MSO more than other alternatives. Snag densities would be at the high end (7.6 snags per acre) of what is considered necessary to maximize densities of primary and secondary cavity nesting birds. However, in many areas snag density would far exceed the optimum 6-8 snags per acre Raphael (1983) found contributed to maximum numbers. He found that providing additional snags did not lead to higher densities or more species (Raphael, 1983). Spotted owl mammalian prey species' populations should benefit as long as the areas can maintain stable soils and produce adequate amounts of forage and cover for those species. As trees fall, some excessive amounts of dead material on the forest floor may reduce the abundance of understory vegetation and could limit the abundance of mammalian prey within those areas.

Alternative 1 would have the least potential impacts from noise disturbance related to salvage activities although recreational traffic would be more substantial throughout currently occupied MSO habitat than is anticipated under other alternatives considered in detail. The current closure of all roads not posted open has reduced recreational traffic along all but major roads within the analysis area.

Cumulative Effects to MSO under Alternative 1

When impacts from past, present, and reasonably foreseeable actions are considered, the total cumulative area to be salvage logged under other actions would amount to approximately 15,700 acres, or 17 percent of the areas burned at moderate and high severity levels. Thus, a large majority of the analysis area would remain in its current state; only BAER treatments to recover soils and watershed stability, plus future projects would be considered in cumulative effects. As other stands in the analysis area are affected by insects and the number of snags increases across the landscape, no further increase in densities or populations of cavity nesting birds is expected when snag densities exceed about eight snags per acre (Raphael, 1983).

No impacts to MSO protected habitat are proposed beyond the felling of trees on about 1,400 acres within PACs to immediately provide additional dead and down material within those PACs.

That action is currently under consultation with the U. S. Fish and Wildlife Service. Seeding of PACs is taking place under BAER and long-term rehabilitation of the PACs. MSO restricted habitat outside of PACs would be subject to potential fuels treatments, consisting of thinning from below, piling and burning of slash, and broadcast burning. All those actions will tend to improve restricted habitat and move it towards threshold conditions, thus benefiting owl habitat.

Direct and Indirect Effects to MSO Common to Alternatives 2, 3, 4 and 5

The recovery plan for MSO states, "Salvage logging within PACs should be the exception rather than the rule" (USDI, 1995, p. 88). The Recovery Team advocated the philosophy of Beschta et al. (1995), and recommended: activities must protect soil integrity; actions should not impede natural recovery; and activities should maintain or enhance native species and natural recovery processes. The plan then recommends "Salvage should be considered in PACs only when the fire is extensive in size and results in the mortality of a substantial proportion of trees (p. 89). Only Alternative 2 proposes treatments within PACs.

All action alternatives would potentially create noise within ¼ mile of PAC boundaries. During salvage activities areas may actually experience lower traffic volumes, compared to normal vehicle traffic, during the breeding season. For example, logging traffic volume along Forest Road 86 near Black Canyon Lake would be only 39 percent of the average vehicle traffic during the breeding season, according to data from the National Visitor Use Monitoring Program. Surveys along that road in 2001 determined that an average of 146 vehicles a day used FR 86 at Black Canyon Lake during the breeding season (Don English, pers. com. 2001). During harvest activities, an average of 57 trucks per day would pass along the same road. Less than 5,000 total log trucks would potentially pass through or within ¼ mile of any PAC boundary within the analysis area. No salvage logging activities are proposed within ¼ mile of active nests. The duration of logging activities is not expected to exceed three to six weeks in any one area.

Delaney (1997) evaluated spotted owl response to noise (chainsaw and helicopter) and did not document any flushing response to stimuli greater than 105 meters (0.07 mile) distant. Grubb et al. (1998) found that goshawks, another raptor, did not demonstrate any discernible response to logging trucks that passed within 500 meters (0.31 mile) of active nests and also determined it is likely that raptors may be less sensitive to logging truck noise than humans. Noise disturbance is expected to be insignificant because of the distance to active nests, the amount of traffic, and the short duration of treatments. Given the above, the likelihood of disturbance of birds is low enough to be considered unlikely to occur.

Mitigation measures to eliminate or reduce impacts for all action alternatives are presented on a PAC-by-PAC basis for each alternative in Appendix C. These measures would reduce noise disturbance and the potential for road kills by logging trucks and related maintenance equipment traveling on roads near or within PACs.

Salvage logging would not further impact the existing condition of suitable nesting and foraging MSO habitat. Although owls show high nest site fidelity and may continue to nest in burned stands, they would not seek out new nest areas within such stands. No change in existing live vegetation would occur. Changes in MSO habitats would occur gradually over decades as tree regeneration occurs and forest succession progresses. Both Forest Plans' direction for snag retention would be met or exceeded in all action alternatives.

Cumulative Effects to MSO Common to Alternatives 2, 3, 4 and 5

For a complete list of all past, present, and reasonably foreseeable future activities considered in this analysis, see Appendix A. Cumulative impacts to MSO habitats within the analysis area

include past overstory removal, fuel treatments within and outside of PACs, development of private property, livestock grazing, recreational development, current salvage logging activities occurring in the three Decision Memos approved in 2002 along with the Phelps and Jersey Horse Timber Sales, treatments during BAER and under these actions, the hauling of timber across Forest Service roads from tribal lands, private land tree removal, fuelwood contracts and public permits to collect wood, current logging contracts and a proposal to contour fall trees within PACs to provide soil stability and increase large logs.

Past logging sales reduced and fragmented MSO habitat. Proposed logging in the region was one of the main threats that led to the listing as the species as threatened under ESA (US Fish and Wildlife Service 1995). Other than noise disturbance, proposed salvage logging would not add to cumulative effects to currently suitable nesting habitat because actions would not occur in currently suitable habitat.

Because the owls are still shifting their use of the analysis area and nesting sites, the number of owls still present within the action area is not currently known. Monitoring in 2003 discovered 16 owls within PACs. Another 11 birds were heard or seen within or outside the analysis area. No new PACs were established because no pairs were located outside of current PACs. Potential collisions and noise from logging trucks, major construction projects, and helicopters could potentially harm spotted owls (USFWS 2003). Because of the seasonal restrictions, speed limits, and avoidance of certain roads in this project it is not anticipated to add to cumulative effects of these hazards for the species. All other federal projects within the action area must consult with US Fish and Wildlife Service and would be subject to similar restrictions to minimize or eliminate harm. Private lands have no such restrictions, and about 3,100 acres that burned at moderate and high severity levels have been or may be cleared of dead trees. The timing of such removal is highly dependent on individual landowner funding. Only two small areas of private land with moderate to high severity burn levels are within about one-half mile of a PAC. What percent of these areas has already been cleared is unknown.

Other future projects are aimed at opening the forest by thinning from below, conducting fuels treatments, and broadcast burning. These types of projects should add nutrients to the soil, reduce competition of trees, and lead towards a more open understory historically found in ponderosa pine and pine-oak stands. Within mixed conifer and pine-oak stands, wherever target threshold stands exist, objectives for treatments must attempt to move those stands towards the threshold conditions described in the MSO Recovery Plan (USDI, 1992). Forest Plan standards require that key species such as oaks are retained in these treatments, and those other key habitat components such as snags and logs are also retained. Objectives to restore the large tree component in target threshold stands while maintaining oaks, snags and large logs should cumulatively provide a diverse prey base and thus benefit this species. Those same objectives will also benefit Northern goshawks, which can prey on MSO. Therefore, cumulative effects would be positive and potentially negative for this species.

Direct and Indirect Effects to MSO Unique to Alternative 2

Salvage logging would occur on about 35,000 acres of areas burned at moderate and high severity levels (Table 42). This is the only alternative that proposes salvage logging in PACs. Most of four PACs would be salvage logged by helicopters on approximately 2,260 acres. Table 43 displays acres by burn severity for these PACs. Because a majority of each PAC proposed for harvest was burned at high severity levels, it is unknown under current conditions whether they would remain inhabited by MSO for long. Spotted owls display high site fidelity and may return; however, this is usually dependent on forage and cover. Monitoring in 2003 revealed a pair in PAC 504, roosting in the cliffs near the peregrine falcon eyrie. Their traditional nesting grove was severely

burned. Monitoring could not confirm nesting by the pair. No owls were located in the other PACs within the Canyon Creek watershed portion of the analysis area. The current conditions created by the fire within these PACs suggest that continued occupancy accompanied by successful reproduction is unlikely.

Table 43 - Acres of burn severity for MSO PACs impacted by Alternative 2

PAC #	Acres By Burn Severity Levels				Percent High or moderate
	Unburned	Low	Moderate	High	
503	0.2	16.3	49.1	387.1	96.36
504	7.4	29.3	66.6	417.9	92.96
509	13.1	177	129.3	291.8	68.90
510	16.6	81	151.0	303.9	82.33

Alternative 2 meets all the recommended criteria of the MSO Recovery Team for permitting salvage logging in burned PACs. Although the peak water flows would not differ significantly, soils within the four PACs would be protected at higher levels because salvaging would put logging slash on the ground to help minimize further soil movement (see soils and hydrologic resources section). By protecting soils, recovery would occur sooner and native vegetation could be stabilized and grow sooner than if no harvest occurs. Snag retention in the PACs would leave 3 snags per acre on average. No treatments would occur within a 100-foot buffer on both sides of perennial streams, so additional snags would be present within Canyon Creek and Mule Creek watersheds to provide shading and for replacement of woody debris. Removal of dead trees under this alternative would not alter forest vegetative structural stage (VSS) or directly affect forest succession timeframes involved in the development of suitable spotted owl nesting or foraging habitat. Because no treatments are planned in the unburned and low severity portions, existing MSO nesting habitat will not be impacted.

In some cases, large stand-replacing fires appeared to have negative impacts on owl occupancy (Elliot, 1985; Gaines et al., 1997). Other studies found low or moderate severity burn areas had little to no impact on nest site fidelity (Scott, 1998; Jenness, 2000; Bond et al., 2002). PAC 509 had the lowest percent of moderate or high severity burn (68.9 percent). PAC 503 had the highest percent, with over 96 percent of the vegetation killed. All of the known nest sites were severely burned and although MSO may return and at least attempt to nest, food resources may be limited for the first 1-3 years after the fire. Noise disturbance would be another factor for owls in the PACs. Breeding season restrictions for harvest activities would apply for all four PACs, so harvesting would be limited to winter months. Thus disturbance vectors to potentially nesting owls would be removed.

Salvage logging is proposed within former and current restricted habitats and within ¼ mile of the boundary of existing PACs within the analysis area, but not within ¼ mile of any surviving nest sites. Noise disturbance could occur, but mitigation measures are in place to minimize such disturbance during the breeding season. Impacts from noise or potential collisions with vehicles

have been minimized, but because salvage would occur in PACs, Alternative 2 could adversely affect Mexican spotted owls.

Cumulative Effects to MSO Unique to Alternative 2

There are no unique cumulative effects anticipated to occur as a result of implementing Alternative 2. All other cumulative effects of this alternative have been disclosed in Effects Common to Alternatives 2, 3, 4 and 5.

Direct and Indirect Effects to MSO Unique to Alternatives 3 and 4

Salvage logging would occur on slopes less than 40 percent on 23,316 acres and 31,794 acres, respectively, within areas burned at moderate to high severity levels. No direct effects to occupied owl habitat within PACs would take place under either of these alternatives because salvage logging is not proposed within any PACs. It is unlikely that owls would move into moderate to high severity burn areas to nest. Salvage logging would not change the current habitat condition for owls because only dead trees in stands that burned at moderate to high burn severity levels would be salvage logged. In addition, no salvage logging would occur within the Canyon Creek watershed and would not affect the PACs in those drainages.

Effects related to road maintenance and log hauling along roads adjacent to, or in some cases, through PACs, could potentially disturb nesting owls. However, mitigation measures to eliminate noise disturbance during the breeding season are in place on a PAC-by-PAC basis. Speed limits for trucks operating near PACs would reduce the potential for vehicle-owl collisions.

Snag retention standards require retention of five snags per acre within ¼ mile of PACs and goshawk PFAs under these alternatives. Outside of these areas, snag density (not size) requirements meet forest plan standards. The resulting density within treatment areas is estimated between 1.9 and 2.1 snags per acre when averaged across the treatment area acres, including those stands containing no snags as defined by the Forest Plans. All snags would be taken from the largest size-class of trees above 18” dbh in each stand, and would be clumped where possible. These densities, especially adjacent to PACs, should provide high quality foraging habitat for nesting owls. Alternatives 3 and 4 generate less noise disturbance to owls, higher snag densities to support foraging habitat, and avoid any direct impact to current protected owl habitat.

Cumulative Effects to MSO under Alternatives 3 and 4

There are no unique cumulative effects anticipated to occur as a result of implementing Alternatives 3 and 4. All other cumulative effects of these alternatives have been disclosed in effects common to Alternatives 2, 3, 4 and 5.

Direct and Indirect Effects to MSO Under Alternative 5

Salvage logging would occur on about 33,000 acres, all on slopes of less than 40 percent (Table 42). Snag retention standards for Alternative 5 are the same as for Alternative 2. Predicted effects to prey population abundance and species composition are similar to Alternative 2, with the exception that no soil protection in the form of coarse woody debris would be added in the Canyon Creek portion of the analysis area. Therefore, it would be expected that mammalian prey abundance would be less under this alternative than Alternative 2. About 1.7 snags per acre on average would be retained within harvest areas. This alternative would provide for prey species abundance and diversity, but not to the level of Alternatives 3 and 4. Snag density would average 5.9 snags per acre across the landscape, which would provide for cavity nesting prey species within the analysis area.

Cumulative Effects to MSO Unique to Alternative 5

There are no unique cumulative effects anticipated to occur as a result of implementing Alternative 5. All other cumulative effects of this alternative have been disclosed in Effects Common to Alternatives 2, 3, 4 and 5.

Northern Goshawks (*Accipiter gentilis*)

Direct and Indirect Effects to Northern Goshawks under Alternative 1

No management activities would occur under this alternative and the areas would be left to recover naturally. No trees or coarse woody debris would be put on the ground to help control soil movement. Eventually, dead trees would fall and decay, while grasses, forbs, shrubs, and new trees would grow. It is estimated that about 80 percent of the trees under 12" dbh would fall within 10 years, providing ample cover for small mammals (Harrington, 1996). Because all large snags would be retained, an average of 7.6 large snags per acre would remain within the analysis area. Studies have shown that maximum cavity nesting bird density is achieved by leaving 6-8 snags per acre, after which bird densities do not increase (Raphael 1983). Adequate numbers of snags would be available for prey species of the northern goshawk.

This alternative would provide the most cover for the longest time period (assuming no re-burn), thus Alternative 1 should provide more cover for prey species, which could mean larger populations of prey and less exposure of prey to goshawks. The landscape would have an abundance of dead and decaying trees and logs. Potential fungi production, another food for prey species, would be highest in this alternative; however, less habitat diversity would be present across the landscape.

Cumulative Effects to Northern Goshawks under Alternative 1

The effects of past activities decreased goshawk habitat. Overstory removal over a large portion of the analysis area reduced the amount of goshawk nesting habitat from presumed historic levels by removing the groups of large trees preferred for nesting by goshawks. Improper livestock grazing coupled with fire suppression reduced the quality of goshawk foraging habitat throughout much of the analysis area because goshawks prefer more open understories for chasing prey (USDA, 1991, Covington and Moore, 1994).

The Rodeo-Chediski Fire burned almost 470,000 acres within and south of the analysis area. Burned Area Emergency Rehabilitation treatments covering about 46,000 acres were completed in 2002 on Forest Service land. Other BAER treatments covering an unknown number of acres were completed on the Ft. Apache Indian Reservation. For a complete listing of past activities within the last 25 years, see Appendix A.

Present activities include salvage logging and fuels treatments along roads, trails, fences, and utility corridors; around administrative and recreation sites; and within one-half mile of private property bordering the forest within the analysis area. Those actions are being carried out under authority of three Decision Memos approved in December 2002. Increasing insect activity is adding to the number and density of dead and dying trees within the analysis area.

There is no state land within the analysis area with the exception of 23 acres acquired by the Arizona Game and Fish Department at Bear Springs. On the 8,696 acres of private land in the action area, the landowners will probably treat approximately 85 to 90 percent of the lands affected by the fire. The landowners are in the process of clearing all or most of the dead trees. The progression of this work is somewhat unpredictable because the landowners are highly

dependent on external sources of funding. The Natural Resource Conservation Service and the Navajo County Extension Service are actively assisting the landowners.

Foreseeable future actions include fuel reduction projects (e.g. thinning from below, thinning and chipping and prescribed burning) on about 23,000 acres and approximately 1,600 of salvage across the analysis area over the next five years. In addition, there are also some long-term rehabilitation treatments being considered in the analysis area, but these are not yet firm enough to qualify as foreseeable actions.

The effects of present and future activities should cumulatively benefit this species. Actions such as thinning smaller diameter trees, piling and burning, and broadcast burning, should have beneficial impacts to goshawk habitat because they open the understory. These types of projects should add nutrients to the soil, reduce competition of trees, and eventually allow recovery of the large tree overstory. Goshawks prefer more open understories for hunting. Objectives to restore the large tree component MSO in target threshold stands will also benefit Northern goshawks, which can prey on MSO. More open understories usually result in grass and forb growth, which can result in higher densities of small mammals and birds, thus increasing prey populations. However, they can also reduce coarse woody debris and large logs, which help keep prey populations at healthy levels. Forest Plan standards require that key species such as oaks, large snags and logs be retained, so the coarse woody debris necessary for small species should be retained. Cumulative effects would thus be positive for this species. Projects should eventually result in an increase in goshawk nesting habitat and increase the quality of foraging habitat.

Direct and Indirect Effects to Northern Goshawks Common to Alternatives 2, 3, 4 and 5

All action alternatives propose salvage of dead trees within areas burned at moderate and high severity levels that were chosen for entry. Salvage logging would not impact the existing condition of northern goshawk nesting habitat quality. The goshawk population would be shifting in the analysis area for several years, due to the new mix of green nesting habitat. At this point in time, the extent and duration of those shifts are unknown. Monitoring in 2003 revealed a low number of nesting attempts within the analysis area as well as within the rest of the forest. Among the 24 PFAs located completely within the analysis area, 20 were revisited in 2003 as of the end of July. Three active nests were found and one new PFA with a nesting pair was found that had become established within the burn area, bringing the total to 25 PFAs. Additional surveys are planned after the field season to determine if previously recorded PFAs need to be recorded as abandoned.

Forest Plan direction for snag retention would be met in all action alternatives. Other habitat components important to goshawks and identified in both Forest Plans include downed logs and coarse woody debris. All action alternatives would increase the amount of coarse woody debris on the ground immediately, but a shortage of large logs would remain for the first five years. See the fire and fuels section for a quantitative analysis of downed logs and woody debris in the analysis area. None of the action alternatives would significantly reduce coarse woody debris in the ponderosa pine and mixed conifer forests in the analysis area because only dead trees ($\geq$12” dbh) would be harvested under these alternatives.

Mitigation measures provide different levels of both snags and down logs for prey species that goshawks depend on in areas proposed for harvest. In addition to effects associated with vegetative components of goshawk foraging habitat, the action alternatives may also impact goshawks through disturbance.

Noise disturbance could have short-term impacts on nesting goshawks when activities occur near goshawk nests during the breeding season (March 1 to September 30). The ID Team has identified temporal and spatial restrictions to minimize the likelihood of disturbance to nesting goshawks within known PFAs (see Appendix C). These restrictions will likely shift as goshawk nesting habits shift, and should not be considered static. Breeding season restrictions for harvest activities would be imposed when and where nesting pairs are found. Restrictions can be lifted within an area during a breeding season only if two complete surveys are conducted to determine that no goshawks are present. It is assumed that current PFAs are occupied until proven otherwise through surveys, or local biologists determine the PFA no longer contains suitable nesting habitat.

Cumulative Effects to Northern Goshawks Common to Alternatives 2, 3, 4 and 5

Overstory removal in the past over a large portion of the analysis area reduced the amount of goshawk nesting habitat from presumed historic levels by removing the groups of large trees preferred for nesting by goshawks. Improper livestock grazing coupled with fire suppression reduced the quality of goshawk foraging habitat throughout much of the analysis area because goshawks prefer more open understories for chasing prey (USDA, 1991, Covington and Moore, 1994).

About 28 percent or about 22,000 acres of the green forests left within the analysis area, are within VSS 4, 5, or 6, compared with 26 percent pre-fire. The proposed salvage logging would not affect that percentage because no logging would occur in green stands. Other proposed actions such as thinning smaller diameter trees, piling and burning, and broadcast burning, should have beneficial impacts to goshawk habitat because they open the understory. These types of projects should add nutrients to the soil, reduce competition of trees, and eventually allow recovery of the large tree overstory. Goshawks prefer more open understories for hunting. Objectives to restore the large tree component MSO in target threshold stands benefits northern goshawks, which can prey on MSO. More open under stories usually result in grass and forb growth, which can result in higher densities of small mammals and birds, increasing prey populations. However, they can also reduce coarse woody debris and large logs, which help keep prey populations at healthy levels. Forest plan standards require that key species such as oaks, large snags and logs be retained, so the coarse woody debris necessary for small species should be retained. Cumulative effects would thus be positive for this species. Projects should eventually result in an increase in goshawk nesting habitat and increase the quality of foraging habitat.

Based on the results of systematic surveys, historical records, and incidental discoveries, the Apache-Sitgreaves National Forests established 96 PFAs around known nesting areas, and is implementing amendments to the 1996 Forest Plan amendment. This amendment was developed to protect goshawk habitats at a landscape (ecosystem) level. Its implementation since 1996 has helped maintain the distribution and quality of habitat for goshawks on the forest, and at least prevented declines in habitat quantity and quality during the implementation of management-related activities.

Direct and Indirect Effects to Northern Goshawks under Alternative 2

See Table 42 for acres to be harvested as proposed in Alternative 2 by both land-based and aerial (helicopter) logging. This alternative produces the most timber, therefore hauling rates and number of haul truck trips would also be maximized. Some roads within the analysis area would experience as many as 5,000 truckloads total to haul timber to processing facilities. Chances of noise disturbance would be greatest for this alternative. Twelve PFAs have treatments proposed within them, cutting only the dead trees in stands that burned at moderate to high severity levels.

Of those twelve PFAs, four PFAs have no restrictions because of the current small amount of nesting habitat and the absence of birds. The others all have breeding season restrictions to minimize disturbance. See Appendix C for a complete list of mitigations to minimize noise disturbance.

Timber harvest through salvage logging and its associated roadwork and potential soil disturbance would be maximized under Alternative 2. Salvage logging would benefit soils in moderate and high severity burn areas by providing more cover in the form of logging slash, which helps keep soil on the sites, increases water infiltration, and provides sites for grass and forb establishment (see soils and hydrologic resources section). Coarse woody debris is extremely important to small mammal productivity (Carey and Johnson, 1995, Lowe et al., 1978). Providing more coarse woody debris could help increase prey populations for goshawks and other raptors (Goodwin and Hungerford, 1979).

As with the MSO, current suitable nesting habitat would not be changed because only stands with essentially 100 percent mortality would be salvaged logged, and no green trees would be cut. This alternative leaves the least number of snags, while meeting both forest plans' minimum standards and guidelines. Within the ponderosa pine type, an average of 1.7 snags per acre at least 18 inches dbh would be left in stands proposed for salvage. When fully implemented, this alternative would leave the least average number of snags/acre (6.3 snags per acre) across the analysis area. Because those snags would be retained on areas that are salvage logged, adequate numbers of snags would be available for cavity nesting prey species (Balda 1975). By putting the coarsest woody debris on the ground, small mammal prey species population may be increased over other alternatives. However, because snag densities would be 5.8 snags per acre across the landscape, which is slightly less than the optimum density of 6-8 snags per acre, cavity nesting bird densities could be less than in Alternatives 3 and 4. Providing high snag densities would provide better quality prey habitat for northern goshawks because goshawks feed more on birds than on small mammals.

Cumulative Effects to Northern Goshawks under Alternative 2

When cumulative impacts of past activities, salvage logging and future proposed actions are taken into account, this alternative could provide the most benefit to retaining soils on site, and provide the most productivity for grass and forb production. In addition, future firewood cutting may affect snag and log density. Forest Service fuelwood permits are available for juniper, oak, and pinyon pine. They limit the diameter to be cut to a maximum of 12" dbh for all species except pinyon pine, which rarely reach that diameter within the analysis area. Large snags are defined as being larger than 18" dbh and would not be impacted by fuelwood permits. Large logs are defined as being greater than 12" dbh and also would not be impacted by fuelwood cutting.

Other cumulative effects are not unique, but are the same as those described under Cumulative Effects of Alternatives 2, 3, 4, and 5.

Direct and Indirect Effects to Northern Goshawks under Alternative 3

Alternative 3 proposes to salvage log the least amount of timber of all the action alternatives. Salvage logging would occur on 30,770 acres in the ponderosa pine habitat used by northern goshawks. Soil disturbance would be minimized because highly erosive soils would be avoided. However, this may actually lead to decreased production of grasses and forbs because of reduced water infiltration and lack of microsites (coarse woody debris on the soil surface) where grass and forb growth can become established. Less woody debris and less grasses and forbs would lead to lower small mammal population sizes compared with Alternatives 2, 4, and 5, but more than Alternative 1.

Road maintenance activities proposed in Alternative 3 would also be the least among action alternatives. Fewer miles of roads previously closed would be re-opened, and fewer temporary roads would be built compared to Alternatives 2, 4, and 5. Therefore, noise disturbance would be least compared with Alternatives 2, 4 and 5.

Alternatives 3 and 4 require that more snags be left than Alternatives 2 and 5. Snags would be reserved from the largest two-inch size class present over 18 inches dbh. Within PFAs and within a ¼ mile buffer around them and around MSO PACs, 5 snags and 3 logs would be left for wildlife species. Outside the buffer zones, two snags per acre would be left standing in ponderosa pine habitat. Snags should be clumped rather than evenly spaced, so some acres may have no snags, while others would have clumps of 3-6 snags, providing enough snags for cavity nesters for the longest period of time. Some large snags are known to remain standing for over 100 years (Dieterich, 1983; Grissino-Mayer et al., 1994), by which time most of the area should have generally sufficient quantity and quality of trees to provide snag habitat for wildlife species.

Cumulative Effects to Northern Goshawks under Alternative 3

When cumulative impacts of past activities, salvage logging and future proposed actions are taken into account, this alternative could provide the least benefit to retaining soils on site, and thus provide the least benefit for grass and forb production.

Across the landscape, snag density would average 6.3 snags per acre, which would provide habitat for high densities of goshawk preferred prey species (birds). Therefore, this alternative may benefit northern goshawk populations about the same as other action alternatives. Future firewood cutting may affect snag and log density. Permits limit the diameter to be cut to a maximum of 12” dbh for all species except pinyon pine, which rarely reach that diameter in the analysis area. Fuelwood cutting would not impact large snags and logs. Other cumulative effects are the same as those already discussed.

Direct and Indirect Effects to Northern Goshawks under Alternative 4

Salvage logging would occur on 34,156 acres. Road maintenance activities would be less than Alternatives 2 and 5, but more than Alternative 3. More miles of roads that were previously closed would be re-opened, then closed, scarified and seeded after use under this alternative compared with Alternative 3. Thus, Alternative 4 would have slightly more potential for noise disturbance, but would provide for better prey abundance than Alternative 3.

Alternative 4 has the same snag requirements as Alternative 3 and would provide adequate snags for cavity nesting species that should last longer than Alternatives 2 and 5. The increase in coarse woody debris would also decrease erosion, increase production of grass and forbs, and increase small mammal populations. It also produces more habitat diversity than Alternative 1. Therefore, this alternative would be more beneficial to northern goshawks than any of the other alternatives.

Densities of snags across the landscape after other actions are considered would be 6.1 snags per acre. Future actions, such as fuel treatments and broadcast burning, would be beneficial to goshawks because they open the understory and temporarily reduce hiding cover for prey. Coarse woody debris would be more than Alternative 3, about the same as Alternative 5, but somewhat less than Alternative 2. As stated earlier, firewood cutting would not affect large log and snag densities. The combination of habitat diversity, snag densities and woody debris would be beneficial to the remaining goshawks in the analysis area.

Cumulative Effects to Northern Goshawks under Alternative 4

No additional cumulative effects were discovered beyond those discussed above in Cumulative Effects to Northern Goshawks Common to Alternatives 2, 3, 4 and 5.

Direct and Indirect Effects to Northern Goshawks Alternative 5

Alternative 5 does not propose helicopter salvage logging but retains the remainder of areas proposed in Alternative 2. Salvage logging would occur on 34,921 acres. Road maintenance activities required, as well as the number of trucks needed for hauling would be less than Alternative 2, but more than the other alternatives.

Snag requirements are the same as Alternative 2, which meets the minimum snag requirements of both forest plans. Snag requirements would not be increased within ¼ mile of TES habitats as proposed in Alternatives 3 and 4. Snags within harvested areas would contribute to habitat quality for prey species. This alternative would not provide for as much high quality foraging habitat for goshawks as Alternative 4, but would provide better small mammal habitat than Alternative 3.

Cumulative Effects to Northern Goshawks under Alternative 5

No additional cumulative effects were discovered beyond those discussed above in Cumulative Effects to Northern Goshawks Common to Alternatives 2, 3, 4 and 5.

Chiricahua Leopard Frog (*Rana chiricahuensis*)

Direct and Indirect Effects to the Chiricahua Leopard Frog under Alternative 1

No known populations of Chiricahua leopard frog have been located within the analysis area. Because soil erosion is predicted to be higher under this alternative than the action alternatives, the potential for sedimentation would be higher. Tanks would have to be dredged more often until the watersheds stabilize, so there is more of a chance for direct impacts to these frogs from equipment used to dredge tanks. Mitigation measures established for action alternatives will protect frogs should Alternative 1 be implemented.

Chitrid fungus is becoming a concern for ranid frog populations. This fungus can be spread by machinery as well as by workers, so the more stock tanks that need work, the higher the possibility of contamination of water. Standard mitigation measures are in place to avoid contamination of waters.

Cumulative Effects to the Chiricahua Leopard Frog under Alternative 1

Implementation of Alternative 1 would not have any cumulative effects when added to the effects of past, present and reasonably foreseeable future activities listed in Appendix A.

Direct and Indirect Effects to the Chiricahua Leopard Frog Common to Alternatives 2, 3, 4 and 5

All the action alternatives have the same potential impacts to this species. There are two lotic riparian systems within the analysis area. Canyon Creek and Mule Creek are both perennial streams that have the potential to support populations of Chiricahua leopard frogs. There are also numerous stock tanks that could provide potential habitat. Arizona Game and Fish Department biologists have conducted extensive surveys for ranid frogs within the last 12 years. Amphibian surveys not specific to the Chiricahua leopard frog have also been conducted (Black Mesa District files, 1999 and 2000; Sredl et al., 1994 and 1997; Clarkson and Rorabaugh, 1989;

Ingraldi, 1995; and Seim, 1994). Although no frogs have been found in previous surveys, presence of this species is assumed during salvage operations until surveys determine otherwise.

Logging slash would provide beneficial ground cover needed to reduce soil erosion, and ground disturbance would increase surface roughness, promoting infiltration. This would result in reducing soil movement and thus erosion potential (see soils and hydrologic resources section). Water quality of runoff from the burned areas has been severely impacted; however, is predicted to improve slightly as a result of salvage. Road maintenance activities are expected to benefit water quality by reducing sediment movement through BMP implementation and mitigation measures. No impacts to potential habitat are anticipated because mitigation measures to protect potential frog habitat include a "no treatment" zone within 100 feet on either side of perennial streams and around perennial stock tanks.

Cumulative Effects to the Chiricahua Leopard Frog Common to Alternatives 2, 3, 4 and 5

Past and present activities listed in Appendix A were examined for cumulative effects when adding effects from implementing action alternatives. No cumulative effects from past and present activities are measurable since no frogs have been located to date.

Reasonably foreseeable future activities that could impact this species would be the repair and maintenance of stock tanks that alter habitat and may add to the sedimentation caused by ongoing road maintenance. Surveys for this species would be required prior to implementation of any of these activities, thus cumulative impacts are not anticipated. Mitigation to avoid impacting frogs and improve potential habitat for ranid frogs would be included in future projects; thus either neutral or beneficial impacts would result from future actions.

Peregrine Falcon

Direct, Indirect and Cumulative Effects

The Apache-Sitgreaves' Forest Plan outlines breeding season restrictions designed to reduce disturbance to nesting peregrines (p 70). Restrictions specific to the peregrine falcon are outlined in the wildlife mitigation measure section in Chapter 2. One known eyrie is within the analysis area, and was active in 2003. Breeding season restrictions would be incorporated into any timber harvest activities planned to occur within one mile of any known eyrie. Because breeding season restrictions would be in place though specific C-Clause provisions in timber sale contracts, no impacts to this species should occur regardless of which alternative may be selected for implementation.

No cumulative effects to peregrine falcons would occur from implementation of any of the alternatives considered in detail, when added to past, present and reasonably foreseeable future activities displayed in Appendix A.

Management Indicator Species (MIS)

Direct and Indirect Effects to MIS From Alternative 1

Direct and indirect effects to MIS from implementation of Alternative 1 are displayed in Appendix E for each MIS species. No change in habitat or population trend from current conditions would occur as a result of implementing Alternative 1 to MIS.

Direct and Indirect Effects to MIS Common to Alternatives 2, 3, 4 and 5

Many MIS are addressed under other sections. For a complete listing of all the species considered and the summary impacts to their habitat trends, see Appendix E. Riparian species present within the Canyon Creek watershed pre-fire that were most likely displaced include the Arizona gray squirrel, common black hawk, warbling vireo, yellow-breasted chat and Lincoln's sparrow. These species would not be impacted by implementation of Alternatives 2, 3, 4 and 5 because suitable habitat for these species no longer exists within proposed treatment areas.

It is expected that changes caused by salvage logging would have both positive and negative effects for some species. For example, large ungulates would benefit from opening of the stands and consequent increased grass and forb production. However, high densities of conifer trees before the fire provided increased hiding cover and habitat security for deer and elk that is no longer present. Increased forage production and decreased cover as a result of salvage would result in no measurable changes in the population trends for these species according to the HQI model.

Small mammals such as red squirrels and Abert's squirrels avoid large openings and their distribution may be affected for several decades, but not from salvage logging. Red squirrels may have foraged in their cone caches immediately after the fire, but once those caches have been emptied of viable seed, they move on to green habitat. Squirrels will no longer be present within moderate to high-severity stands; so would not be impacted by any of the action alternatives.

The violet-green sparrow, western bluebird and the western wood peewee occur in the analysis area. All these species are frequently found in relative abundance in post-fire cover types. Existing habitat in the Tonto National Forest may lead to increases in their population. Their dependence on standing dead trees in post-fire habitats makes it likely a negative effect could occur from post-fire salvage logging in the Canyon Creek area as proposed in Alternative 2.

The juniper titmouse is a management indicator species found with the analysis area in open stands of pinyon-juniper, which was not present within the Canyon Creek portion of the analysis area. The pinyon-juniper (PJ) stands burned in the central and eastern portion of the analysis area were mostly very thick stands with a large majority of juniper and well over 70 percent canopy closure, which would not be considered preferred nesting habitat. Eighty-three percent of the PJ stands were considered low habitat quality by the HQI model. Stands considered for fuelwood and small product sales are not currently suitable for this species, therefore Alternative 3, 4, and 5 would not impact this species. However, because large juniper snags are important to this and other cavity nesting species, all juniper snags having at least one main trunk equal or larger than 18" at the root collar have been protected (see Mitigation Measures in Chapter 2).

Because the pygmy nuthatch requires large snags for nesting and especially for winter roosting, the salvage of large snags would impact the existing condition of pygmy nuthatch habitat quality, although this was not reflected in the HQI modeling. Salvage logging could reduce the pygmy nuthatch population because it requires large amounts of cover.

Cumulative Effects to MIS Common to Alternatives 2, 3, 4 and 5

Wildlife habitat functions in the analysis area have been modified from historic conditions. Mid-elevation stands once contained a sparse distribution of large diameter trees with very open stand conditions under the primary canopy, and grass was abundant in the understory. Practices such as timber harvest, fire suppression, grazing, and road building have changed the quantity and quality of wildlife habitat for many species. Overstory removal has taken place on a great deal of the analysis area during the past century.

Intact wildlife habitats declined strongly from historical to the current period across the analysis area. Strongest declines were for species dependent on mid-elevation old-forest ponderosa pine habitats and for species dependent on more open under stories with abundant grass and forbs. Habitats for these species have become increasingly fragmented, simplified in structure, and filled with single-story young forest stands of pine. For example, prior to the fire, there were shortages in the analysis area of large tree structure (greater than 18-inches dbh) stages created by overstory removal prescriptions; increased stands densities resulting from livestock grazing and fire suppression; a large majority of pole-sized structural stages; and a lack of more open canopies. In addition, juniper had become much more common and dense in the transition zone between ponderosa and pinyon pine stands for the same reasons.

Human activity includes 8,696 acres of scattered private land parcels that have been developed, creating a highly integrated Wildland/Urban Interface (WUI) situation on some portions within the analysis area. Wildlife habitats within the WUI are fragmented by these developments. The primary human activities in the area are hunting, camping, fuelwood cutting, and hiking.

See summaries for cavity nesting birds, small mammals and big game in the snags and logs section. Riparian species have most likely been displaced by the fire, but would not be impacted from any proposed actions or foreseeable future activities.

Within the analysis area, the HQI for juniper titmouse is at only 20 percent of the habitat capability, the same as before the fire occurred. Almost all habitat within the analysis area was rated at low to moderate quality and only 277 acres of high quality habitat were lost in the fire. The Forest-wide analysis for MIS determined that the forest is at 90 percent of its potential habitat capability for this species, so it should remain well distributed across the forest.

A loss of some 78,000 acres of habitat that provides for both foraging and cover has occurred for the pygmy nuthatch. The majority of this was low quality habitat, which translates into an improvement of HQI within the project area as the ratio of high/low quality habitat has improved. Foreseeable future projects within the pinyon-juniper habitat in the analysis area are fuelwood projects that have already been discussed under the snags and log section.

Migratory Birds

Because of the wide diversity of non-game wildlife and bird species that are found within the analysis area, a mosaic of habitat conditions would be best for the entire array of migratory bird species. Those bird species listed in *Birds of Conservation Concern 2002* (USDI, 2002) under BCC Region 16, Southern Rocky Mountain Region; and BCC Region 24, Sierra Madre Occidental, were reviewed for their potential occurrence in the analysis area. Those species present in any season, but not considered rare accidentals, were analyzed for impacts from the proposed harvest activities.

Direct and Indirect Effects of Alternative 1 for Migratory Birds

A complete list of species considered and anticipated impacts from salvage logging are listed in Appendices D and E. Table 44 includes those species that use cavities for nesting, which are the only species potentially impacted by action alternatives being considered. Because all alternatives leave ample snag densities across the landscape, no direct or indirect effects would occur to any species protected by the Migratory Bird Treaty Act.

Table 44 - Impact of all action on residency status, abundance and habitat type for cavity nesting birds of conservation concern that may occur within the analysis area

Species	Residency / Abundance	Habitat	Determination of impact for all action alternatives
Circus cyaneus Northern Harrier	Permanent / Fairly common	Grassland	No Impact (treatments are not proposed in suitable habitat)
Buteo swainsoni Swainson's Hawk	Summer / Rare	Grassland	No Impact (treatments are not proposed in suitable habitat)
Buteo regalis Ferruginous Hawk	Permanent / Uncommon	Grassland	No Impact (treatments are not proposed in suitable habitat)
Aquila chrsaetos Golden Eagle	Permanent / Uncommon	Grassland	No Impact (treatments are not proposed in suitable habitat)
Faco mexicanus Prairie Falcon	Permanent / Rare	Grassland	No Impact (treatments are not proposed in suitable habitat)
Centrocercus minimus Gunnison Sage Grouse	Not present	Sagebrush	No Impact (not present)
Tringa solitaria Solitary Sandpiper	Migratory/ Rare	Ponds and Creeks	No Impact (treatments are not proposed in suitable habitat)
Limosa fedoa Marbled Godwit	Not known from AA	Marshes and lakes	No Impact (treatments are not proposed in suitable habitat)
Phalaropus tricolor Wilson's Phalarope	Migratory / Fairly Common	Marshes and lakes	No Impact (treatments are not proposed in suitable habitat)
Otus flammeolus Flammulated Owl	Summer / Fairly Common	Pine-Oak	May Impact (due to possible nest tree removal)
Speotyto cunicularia Burrowing Owl	Summer / Rare	Grassland	No Impact (treatments not proposed in suitable habitat)

Species	Residency / Abundance	Habitat	Determination of impact for all action alternatives
*Asio flammeus*Short-eared Owl	Summer / Rare	Marsh, field and prairie grassland	No Impact (treatments not proposed in suitable habitat)
Cypseloides niger Black Swift	Not known from AA	Waterfalls and Cliffs	No Impact (treatments not proposed in suitable habitat)
Melanerpes lewis Lewis's Woodpecker	Permanent / Fairly Common	Dry open woods	May Impact (due to possible nest tree removal)
Sphyrapicus thyroideus Wouldiamson's Sapsucker	Permanent / Fairly Common	Ponderosa pine	May Impact (due to possible nest tree removal)
Vireo atricapillus Gray Vireo	Summer / Rare	Sparse Woodlands	No Impact (treatment may be beneficial)
Gymnorhinus cyanocephalus Pinyon Jay	Permanent / Common	Open Woodlands	No Impact (treatment may be beneficial)
Toxostoma benderei Bendire's Thrasher	Permanent / Rare	Semi-desert Grassland	No Impact (treatments not proposed in suitable habitat)
Toxostoma crissale Crissal Thrasher	Possible in Canyon Creek/ Uncommon	Dry Water Courses	No Impact (habitat burned)
Anthus spragueii Sprague's Pipit	Migratory / Rare	Grasslands	No Impact (treatments not proposed in suitable habitat)
Vermivora virginiae Virginia's Warbler	Summer / Fairly Common	Brushy Oak Woodlands	No Impact (treatments not proposed in suitable habitat)
Dendroica nigrescens Black-throated Gray Warbler	Summer / Fairly Uncommon	Oak-pinyon	No Impact (treatments not proposed in suitable habitat)
Dendroica graciae Grace's Warbler	Summer / Fairly Common	Pine-Oak	No Impact (treatments not proposed in suitable habitat)

Species	Residency / Abundance	Habitat	Determination of impact for all action alternatives
Amphispiza belli Sage Sparrow	Not present	Sagebrush-Desert	No Impact (treatments not proposed in suitable habitat)
Calcarius ornatus Chestnut-collared Longspur	Migratory / Uncommon	Dense Grasslands	No Impact (treatments not proposed in suitable habitat)
Cardellina rubrifrons Red-faced Warbler	Summer / Fairly common	Spruce-fir, pine, oak and aspen	No Impact (treatments not proposed in suitable habitat)

Cumulative Effects to Migratory Birds under All Alternatives

Present and future activities have common objectives to improve current conditions by improving current soil conditions, reducing competition of trees, managing for return of the large tree component, and providing snags, logs and coarse woody debris in sufficient quantity to provide prey for raptor species. Those migratory species listed above that inhabit pinyon-juniper, pine-oak, and pine woodlands; should benefit in the long term from these efforts. Snag dependent species would be impacted similarly to those mentioned under the snags and logs section. The other species are either grassland species, which may experience beneficial impacts cumulatively because there would be more open areas in the analysis area in the future, or they are shorebirds that would not be impacted by any actions considered here. No significant cumulative effects to migratory birds would occur from implementation of any alternative when added to past, present and reasonably foreseeable future activities displayed in Appendix A.

Fisheries and Aquatic Resources

Compared with pre-fire conditions of the streams and washes (see soils and hydrologic resources section), the Rodeo-Chediski Fire had and will continue to have devastating impacts on aquatic resources. the effects of any proposed actions are trivial beside the initial impact of the fire and subsequent flooding that has occurred. Little of the analysis area flows directly into perennial streams. Most of the streams in and below the burned area are ephemeral, intermittent, or perennially interrupted. The analysis area does contribute to perennial flow, usually many miles downstream (USDA, 2002). However, many of the headwaters areas within the ephemeral drainages on the National Forests were severely burned. Some of the small drainages that were severely burned have experienced a loss of significant amounts of riparian vegetation, groundcover, and the buffering ability for large rain events.

The riparian areas in the larger washes were not severely burned due to pre-existing conditions, i.e., these larger channels lack sufficient riparian vegetation available for proper functioning condition and have wide floodplains. The fire moved through these areas quickly because there was little fuel to carry the fire (USDA, 2002). Severely burned areas in the upper reaches of even small ephemeral drainages may contribute to some residual downstream effects to stream morphology and aquatic life, including fish and macro invertebrates many miles downstream.

Fisheries habitat resources are normally able to survive the immediate conditions of a wildfire, including flames, heat, and smoke. However, aquatic wildlife and their habitats are quite susceptible to intense flooding, increased erosion, and slurries of ash that can follow a wildfire during significant rain events. Ash slurries can be toxic to some fish. Two sport-fisheries were heavily impacted by the fire; Black Canyon Lake and Canyon Creek.

Direct and Indirect Effects on Fisheries and Aquatic Resources from Alternative 1

Leaving the watersheds of these important fisheries areas untreated would leave all areas in their current conditions. In the Canyon Creek watershed, vegetation was killed along the hillsides and in the riparian zones, which resulted in hydrophobic soils in some areas. The potential for high erosion rates, sediment yields, loss of soil nutrients, and physical and biological changes in stream channels would occur because of the extent and severity of the fire in this watershed.

Implementation of Alternative 1 would not lessen the expected increase in the amount of water flowing over exposed bare soils. This increase in overland flows would likely cause sheet erosion, rills or gullies, and substantially increases the sediment load into the streams. An accelerated loss of soil adversely affects terrestrial and aquatic ecosystems by depleting upland soil nutrients and depositing excess sediments in streams. This would likely result in scouring of drainages, change stream morphology and cause downstream impacts to fisheries.

Effects of no treatment would be most severe in the Canyon Creek watershed. The upper reaches of this watershed were severely impacted, with about 84 percent of the steep slopes at the upper end of Canyon Creek and Mule Creek burned at moderate (27 percent) or high (57 percent) severity levels. Surveys at the end of the summer of 2002 showed only a few fish survived in Canyon Creek above the Fort Apache Indian Reservation boundary. Both Canyon Creek and Mule Creek had severe sedimentation and debris flows during the subsequent monsoon season following the fire. Water clarity was good (1-2 feet) by September; however most pools had filled with silt.

Scouring and sedimentation are expected to continue, putting both riparian and wet meadow habitats at risk. Thus far, debris flows have been minimal because much of the debris in the channels were consumed during the fire, but that will change as hillside erosion and stream scouring undermine stream banks and trees, causing channel instability.

The upper reaches of Canyon Creek will impact the alluvial fan area around OW Ranch. This valley bottom will receive increased peak stream flows and sediment that will lower water quality. Increased debris loads will occur at the apex of alluvial fans where streams flow out into the valley. Substantial alteration of channels and movement of large woody debris is expected to occur. This area has fine soils and stream channels could become permanently eroded resulting in a lowered water table. Implementation of Alternative 1 is likely to lead to long-term (20+ years) impairment of the fisheries and macro invertebrate resources.

The fish kill in Black Canyon Lake occurred due to ash and debris and it is anticipated these impacts may continue for quite some time. The AGFD has studied these effects and anticipates the complete loss of the native bluehead sucker population. The AGFD stocked the lake with rainbow trout early in April 2003 because pH levels had returned to normal. Implementation of Alternative 1 would result in more soil and sedimentation entering the lake than any of the action alternatives (refer to soils and hydrologic resources section).

Cumulative Effect of Alternative 1 on Fisheries and Aquatic Resources

See Appendix A and the big game section for a listing of actions examined for cumulative effects to fisheries and aquatic resources. Future proposed actions are not likely to have any significant impact on the current conditions of the watersheds. Soil erosion will be substantially reduced once vegetation, either native or seeded, has been re-established on the watersheds, which will be short term in some areas, but long term in others. Thus the cumulative effects for alternative 1 are essentially the same as the direct and indirect effects.

Black Canyon watershed is expected to recover more rapidly because damage is less severe in this area. However, Black Canyon Lake could become completely filled in with sediment within 2-3 years and may require dredging. Dredging would require draining the lake, which would kill most aquatic wildlife until such time as this activity was completed and the lake refilled and restocked. Whether the lake would fill with sediment is uncertain at this time.

Direct and Indirect Effects to Fisheries and Aquatic Resources Common to Alternatives 2, 3, 4 and 5

All action alternatives propose salvage logging to occur within portions of Black Canyon and Canyon Creek watersheds. Other watersheds either do not contain adequate habitat for fish or macro invertebrate habitat, or contain extremely limited habitat that will likely not be significantly impacted by any of the action alternatives being analyzed. Table 45 displays the acres of salvage logging proposed to occur within Black Canyon and Canyon Creek watersheds with aquatic resources that may be affected by proposed action alternatives.

Table 45 - Summary of proposed salvage acres compared to moderate and high severity burn acres within the Black Canyon and Canyon Creek watersheds by alternative

6th Code Watershed	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Black Canyon Watershed	Salvage log 1,100 acres or 75 percent of the watershed	Salvage log 377 acres or 26 percent of the watershed	Salvage log 1,100 acres or 75 percent of the watershed	Salvage log 1,100 acres or 75 percent of the watershed
Canyon Creek Watershed	Helicopter log 2,259 acres or 38 percent Land-based salvage log 2,701acres or 46 percent Total treatment area equals 84 percent of the watershed	Salvage log 2,666 acres or 45 percent of the watershed	Salvage log 2,554 acres or 43 percent of the watershed	Salvage log 2,701 or 46 percent of the watershed

Percentage figures represent acres burned at moderate to high severity levels in the watershed that would be salvaged logged by action alternatives.

Salvage logging would benefit soils (USDA, 2002) within areas burned at high-severity levels where ground cover is lacking. Salvaging dead timber would put treetops and timber slash on the ground to slow erosion and provide ground disturbance to assist in breaking up surface-crusted soils by increasing surface roughness. Both of those effects promote infiltration by impeding surface runoff, slowing soil movement, adding organic matter to the soil, and eventually aid in rebuilding soil A-horizons (refer to soils and hydrologic resources section). Salvage logging would provide benefits to both watersheds and ameliorate some of the more catastrophic effects predicted for Canyon Creek watershed.

Cumulative Effects Common to Fisheries and Aquatic Resources from Alternative 2, 3, 4 and 5

Cumulative effects to fisheries and aquatic resources are similar to those effects discussed under threatened, endangered, sensitive and proposed species in this section and in the soils and hydrologic resources section for Alternatives 2, 3, 4 and 5. It is unlikely that reasonably foreseeable future activities listed in Appendix A would significantly affect fisheries and aquatic resources beyond those cumulative effects previously discussed in those respective sections.

Heritage Resources

Introduction

Heritage resources (also known as cultural resources) are generally regarded as those resources associated with human use of an area. They can include archaeological sites or ethnographic locations (e.g., a place which reflects traditional importance to modern tribal culture(s)) associated with past and present use of an area. These can be physical remains such as buildings, structures, or sites; or areas and objects of scientific, historic, or social value. Heritage resources can also include intangible traditional use areas associated with traditional cultural practices such as ceremonial and religious lifestyles, subsistence, or other aspects of cultural activities that were prevalent prior to European contact.

This section addresses the current condition of heritage resources in the analysis area and the environmental consequences of the proposed management activities.

Methodology Used for Data Collection and Analysis

Methodology used for data collection consisted of: review of historic materials and archival documents relevant to the project area (currently, only the Tonto National Forest has a heritage overview; an ethnographic overview of the remainder of the analysis area will be completed prior to any treatments); consultation with interested tribes and the Arizona State Historic Preservation Office (SHPO); review of the Apache-Sitgreaves National Forests GIS corporate layer and Tonto National Forest site and project atlases was completed for known heritage resource locations; and numerous post-fire surveys, such as those conducted under Burned Area Emergency Rehabilitation (BAER) activities and under contract by SWCA Environmental Consultants that have provided new information to compare in some instances to known baseline information. These processes determine the project's area of potential effect (APE) based on the geographic area in which a project may alter the character or use of any existing cultural properties.

There has been an on-going effort to document the post-burn condition of known archaeological sites to evaluate the level of disturbance resulting from this fire. Approximately 600 post-burn assessments have been conducted and are currently being entered into a database to establish site treatment priorities. This information will be expanded to include additional surveys within identified treatment areas.

Regulatory Requirements

National Historic Preservation Act

The primary legislation governing modern heritage resource management is the National Historic Preservation Act (NHPA) of 1966 (amended in 1976, 1980, and 1992). Section 106 of NHPA requires that federal agencies take into consideration the effects of their undertakings on properties listed in or eligible for the National Register of Historic Places. Federal Regulations 36 CFR 800 contains procedures for implementing Section 106 of NHPA. Forest Service Manual 2360 provides the basis of specific Forest Service heritage resource management practices.

State Historic Preservation Office

A programmatic agreement between the Southwestern Region and Arizona, New Mexico, Texas, and Oklahoma State Historic Preservation Offices (1990) guide national forests in Region 3 in identifying, evaluating and protecting heritage resources on National Forest System lands. The Forest Service is required to consider the effects of agency actions on heritage resources that are

determined eligible for the National Register of Historic Places (NRHP) or on heritage resources not yet evaluated for eligibility.

A formal programmatic agreement between the Apache-Sitgreaves and Tonto National Forests and the Arizona State Historic Preservation Office has been completed (as provided for in 36 CFR 800) to specifically detail procedural requirements and stipulations for both Forests for all rehabilitation and restoration projects associated with the Rodeo-Chediski Fire in order to satisfy Section 106 requirements of the National Historic Preservation Act.

Laws and Regulations

Several laws address various aspects of heritage resource management on the National Forest System lands, including the Archaeological Resource Protection Act of 1979 (ARPA), as amended in 1988. ARPA and two other regulatory acts describe the role of tribes in the federal decision-making process, including heritage management. ARPA requires tribal notification and consultation regarding permitted removal of artifacts on federal lands.

The Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) recognizes tribal control of human remains and certain cultural objects on public lands and requires consultation prior to their removal. The American Indian Religious Freedom Act of 1978 (AIRFA) requires federal agencies to consider the impact of their actions on tribal traditional cultural practices and access to cultural sites. The National Historic Preservation Act (NHPA) also specifically requires tribal participation in the NHPA Section 106 consultation process.

Apache-Sitgreaves and Tonto National Forest Plans

Forest-wide standards and guidelines for heritage resources are found in both forest plans. On the Apache-Sitgreaves National Forests, this direction is found on pages 57-59, 104-105 and monitoring requirements are listed on page 238 (USDA, 1987). Extensive standards and guidelines for the Tonto National Forest are found on pages 38, 38-1 through 38-4. Cultural resource objectives and priorities are listed in Appendix H on pages 251-253 and monitoring requirements on page 212 (USDA, 1985).

Affected Environment

Heritage resources encompass the remains from past cultures, plus living, changing modern-day cultures. Present day cultures can identify with both physical site remains and subtle cultural elements that further distinguish and define a groups' cultural identity. Remains of heritage resources are usually referred to as "sites" or historic properties, with the physical remains frequently referred to as archaeological sites.

If these remains are associated with living peoples they may be considered ethnographic resources. Most often, ethnographic resources are associated with traditional cultural properties that have traditional cultural significance (National Register Bulletin 38). All these resources are irreplaceable and nonrenewable resources documenting the legacy of past human use of the Forests. Without adequate protections or mitigations, such resources are vulnerable to damage and loss through a variety of effects that might result from the proposed action or alternatives being considered.

The White Mountain Apache, San Carlos Apache, Tonto Apache, Yavapai-Apache Nation, Yavapai-Prescott Indian Tribe, Pueblo of Zuni, Hopi Tribe, Navajo Nation, and Fort McDowell Indian Community have historic ties and an interest in either the Apache-Sitgreaves or Tonto National Forests. Each group has their own history, traditions, and relationship to the land and to the other groups. Traditional use of this area and

its resources by these groups dates back several generations and for some, many centuries. For this reason, an ethnographic study of the analysis area is being conducted to identify areas having traditional importance as reflected by traditional life-ways, religious practices and oral histories. Consultation will be completed with all of the above listed tribes concerning this project prior to implementation of any activity in order to identify any traditional cultural properties or other areas of importance within proposed treatment areas.

Until recently, the analysis area has had very little formal archaeological investigation aside from work conducted by Dr. Fred Plog (Arizona State University) in the late 1970s and Dr. Barbara Mills (University of Arizona) in the 1990s. A few small surveys conducted for low acreage projects, such as those related to range and wildlife improvements, are considered "complete coverage" surveys, since 100 percent of the project area was surveyed to current standards.

Approximately 56,000 acres within the Rodeo-Chediski Fire have been adequately surveyed to date. A total of approximately 1,643 sites have been identified through record and site atlas searches on the Apache-Sitgreaves National Forests with an additional 45 situated on the Tonto National Forest. Additional surveys are in progress and the results will be compiled, the Arizona SHPO consulted, and concurrence with these findings obtained prior to implementation of any ground disturbing activities within treatment areas of this project.

Historical Use

Results of the various surveys and studies conducted in the analysis area so far show a long period of human usage, extending back into the Archaic Period approximately 5,000 BC until the advent of agricultural use in the area around 700 AD (North, et al., 2003). While other areas of Arizona exhibit evidence of Paleoindians, and show human usage extending back to the beginning of the Holocene 10,000 BC, the only evidence of Paleoindian use of the analysis area is in the form of individual, isolated spear points (North, et al., 2003).

The majority of the heritage resources identified consists of prehistoric sites dating from approximately 900 AD to the early 1300s AD (North, et al., 2003). There are several large room block sites containing between 30 and 40 rooms with associated features and artifacts, including kivas (Linda Martin, personal communication, 2002). The majority of the sites are typically small room blocks of between 4-6 rooms, limited habitation sites, or artifact assemblages without any surface features. Artifact scatters, procurement and/or processing areas, rock art sites, and rockshelters constitute the majority of sites present.

Subsequent use of the area by Western Apache groups is believed to have begun in the 1500s, although oral histories testify to their arrival into central Arizona when many of the prehistoric pueblos were still occupied, around 1400 A.D (Louise Senior, personal communication, 2003). Traditional use of the analysis area by the western Apache was transitory in scope and evidence of their presence is restricted to artifact assemblages, possible grinding/processing locations, and rock art sites (Jeremy Haines, personal communication, 2002). The ephemeral nature of protohistoric Western Apache sites and the reuse of prehistoric artifacts and habitation sites make their identification difficult.

Historic Euro-American use is known to have begun in 1878 (North, et al., 2003), largely after military activities had relegated the Western Apaches on to reservations to the south at San Carlos and Fort Apache. Historic use is primarily confined to ranching. Ranches had been patented under the Homestead Act and several of these inholdings have subsequently been subdivided during the last 40 to 50 years. Other historic uses include logging railroad features with associated camps dating from the 1920s to 1940s; transportation routes such as military wagon roads and state

highways; sheep herding; depression era campgrounds; Forest Service administrative sites (lookouts and ranger stations); and homesteading (Linda Martin, personal communication, 2002).

Current Conditions

While many types of heritage resources can survive low-severity fires with little or no damage, moderate to high severity burns can affect a wide range of sites and artifacts. The use of bulldozers for the creation of fuel breaks, severe erosion resulting in pedestalling of artifacts, soot-staining of artifacts, artifact and architectural alteration, flooding, and the resulting high visibility of sites have had adverse effects on site components and increased the potential for vandalism.

Ninety-two historic period sites have been recorded within the analysis area on the Apache-Sitgreaves National Forests and three on the Tonto National Forest (Jeremy Haines, personal communication 2003; Ryan, 2002). Of these, twelve had organic components such as cabins, corrals, and other structures on the Apache-Sitgreaves National Forests and three cabins dating from the 1880s on the Tonto National Forest , all destroyed by the fire. An additional four sites containing historic fencing or railroad ties were destroyed on the Apache-Sitgreaves National Forests (Jeremy Haines, personal communication, 2003).

Some protective measures were conducted following the fire in the form of emergency rehabilitation for six large prehistoric habitations sites. This primarily took the form of dropping trees in a jackstraw manner to limit erosion on the sites as well as remove the possibility of trees uprooting naturally and destroying architectural features. At least 470 previously recorded prehistoric sites contain surface and/or subsurface architectural features that are directly at risk as a result of the fire and are currently being treated under BAER authorities.

Moderate to high intensity fires can have a detrimental effect when fuel loads are heavy in the vicinity of prehistoric sites. Concentrated heat intensities in discrete locations can impact subsurface aspects of sites when stumps and root systems burn (Taylor, et al., 1990). Surface ceramics have cracked and spalled and even dense rocks such as greenstone (a metamorphic basalt) have been known to shatter. Rock art can be affected with pictographs (painted designs) that is oxidized and/or flaked away from the heat and petroglyphs (pecked designs) damaged depending on the duration and heat intensity by spalling and/or breaking of the parent rock (North et al, 2003).

Moderate to high intensity burns can result in large numbers of standing trees being killed, but not entirely consumed by flames. Over time, these trees fall naturally, exposing the root wad. This circumstance creates the largest threat to the preservation of the heritage resources within the analysis area. When such trees are present within a site and particularly within site features, disastrous levels of disturbance to subsurface features, buried environmental information and human remains is a strong likelihood. This would have a correlary adverse effect on the integrity of the site and the status of the site's eligibility to the National Register of Historic Places.

The most visible result of a wildfire is the destruction of vegetation. In instances where stumps and root systems burn under ground, impacts to buried site components occur in a variety of ways altering artifactual remains, and destroying pollen and other prehistoric environmental evidence. Subsurface fire can impact human remains and alter or impact the effectiveness of several scientific dating techniques (Traylor, et al., 1990).

Increased surface visibility is a secondary aspect of surface vegetation loss as a result of this wildfire. Sites once masked by brush, are now exposed. This can increase the scientific

knowledge and the information potential of any given area as evidenced by the newly identified sites found during recent surveys. Unfortunately, increased visibility also results in an escalation of vandalism, pothunting and defacement of sites. Such vandalism has been documented within the analysis area (Jeremy Haines, personal communication, 2002).

Sheet erosion is occurring over wide areas, resulting in displacement and wide dispersal of surface artifacts on sites situated in moderate to high intensity burn zones. Soil loss under rocks that are part of a structure can result in the displacement of surface features. The degree to which erosion can affect a site is largely dependant upon topography and soil type.

Instances of pedestalling have been observed on several sites where underlying soil has been washed away, and artifacts are left resting on a narrow stem of soil, suspended up to three inches above the ground level. This situation not only impacts surface artifacts and features but also increases the likelihood that subsurface features, including burial sites, will be exposed. Most of the known prehistoric habitation sites are situated in areas vulnerable to erosion.

Environmental Consequences

Alternative 1

Direct and Indirect Effects

Implementation of alternative 1 would result in several direct impacts to heritage sites within the analysis area. Failure to reduce accumulated fuel loads would increase the potential of a reburn, thereby increasing the potential for adverse effects on heritage resources buildings, structures, and artifacts. The potential for the destruction of heritage resources is high if dead standing trees are allowed to fall and uproot naturally. Without implementing road management and soil and watershed mitigation measures, the risk of erosion and flooding are greatly increased, in addition to the increased risk from looting and vandalism due to site visibility.

Cumulative Effects

Appendix A displays past, present and reasonably foreseeable future activities occurring within and adjacent to the analysis area. There would be no cumulative effects of implementing alternative 1 to past activities that occurred within areas burned at moderate and high severity levels for heritage resources. Because site avoidance is required for all present-day activities and those occurring in the reasonably foreseeable future, no cumulative effects are anticipated by implementation of alternative 1.

Effects Common to Alternatives 2, 3, 4 and 5

Direct and Indirect Effects

Removal of dead standing trees will reduce long-term fuel continuity and fire hazard that will benefit heritage resources within the analysis area. Removal of dead standing trees from sites will reduce the potential damage as dead trees uproot naturally. Mitigation measures are in place (see Table 7) that will minimize potential impacts to heritage resources by prohibiting the use of mechanized equipment within site boundaries and felling dead trees that will rot and fall, damaging sites when root wads pull out of the ground.

Felling dead trees within site boundaries, especially with attendant slash dispersal, will provide surface stabilization against continued erosion and is currently being treated under BAER authorities. Slash dispersal would also assist in masking the visibility of sites, thereby providing protection against the possibility of looting and limit the likelihood of cross-country vehicle traffic that could impact heritage resources.

No impacts to heritage resources from road maintenance and temporary road construction activities are anticipated. All proposed haul roads and temporary road locations have been surveyed and heritage resources identified for avoidance. However, if road design standards in combination with topography, natural features, and public safety needs indicate that any particular heritage resource cannot be avoided, then data recovery will occur.

Increased dust and dirt, both airborne and alluvial, could result in soil deposition on nearby site surfaces in the short-term. However, it is anticipated any soil deposition on site surfaces will be negligible and have no effect on site integrity or significance.

Cumulative Effects Common to Alternatives 2, 3, 4 and 5

Appendix A displays past, present and reasonably foreseeable future activities occurring within and adjacent to the analysis area. There would be no cumulative effects of implementing alternative 2, 3, 4 and 5 to past activities that occurred within areas burned at moderate and high severity levels for heritage resources. Present activities occurring within the analysis area are actions approved in the three Decision Memos signed December 23, 2002 to remove dead trees killed by the fire. All treatment areas were surveyed and heritage sites have been avoided. Likewise, heritage resources within the Jersey Horse and Phelps Timber Sales have been identified and avoided. Because site avoidance is required for all present-day activities and those occurring in the reasonably foreseeable future, no cumulative effects are anticipated by implementation of these alternatives.

Alternative 2

Direct and Indirect Effects

There would be no additional direct or indirect effects on heritage resources from activities proposed in Alternative 2. Helicopter yarding does not have a potential for ground disturbance aside from selected landings and decking areas. These areas would not be established within or adjacent to any known heritage resources. Additionally, the likelihood of heritage resources situated on slopes over 40 percent is negligible aside from the possible presence of caves or overhangs which would not be impacted by the use of helicopters to aerially yard trees.

Cumulative Effects

No additional cumulative effects unique to alternative 2 would occur beyond those disclosed in the Effects Common to Alternatives 2, 3, 4 and 5 discussions above.

Visual Resources

Introduction

The Rodeo-Chediski Fire lies east to west along the Mogollon Rim, with a northern aspect facing toward the Colorado Plateau. The burn area is visible from numerous viewpoints along State Highways 60 and 260, Forest Roads 86, 300 and many others, as well as locations below the Mogollon Rim.

The White Mountains and Mogollon Rim areas are well known destinations for outdoor recreation and climatic relief from summer temperatures in the Phoenix and Tucson metropolitan areas. Not only is the value of climatic relief significant to Arizonans, but the scenic value of pine trees is also significant. Local tourist businesses advertise pine trees; community street names reflect variations such as Pine Rim Road, Tall Timbers Road, and Ponderosa Lane; and real estate values take into account whether or not property is located in the pines. This landscape offers a wide variety of activities associated with scenic viewing; photography, hiking, mountain biking, off-highway vehicle use, picnicking, horseback riding, big game hunting, fishing, camping, wildlife photography, and driving for pleasure.

Methodology Used for Data Collection and Analysis

Methods used to evaluate the visual resource include: Visual Management System /Visual Quality Objectives (VQO), and Scenery Management System (SMS). Initial data for the analysis area was compiled from historic visual quality inventory maps used during the land management planning processes for both the Apache Sitgreaves and Tonto National Forests.

The Forest Service was required to begin using the SMS program to replace concepts and terminology of the Visual Management System (VMS) used during the forest planning process that occurred in 1987. The major difference between the two systems is a more complete discussion of “landscape character” with SMS. Inventory and analysis required for implementing SMS will be accomplished during the revision of both forest plans. Landscape character is an overall visual and cultural impression of landscape attributes, the physical appearance and the cultural context of a landscape that gives it an identity and “sense of place.”

Projecting what the forest visitor is likely to see from high use areas and more highly traveled Forest System roads was analyzed. Photographs were taken from several locations throughout the analysis area, focusing in views where like treatments are proposed in the alternatives and specifically from areas determined as most representative of critical viewing locations. High use areas included views from several subdivisions and recreation sites within the analysis area. Maps and photographs of these locations are on file in the project record.

Visual Management System /Visual Quality Objectives (VMS/VQO)

These systems provide a methodology for inventory and description based on the physical and sociological characteristics of an area. The sensitivity of the view to alteration by various forest activities is directly related to the frequency with which it is seen. Therefore, locations visible from highways, arterial roads and areas next to private lands are considered more sensitive than remote areas.

Classifications used to describe landscape character found within the analysis area follow. The classification of preservation does not occur within the analysis area and therefore is not defined. They are:

- **Retention** - Refers to landscapes where the valued landscape character "appears" intact. Deviations may be present but must report form, line, color, texture and pattern common to the character so completely that they are not evident. This condition would not be readily noticeable to the casual observer. This classification calls for the maintenance or creation of scenic variability and the prompt treatment of slash.

- **Partial Retention** - Refers to landscapes where the valued landscape character appears slightly altered. Noticeable deviations must remain visually subordinate to the landscape character being viewed. With consideration given primarily to the size and shape of created openings, this classification provides more latitude for the visual effects of stand treatments.

- **Modification** – Refers to landscapes where the valued landscape character appears moderately altered. Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings.

- **Maximum Modification** – Management activities strongly dominate the landscape character. When viewed as foreground or middle-ground they may not borrow from valued attributes of size, shape, edge effect and pattern of natural openings of the landscape being viewed. However, when viewed as background, they must borrow from the visual characteristics of the surrounding area or landscape character.

Scenery Management System (SMS)

Landscape character descriptions, as defined in *Landscape Aesthetics – A Handbook for Scenery Management* (USDA, Handbook 701, October 2000), describes positive scenic and cultural elements to the landscape that collectively form the base for alternative comparisons. Landscape management that tends to preserve positive scenic elements will maintain or increase the scenic integrity of the landscape. Conversely, landscape management that eliminates or obscures positive scenic elements will degrade scenic integrity. Scenic integrity is measured using the state of disturbance created by human activities or alterations.

Scenic Integrity Levels

Scenic integrity levels are used to classify landscapes by degree of alteration found within the analysis area. The scenic integrity level of very high does not exist within the analysis area and therefore is not defined here. They are:

- **High:** Landscapes where the valued landscape character appears intact are said to have high scenic integrity. Deviations may be present but must repeat the form, line, color, texture and pattern common to the landscape character so completely and at such scale that they are not evident.

- **Moderate:** These are landscapes where the valued landscape character appears slightly altered. Noticeable deviations must remain visually subordinate to the landscape character being viewed.

- **Low:** In these landscapes the valued landscape character appears moderately altered. Deviations begin to dominate the valued landscape character being viewed.

- **Very Low:** These are landscapes where the valued landscape character appears heavily altered. Deviations may strongly dominate the valued landscape character. Deviations must be shaped and blended with the natural terrain so that the unnatural elements do not dominate the composition.
- **Unacceptable Low:** Landscapes where the valued landscape character being viewed appears extremely altered and are considered to have unacceptable low scenic integrity. Deviations are extremely dominant and borrow little if any form, line, color, texture, pattern or scale from the landscape character.

Table 46 under affected environment displays the relationship between the SMS and VQO systems.

Landscape Visibility

Portions of the analysis area are visible from a variety of locations such as high use areas and along the road system. High use areas include three Forest Service lookouts, various developed and undeveloped recreation sites and several subdivisions within the analysis area. Most of these viewpoints are along highly traveled Forest System roads and State Highway 260. Because of the size of the analysis area, it can be viewed only in small portions from any one vantage point.

Regulatory Requirements

NEPA requires integrated use of the natural and social sciences in all planning and decision-making that affect the human environment. The human environment includes the natural and physical environment and the relationship of the people to the environment (40 CFR 1508.14).

CFR 219.21 (f) states, “the visual resource shall be inventoried and evaluated as an integrated part of evaluating alternatives … (for) both the landscape’s visual attractiveness and the public’s visual expectation. Management prescriptions …shall include visual quality objectives.”

A landscape character goal is an objective for the overall scenic character of the landscape. There is language in both forest plans specifying limits of change in VQOs. Visual Quality Objectives are the forest plan direction (Forest Service Chief’s letter, file code 2380, dated March 10, 1997) until such time as both forest plans are revised with Scenic Integrity Objectives. Both forest plans are scheduled for revision in the next several years and changes in sensitivity/concern levels will be considered at that time.

The intent of this direction was to maintain the natural appearing landscape character that existed at the time both plans were developed in the 1980s.

Apache-Sitgreaves National Forests Land and Resource Management Plan

The Apache-Sitgreaves National Forests Land and Resource Management Plan (USDA, 1987) provides overall direction for visual quality on the forest. A goal is stated to “maintain and enhance visual resource values by including visual quality objectives in resource planning and management activities (page 14). Standards and guidelines state, “Slight deviations from acceptable variations in visual quality objectives can only be considered on a case-by-case basis and only authorized by the Forest Supervisor” and “Highly scenic area on or near highways or recreation sites are managed as foreground retention without any variation” (page 54). The following limits of change were stated:

- Retention: +/-2% foreground, +/-5% background, midground
- Partial retention: +/-5% foreground, +/-10% back and midground
- Modification/maximum modification: +/-10% in all zones.

Tonto National Forest Land and Resource Management Plan

The Tonto National Forest Land and Resource Management Plan (USDA, 1985) provides direction for visual quality on the forest. A goal is stated to "Emphasize visual quality objectives in all resource planning and management activities" (page 21). Standards and guidelines provide direction to "Manage for visual quality objectives ranging from preservation to maximum modification as defined for each prescription and delineated in the Forest's Visual Resource Inventory" and "Refine variety, classes, sensitivity levels and visual quality objectives when needed for project level planning" (page 38-4).

Affected Environment

Before the Rodeo-Chediski Fire occurred, tree harvesting from the last 20 to 30 years, and past fires created evident to obvious alterations to the landscape and an assortment of vegetation patterns. The analysis area is typical of other landscapes found in central Arizona along the Mogollon Rim. The vegetation is moderately varied coniferous forest, primarily montane conifer, which is the predominant vegetation. Pinyon-juniper woodlands are common to parts of the area. Stringers of riparian deciduous forest and woodland are common along watercourses. The area is primarily drained by ephemeral washes.

The initial visual effects of the Rodeo-Chediski Fire were immediate and dramatic due to the changes in the landscape. Patches of blackened trees combined with hillsides of brown-needled trees left a mosaic of color and texture. In areas where the fire burned intensely, no needles or branches were left on the trees. Where the fire burned less intensely, tree needles remain on the branches but turned brown or black due to heat and mortality. Blackened ground surfaces dominate the view as one travels through the burn area. Long distance views from State Highway 260 afford views of blackened trees along ridges in the distances and close-up vistas along the road. Since post-fire BAER rehabilitation effort were completed in the summer and fall of 2002, straw mulch and some green grass are dominant views from many travel ways through the analysis area.

Many roads previously hidden from view are now very evident due to the loss of vegetation. Fire lines and safety zones, created to control the fire and provide safety for firefighters are still visible at points across the landscape and are likely to remain obvious for the next 10 years. The longest lasting visual contrast is caused by soil disturbance from fire-line construction. Effects from tree removal are generally shorter because ground vegetation often occurs within 2-3 years.

Overall, the landscape is natural appearing although some highly visible and altered areas dominate large expanses. The burn severity pattern across the analysis area is a mosaic and ranges from unburned to areas that burned at high severity levels. Unburned areas show little evidence of the fire, and have few if any elements that detract from the landscape, resulting in a moderate to high scenic integrity rating. Areas that burned at low severity levels include areas that were burned with a cool ground fire that did not damage the overstory. Much of the low burn severity areas still have live trees resulting in a moderate to high scenic integrity rating depending on the level of domination past activities have on the view.

In contrast, large portions of the analysis area burned at moderate to high severity levels. In both of these severity classes, evidence of the fire is high. In the moderate burn severity areas, the fire burned very hot, consuming all litter and also burned hot enough to kill some trees by killing their roots. Such areas normally appear green after the fire as it takes time for the trees to die and turn brown. In some areas, no green vegetation is visible, all needles are brown or gone, and soil has been eroded away from the monsoon season following the fire. In areas of high burn severity, the scenic integrity is rated as low to very low because crown and ground fire consumed everything and only blackened dead trees are left.

The south boundary of the analysis areas is located along the Mogollon Rim. These steep slopes are visible from viewpoints south of the Mogollon Rim on the Tonto National Forest such as Valentine Ridge, Airplane Flats and dispersed day use areas along Canyon Creek. These areas were severely impacted by the fire with many of the slopes completely denuded.

Due to past activities that occurred within the analysis area such as timber sales, wildfires, utility corridors, and roads, burn severity levels do not necessarily equate to scenic integrity or VQOs. For instance, all unburned areas would not necessarily be classed as high or retention. Likewise, areas that burned at moderate or high severity levels would not necessarily be rated low to very low or modification or maximum modification due to the presence or absence of past activities. Table 46, linking the two systems together, can only be used in its broadest sense.

Table 46 - Comparison of SMS scenic integrity ratings and VQO ratings by burn severity level within the analysis area

SEVERITY CLASS	SMS – scenic integrity	VQO
Unburned	High to Moderate	Retention to Partial Retention
Low	Moderate to High	Partial Retention to Retention
Moderate	Low to Very Low	Modification to Maximum Modification
High	Low to Very Low	Modification to Maximum Modification

The analysis area is visible from many of the travel ways and high use areas within and adjacent to the analysis area. The visual effects of the fire were most obvious directly after the fire took place in areas with blackened and brown needled trees and exposed ground surfaces. Since then some of the effects have dissipated, although straw mulch placed during BAER activities is visible from many viewpoints. The contrast of the light straw mulch against the blackened trees and ground surface is highly visible.

Short-term changes may include views of stumps, changes to the soil color and reduction in understory vegetation. In the long-term, those disturbances will be softened as the understory vegetation grows. Openings in the tree canopy of various sizes resulting from salvage harvests may be visible. Structure of the forest stands would change from dense stands of snags to a stand with more openings and fewer trees per acre.

Currently the area surrounding and including the analysis area is experiencing a bark beetle epidemic. Trees weakened by the fire but not killed outright are more susceptible to attack from insects and disease. Green trees within the burn area are also susceptible to the bark beetle epidemic. These trees initially appear as clusters of red-needled trees or scattered red-needled individual trees.

Soil erosion has created exposed ground surfaces and will be slow to revegetate. Areas where soil erosion has occurred appear as patches of lightly colored, sometimes gray, soils with scattered weeds and exposed rocks.

Environmental Consequences

The analysis area is a portion of the ponderosa pine/mixed conifer forest that stretches across the state of Arizona. Large portions of the analysis area are in the ponderosa pine type and appear to be contiguous pine forest. The Rodeo-Chediski Fire burned in a mosaic with large patch sizes that will be uncharacteristic of the pre-fire landscape and will enhance the aesthetics of the area. In areas with mixed fire severity levels, a mosaic pattern with patchy openings will be visible. Areas of dense but small trees in areas that burned at high severity levels will become openings. The environmental consequences of implementing alternatives considered in detail are discussed in this section.

Alternative 1

Direct and Indirect Effects

Since no management activities would occur by implementing Alternative 1, existing visual conditions would continue. Burned areas would revegetate over time and a mature forest would fill in the burned areas and harvest openings. In the short-term (less than 10 years), Alternative 1 would result in a less visually diverse landscape then under alternatives proposed for salvage logging treatments. Visual effects along State Highway 260 would continue to be the same as immediately after the fire. Evidence of the fire and BAER treatments would be obvious in the foreground immediately along the highway and in the background on distant ridges. In the long-term, the landscape would recover to its previous forested character unless a reburn occurs and starts this process anew. Past human-related changes to the landscape would remain evident for many years.

Cumulative Effects

Alternative 1 would provide a diversity of grasses and shrubs mixed with weathering snags in foreground views. Areas burned at low intensity levels would support green trees that would act as focal points and add variety to the landscape. Visual quality from roads and trails would be reduced as the snags fall to the forest floor in the foreground. The forest floor would appear cluttered and the vertical element that the snags provide would be lost. Accumulations of forest litter and competition from grasses may slow the establishment and growth of new trees. Trees would become re-established within the analysis area where seed sources exist. It may take the landscape hundreds of years or more to recover to its previous forested character. Natural reforestation would result in random spacing and distribution of species.

Areas that are currently being salvaged logged under the authority of Decision Memos approved December 23, 2002 are removing dead trees in the foreground of high use areas and along highly used roads within the analysis area. Removal of dead trees in the foreground of areas classed as retention and partial retention would soften the effects of the fire by reducing the occurrence of

dead trees that would fall in a jackstraw fashion five to 10 years post-fire. Regrowth of vegetation in the long-term would screen these areas.

Implementation of Alternative 1 would not enhance the foreground scenic quality. Future foreseeable activities such as fuel reduction projects within the wildland-urban interface would require additional treatments to treat foreground scenic quality due to the high volume of down and dead logs that will have fallen down.

Effects Common to Alternatives 2, 3, 4 and 5

Direct and Indirect Effects

All action alternatives propose salvage logging in areas that burned at moderate to high severity levels to remove dead trees of commercial value. These alternatives consider salvage logging activities of approximately 38,500 to over 45,000 acres, harvesting between 48-84 mmbf depending on the alternative selected.

Many of the salvage logging units visible from State Highway 260 and Mogollon Rim communities would be treated through commercial harvest and small sale activities to remove dead trees in areas burned at moderate to high severity levels.

Ground disturbance associated with salvage logging would have short-term visual effects. Effects of temporary road construction would be short-term; as temporary roads are closed, scarified and seeded after harvesting activities are complete; and vegetation becomes re-established. Likewise, road maintenance activities would have short-term visual effects that will all but disappear as vegetation becomes re-established along roadway shoulders. Road maintenance activities would have no significant visual effects.

Several treatment areas are along Forest Road 86 that has historically been a dispersed camping area for visitors using Black Canyon Lake and heavily used for recreational activities such as driving for pleasure from the Heber and Overgaard communities. Treatment areas along Forest Road 86 and Forest Road 300 are well known travel routes for recreational driving for pleasure for visitors.

Forest roads in the analysis area would continue to be maintained to levels commensurate with use during harvest activities. These activities include improving road and surface drainage, clearing roadside vegetation and repair or maintenance of some culverts. Temporary roads constructed to access harvest units would be closed and reseeded following harvest activities. The visual effects of this type of work are short-term and may go unnoticed by some forest visitors.

Cumulative Effects Common to Alternatives 2, 3, 4 and 5

The Arizona Department of Transportation removed dead trees within the right-of-way along Highway 260 in the fall of 2002, broadening the visual corridor in the immediate foreground. This corridor will continue to broaden as private landowners remove additional dead trees from their property along this highway.

Watershed stabilization work implemented by the BAER team to protect life, property and resource values is visible throughout the analysis area. The visual impacts of removing additional dead trees adjacent to these areas as proposed in Alternatives 2, 3, 4 and 5 would have some cumulative effect when added to the visual effects in the immediate foreground. These cumulative effects would be insignificant.

Areas that are currently being salvaged logged under the authority of Decision Memos approved December 23, 2002 are removing dead trees in the foreground of high use areas and along highly used roads within the analysis area. These treatments are occurring in the vicinity of high use areas and adjacent to Highway 260 and FDR 86 and other highly traveled roads throughout the analysis area. Treatments are also occurring adjacent to private lands in the wildland-urban interface. Residual logging slash is being treated by crushing, removal for fuelwood, or disposal through sales of other forest products. Two or three years following these activities, grasses, forbs and shrubs should dominate the understory. Removal of dead trees in the foreground of areas classed as retention and partial retention would soften the effects of the fire by reducing the appearance of dead trees that will have fallen in a jackstraw fashion 5-10 years post-fire. Regrowth of vegetation in the long-term would screen these areas with the passage of time. No cumulative effects from salvage logging are anticipated in these areas as a result of implementing any of the action alternatives.

Both the Phelps and Jersey Horse Timber Sales were contracted pre-fire and then modified to remove dead trees resulting from the fire. The visual appearance of these areas is open with pockets of green standing trees. There would be no cumulative effects from removing dead trees as proposed in Alternatives 2, 3, 4, and 5, when added to the visual effects of the Phelps and Jersey Horse timber sales because of the distance between the existing and proposed treatment areas.

Reasonably foreseeable future activities within the analysis area include broadcast burning, thinning and chipping. The Heber/Overgaard Wild land Urban Interface Project proposes thinning understory pine trees over 3,500 acres southwest of Heber/Overgaard within the analysis area in unburned vegetation. These reasonably foreseeable future activities would not have cumulative effects when added to the visual impacts of salvage logging because they would occur outside of proposed treatment areas and are removed in distance and time.

Alternative 2

Direct and Indirect Effects

Alternative 2 proposes salvage logging within the upper tributaries of Canyon Creek through use of helicopters on slopes over 40 percent along the face of the Mogollon Rim. Approximately 2,259 acres were burned at moderate and high severity levels in this area. The scenic integrity of this area is now considered as low to very low. This portion of the analysis area is classified as retention in the Tonto's forest plan visual quality objective inventory.

Areas where helicopter logging occurs would also be visible from portions of the Young Road (Forest Road 512), the residential areas of OW Ranch and Canyon Creek Fish Hatchery, and portions of the Fort Apache Indian Reservation. Structure of the forest stands would change from dense stands of snags to a stand with more openings and fewer trees per acre in the short-term. Within 2-5 years all small diameter dead trees will rot and fall down in a jackstraw fashion. Larger trees will begin to fall down over a period of years depending on their size and other factors.

Salvage logging by helicopter yarding methods would remove the commercial sized dead trees except for those retained to meet wildlife needs as snags. This results in very little impact to visual resources, as there is little to no ground disturbance (no roads or skid trails) and therefore meets partial retention and/or retention standards. Helicopter landings would be rehabilitated after use. These activities have short-term impacts on the landscape.

Cumulative Effects of Alternative 2

There are no unique cumulative effects anticipated to occur as a result of implementing Alternative 2 in the Canyon Creek drainages. All other cumulative effects of this alternative have been disclosed in Effects Common to Alternatives 2, 3, 4 and 5.

Alternatives 3, 4 and 5

The direct, indirect and cumulative effects of Alternatives 3, 4 and 5 have been disclosed in Effects Common to Alternatives 2, 3, 4 and 5.

Recreation

Introduction

This section discusses recreation related resources and opportunities affected by the Rodeo-Chediski Fire of 2002 and discloses the possible impacts of salvage logging to them.

The White Mountains and Mogollon Rim areas are well known destinations for outdoor recreation and climatic relief from summer temperatures in the Phoenix and Tucson metropolitan areas. Popular recreational activities include hiking, mountain biking, off-highway vehicle use, fishing, picnicking, camping, horseback riding, big game hunting, firewood gathering, wildlife and scenery viewing, and driving for pleasure. These areas also provide a limited amount of winter sport opportunities. With adequate snowfall, travel by snow mobile and cross-country skiing are popular in the Forest Lakes area. Pedestrians and mountain bikers from local communities routinely use trails in the area for exercise and pleasure.

Methodology Used for Data Collection and Analysis

Following are brief descriptions of the methodology used for data collection and analysis for this proposal.

Meaningful Measures

The meaningful measures process was developed for use in the Forest Service's National Recreation Business Management System to establish standards of quality, estimate costs and prioritize work. An inventory of recreation facilities has been completed to provide facility details and design capacities measured in "Persons At One Time" (PAOTs). If site capacities are unknown, the normal calculating conventions are: five persons per family picnic/camp unit and 3.5 persons per parking lot spaces such as those found at trailheads and visitor centers.

Recreation Opportunity Spectrum

The Recreation Opportunity Spectrum (ROS) is a framework for stratifying and defining classes of outdoor recreation environments, activities, and experience opportunities. Settings, activities, and opportunities for obtaining experiences have been arranged along a spectrum divided into six ROS classes: Primitive; Semi-primitive non-motorized; Semi-primitive motorized; Roaded Natural; Roaded Modified; Rural and Urban (FSM 2300 - Recreation, Wilderness and related resource management and WO amendment 2300-90-1 2330.3 Exhibit 1). The Apache Sitgreaves National Forests adopted the class of Roaded Modified (RM). Roaded Modified includes lands that fall into the Roaded Natural class but have heavy vegetation changes and obvious site modification from fire, thinning, and timber harvesting activities.

Regulatory Requirements

Following are the major regulatory requirements considered during analysis of the recreation resources found within and adjacent to the analysis area.

National Environmental Policy Act:

NEPA requires integrated use of the natural and social sciences in all planning and decision-making that affect the human environment. The human environment includes the natural and physical environment and the relationship of the people to the environment. (40 CFR 1508.14)

Apache-Sitgreaves National Forests Land and Resources Management Plan

The Apache-Sitgreaves National Forests Land and Resource Management Plan (forest plan) (USDA, 1987) provides overall direction for all resources on the forest. Recreation related goals are:

- Manage the recreation resource to provide opportunities for a wide variety of developed and dispersed experiences. Provide for developed site and dispersed visitor use (p. 13).
- Maintain a variety of forest trails, considering people's needs. Includes foot and motorized and challenge and adventure opportunities, as well as opportunities for the handicapped (p. 14).
- Establish off road vehicle (ORV) use areas and closures as needed to meet demand and other resource objectives. Manage ORV use to provide ORV opportunities while protecting resources and minimizing conflicts with other users (p. 14).

The Forest's Plan (p. 48) allows the following variations in ROS class are acceptable:

- Semi-Primitive Motorized: +/- 10%
- Roaded Natural and Roaded Modified: +/-15%
- Rural: +/-15%

Tonto National Forest Land and Resources Management Plan

The Tonto National Land and Resource Management Plan (forest plan) (USDA, 1985) provides overall direction for recreation resources with a goal to: "Maintain and enhance visual resources values by emphasizing recreation resource management which will increase opportunities for a variety of developed and dispersed experiences. Provide those developed sites needed to meet most of the public demand and to support dispersed visitor use." (p. 21). Standards and Guidelines state "ROS classes will be managed according to the existing inventory for all Management Areas (p. 39)."

Affected Environment

Dead trees that have fallen or will fall within the next three to five years impacted many of the recreation resources found within the analysis area. Impacts that will drive visitors to other recreation destinations include fewer trees offering shelter from sun and wind, reduced aesthetic appeal to visitors who do not appreciate charred landscapes, and flood damage.

All of the burned area was closed to public access during the fire until emergency work was completed under BAER authorities. Public access is currently restricted by Closure Order # 01-377 that allows motorized vehicles to travel only on specific roads. Overnight camping, campfires, smoking and fuelwood cutting is currently prohibited within the fire perimeter.

Recreation Opportunity Spectrum

Four out of a possible six ROS classes occur in the analysis area, which is classified fairly high on the development scale because of the proximity to communities that have a long history of use within the area. The following table provides a brief description of each ROS class.

Table 47 - ROS class descriptions and acreage within the analysis area

ROS Class Description	ROS Acreage
Rural: Site heavily modified. Some facilities designed strictly for comfort and convenience of users. Luxury facilities not provided. Facility design may incorporate synthetic materials. Extensive use of artificial surfacing of roads and trails. Vehicular traffic control usually obvious. Primary access usually over paved roads. Development density 3-5 family units per acre. Plant materials usually native. Interpretive services often formal or structured.	6,750 acres
Roaded Modified: The environment is substantially modified except for campgrounds. Roads, landings, slash and debris may be strongly dominant from within yet remain subordinate from distant sensitive roads and highways. There is an opportunity to get away from others, but with easy access. There is feeling of independence and freedom but little challenge and risk. There is moderate evidence of other users on roads and little evidence of others or interaction at campsites. Access and travel are by conventional motorized vehicles (sedans, trailers, RVs, and OHVs). The sites have moderate site modification. (R6-REC-118-94)	20,194 acres
Roaded Natural: Site modification moderate. Facilities about equal for protection of natural site and comfort of users. Contemporary/rustic design of improvements is usually based on use of native materials. Inconspicuous vehicular traffic controls usually provided. Roads may be hard surfaced and trails formalized. Development density about three family units per acre. Primary access may be over high standard roads. Interpretive services informal, but generally direct.	111,850 acres
Semi-primitive Motorized: Little site modification. Rustic or rudimentary improvements designed primarily for protection of the site rather than the comfort of the users. Use of synthetic materials avoided. Minimum controls are subtle. Little obvious regimentation. Spacing is informal and extended to minimize contacts between users. Motorized access is provided or permitted. Primary access is over primitive roads. Interpretive services are informal.	34,445 acres

There are no areas designated as roadless or semi-primitive that would be impacted by any of the action alternatives within the analysis area.

Developed Recreation Sites

Several developed recreation sites located within the analysis area were impacted by the fire. The following table displays the number of PAOTs that each site was designed to accommodate, acres within each site, and whether it is a designated fee area. Sites managed by concession are also displayed.

Table 48 - Developed recreation sites within the analysis area

Developed Site	Number of PAOTs	Number of Acres	Fee Area	Concession
Black Canyon Rim Campground	150	20	Y	Y
Black Canyon Lake Day Use	280	10	N	N
Canyon Point Campground	620	116	Y	Y
Gentry Lookout Campground	30	3	Y	Y
Lewis Canyon Campground	150	20	Y	N
Valentine Ridge Campground	45	5	N	N
Upper Canyon Campground	300	10	N	N
Colcord Ridge Campground	200	6	N	N
Airplane Flat Campground	280	5	N	N
Canyon Creek Fish Hatchery Interpretive Site	50	0.1	N	N

Black Canyon Rim Campground, Black Canyon Lake Day Use/Picnic/Boat Ramp and Gentry Lookout Campground were undamaged by the fire. Vegetation in the Canyon Point Campground was back burned during fire suppression efforts. Lewis Canyon Group Campground received minimal damage to signs and other improvements. Hazard trees have been felled and stump holes filled within 30 feet of the roads within these sites under BAER authorities.

A single vault toilet in Valentine Ridge Campground was destroyed. Fire damages to facilities in Canyon Creek, Colcord Ridge and Airplane Flat Campgrounds were minimal. Additional trees are expected to die in these sites within the next year and will be removed during routine maintenance activities.

Concentrated Use Areas

Several popular areas provide dispersed camping and or day use opportunities in the forest and along Canyon Creek. A concentrated use area (CUA) is an undeveloped site or area where evidence of recreation use is obvious and generally found along a forest road. Site management is

minimal as they are not marked or signed. Affected CUAs are now surrounded by a tremendous number of hazard trees and stump holes. A table follows to display identified CUAs within the analysis area.

Table 49 – Concentrated use areas within the analysis area affected by the fire

Concentrated Use Area	Number of PAOTs	Number of Acres
Fence Tank	100	10
Bagnal Tank	100	10
Forest Road 9595C	25	5
Shelly Draw	25	5
Saloon Canyon	25	5
Forest Road 86 east	25	5
Forest Road 86 west	25	5
Baca Meadows	175	20
Forest Road 9562 E Hidden Tank	25	5
Forest Road 9562	25	5
Forest Road 9561T	25	5
Forest Road 9561S South Throw Down	100	20
Gentry Canyon	50	10
Forest Road 9659U	25	10
Forest Road 300	25	10
Forest Road 196	25	20
Weather Station Group	100	20
Brookbank	100	40
Valentine Canyon	50	10
Lower Canyon Creek Day Use	200	20
OW Dispersed	20	2
Forest Road 34 Dispersed	20	2
Forest Road 33 Dispersed	10	1

Special Use Outfitter Guide Activities
Several outfitter guide permits authorize commercial recreational activities within portions of the analysis area. A cross-country ski rental and groomed trail permit goes through and south of Canyon Point Campground. Signs were burned during the fire and several trails were used as fire lines and widened by bulldozers. Trails permitted for guided horseback rides south of Forest Lakes are also inside the analysis area.

Recreation Events

Portions of the racetrack for the annual Whiplash Motor Sports Race, a recreation event under special use permit, are inside the analysis area. Mitigation for the 2002 race included changing the route to exclude that portion within the analysis area.

Hunting

Portions of Arizona Game and Fish Hunt Units 3B, 3C, 4B and 23 are within the analysis area. These units are popular for hunting elk, deer, pronghorn antelope, bear, turkey, squirrels and cottontail rabbits. Numerous outfitter/guide special use permits have been authorized to permit guided hunting activities on National Forest System lands within these units. Most of these permits are statewide, authorizing the outfitter guide to conduct guided activities on all of the national forests within Arizona.

Roadless Areas and Wilderness Areas

There are no designated roadless or wilderness areas within or adjacent to the analysis area.

Wild and Scenic Rivers

A segment of Canyon Creek was identified as eligible for potential wild, scenic, recreational river designation in the 1993 Resource Information Report (USDA, 1993). The segment, located within a half-mile wide corridor approximately 5.4 miles in length, begins at Canyon Creek Springs and continues to the boundary of the Fort Apache Reservation. The segment meets eligibility requirements because it is free flowing, free of impoundments and has outstanding remarkable wildlife and ecological values. This segment has not been officially designated as part of the Wild and Scenic Rivers system to date.

This river segment, including the Canyon Creek day use recreation site and Airplane Flat Campground, is a popular destination of summer visitors, and is classified as recreational. The segment is managed as a “Blue Ribbon” fishery by the Arizona Game and Fish Department and provides fishing opportunities with artificial flies and lures only.

The fire heavily impacted the outstanding remarkable wildlife and ecological values existing within this segment of Canyon Creek. The rating for outstanding remarkable value of wildlife is related to the quality of the riparian habitat for a variety of species. Some of the species are listed as threatened and endangered wildlife species (see wildlife section and Appendix D). This stream segment was rated as having outstanding remarkable ecological values because the habitat was composed of a variety of plant and fish species.

The entire segment was burned with approximately 36 percent of the area burned at moderate to high severity levels. As a result, the fishery has been heavily impacted by lost streamside vegetation, flooding and silting. The riparian habitat in the upper reaches of this stream has been destroyed and will take several years to revegetate.

Off Highway Vehicles

No designated off-highway vehicle (OHV) trails exist in the analysis area. Use by OHVs in the past has been both cross-country and on existing forest roads, primarily during the summer and fall hunting seasons. Closure Order #01-377 now in place limits use of OHVs to roads posted as open to travel by the public and is enforced by Forest Service law enforcement officers.

Recreation Trails

Over 106 miles of trails within the analysis area were affected by the fire. Because user safety has been compromised, all or portions of these trails are currently closed. Some portions of these designated trails are actually Level 2 forest development roads. Portions of the General Crook Trail, a national recreation trail, are within the analysis area.

Out of a total of 106.7 miles of trails within the analysis area, approximately 49 miles are currently being treated to remove dead trees in areas burned at moderate and high severity levels, authorized under a separate Decision Memo approved December 23, 2002. Unless the dead trees are removed, these trails will remain closed to public access for an indefinite period of years. These trails will be reopened to the public upon completion of these actions.

Table 50 - Trails affected by the Rodeo-Chediski Fire

Trail Name	Trail Number
General Crook (also known as the Highline Trail)	140
Hangman	500
Cottonwood	508
Rum Run	513
Spring Loop	514
Wedding Day	515
Feeling Blue	516
Plunge	517
Mellow	518
Dare Me	519
Late Night	520
Back Alley	521
Trail #522	522
Section Line	523
Maze	524

Trail Name	Trail Number
Trail #525	525
Trail #526	526
Sand Pit	527
Meadow	529
Trail #530	530
Chihuahua Pine	638a
Los Caballos	638
Lookout Connector	640a
Juniper Ridge	640
Ghost of the Coyote	641
Valentine	551

Environmental Consequences

The environmental consequences of implementing any one of the proposed alternatives to the various elements of the recreation resource occurring within the analysis area are discussed in the following section.

Alternative 1

Direct and Indirect Effects

Under this alternative, no proposed activities would occur. Natural restoration processes would recover areas impacted by the fire and previous land uses. Selection of Alternative 1 would not change the ROS classification or acreages within the analysis area. Implementation of this alternative would not affect the potential eligibility of Canyon Creek for designation as a wild and scenic river.

Actions to remove dead trees along trails and primary access roads (see transportation section) were authorized under separate Decision Memos signed December 23, 2002, and are currently underway. Implementation of Alternative 1 would not impact these travel routes.

Activities such as hiking across country would become very difficult if not impossible in some areas. Hunters attempting to retrieve big game within these areas would only be able to do so with great difficulty. Off highway vehicle use would be limited to roads maintained open to travel in those areas that burned at moderate and high severity levels. Many of the existing roads within the area would become unusable as trees fall across them, limiting activities such as driving for pleasure. Implementation of this alternative would change the broad scale patterns and types of recreation uses in the analysis area in the long-term.

Cumulative Effects

Recreational activities that occurred before the fire would continue into the reasonably foreseeable future in areas that were unburned or burned at a low severity level within the analysis area. Implementing Alternative 1 in areas that burned at moderate and high severity levels would have long term impacts on recreation use patterns and activities as dead trees fall. Such activities as hunting and hiking across country would become very difficult in areas where dense stands of dead trees exist.

Effects Common to Alternatives 2, 3, 4 and 5

Direct and Indirect Effects

Implementing any one of Alternatives 2, 3, 4 or 5 would not change the ROS classification or acreages within the analysis area. Mitigation measures are in place to limit impacts from skid trails and temporary road construction. There are no roadless areas or primitive areas that would be impacted by action alternatives.

Forest visitor safety is a concern throughout the analysis area. Stump holes and falling dead trees are potential hazards to forest visitors. Action alternatives would improve visitor safety to some degree by removing dead trees in the vicinity of popular recreation sites.

Recreation opportunities in the analysis area would be temporarily impacted by salvage activities. Area closures to protect forest visitors during salvage logging activities; and the associated noise, increased traffic and dust; would temporarily displace visitors to other forested areas. The broad scale patterns and types of recreation uses would not change appreciably under any of the alternatives over the long-term. Low density recreation uses such as driving for pleasure, dispersed camping, hunting, and trail use would continue across the analysis area after salvage logging activities are completed and the area is reopened to public access.

Developed Recreation Sites

Developed recreation sites closed because of effects of the fire are Valentine Ridge, Upper Canyon and Airplane Flat Campgrounds. Closure of these campgrounds has displaced forest visitors to other developed campgrounds. Visitation to undamaged developed recreation sites would continue at pre-fire levels, and might increase somewhat from forest visitors displaced from their preferred fire damaged sites Sites remaining open to public use may be impacted by salvage logging activities in the form of noise and dust from trucks and associated traffic during active operations.

Visitors using facilities near the analysis area may experience overcrowding. Some may find recreation opportunities outside of the White Mountain and Rim areas and return to those areas in the future. The burned area may also attract visitors due to its notoriety in Arizona's history or because of their own connection to the land and interest in the process of landscape change.

Concentrated Use Areas

Access to concentrated use areas would not be improved once salvage logging activities are completed since only road maintenance would occur during operations. Visitor safety would be improved adjacent to CUAs after dead trees have been removed or treated. Those CUAs burned at moderate and high severity levels would no longer be attractive to visitors seeking climatic relief due to the lack of large pine trees that once provided shade.

Other local areas are likely to become more attractive to many people until vegetation returns to areas burned at moderate and high severity levels. Although it is difficult to predict where forest visitors may go, areas with similar vegetation and climatic relief along forest roads would be more attractive than areas that have been damaged by the fire. Major forest roads to the north and east of the analysis area may see increased use. Visitors seeking alternate sites may add to current camping and day use impacts in adjacent areas causing a slight increase in resource impacts. Some people may choose not to travel to the White Mountain/Rim area at all.

Special Use Outfitter Guide Activities

All action alternatives could affect outfitter guides, causing them to seek other areas in which to operate for the duration of harvest activities. Noise and additional vehicle traffic could temporarily interfere with activities under permit. In the long-term, action alternatives would lower risks of large falling trees to guides and their clients. As smaller trees begin to fall in 3-5 years, guides may avoid the analysis area until the majority of these trees are down.

Recreational Events

None of the action alternatives propose activities in the location of the permitted Whiplash Motor Sports Race. This event is held north of Highway 260 and would not be impacted by proposed salvage logging activities.

Hunting

All action alternatives may temporarily interfere with hunting activities. Noise and additional vehicle traffic may make hunting in the analysis area less desirable. Once harvest activities are complete, hunting activities may return to post-burn levels until such time as smaller trees begin to fall down in 3-5 years. Hunting activities would likely be less than pre-fire levels for years to come.

Cross Country Travel/OHV Travel

Skid trails resulting from tractors and skidders may be apparent for some time after salvage logging has been completed. Skid trails along with evidence of temporary roadways from BAER treatments may encourage cross-country OHV travel. In the long-term, vegetation would return to skid trails with the passage of time, leaving them less attractive to OHV use.

Action alternatives propose to remove commercial sized dead trees from specific treatment areas as displayed on maps for each alternative considered in detail. They also propose constructing temporary roads where needed to access salvage units. These roads would be decommissioned and reseeded upon completion of logging activities. Skid trails would be used to yard trees to landings. Within 2-5 years, the remaining un-merchantable trees would begin to rot and fall (see fuels and fire section) across the temporary roads and skid trails, blocking OHV use. OHV use within the analysis area is anticipated to decrease from current levels as trees fall, blocking temporary roads, and skid trails, and cross country routes.

Cumulative Effects Common to Alternatives 2, 3, 4 and 5

Past, present and reasonably foreseeable future activities considered during this analysis are found in Appendix A.

Activities in developed recreation sites have been limited to facility development to accommodate changes in visitor use patterns and increases in number of visitors. Few if any facility developments have been made since developed sites were initially constructed.

Those areas that are currently being salvage logged to remove hazard trees under authorities of Decision Memos approved December 23, 2002 will provide higher levels of user safety for visitors once these activities have been completed.

No future development or changes to existing facilities are expected to occur in the foreseeable future. No cumulative effects to developed sites are anticipated from implementing Alternatives 2, 3, 4 or 5. There would be a general increase in recreation use within the analysis area in the long-term as the population of surrounding areas continues to grow.

In the long-term, big game hunting opportunities may increase due to increased production of forage in areas burned at moderate and high intensity levels. No other cumulative effects to other recreational activities occurring within the analysis area are anticipated by implementing action alternatives.

Noise and engine emissions associated with salvage logging are temporary and would not contribute to long-term cumulative effects within the analysis area.

Alternative 2

Direct and Indirect Effects

Alternative 2 proposes salvage logging within the upper tributaries of Canyon Creek through use of helicopters on slopes over 40 percent along the face of the Mogollon Rim. Approximately 2,259 acres were burned at moderate and high severity levels and the scenic integrity of this area is now considered low to very low. Areas where helicopter logging occurs would be visible from portions of the Young Road (Forest Road 512); the residential areas of OW Ranch and Canyon Creek Fish Hatchery; and portions of the Fort Apache Indian Reservation. Structure of the forest stands would change from dense stands of snags to a stand with more openings and fewer trees per acre in the short-term. In the long-term, all dead trees will rot and fall down in a jackstraw fashion.

Initial damage to Canyon Creek from the fire and subsequent flooding far exceeds the temporary disturbance anticipated during salvage logging activities. Slash from salvage logging would provide approximately 30 percent groundcover on steep slopes within Canyon Creek (see Soils and Hydrologic Resources section). Limbs and treetops left on the ground would catch sediment on steep slopes, becoming the only effective ground cover until vegetation can become reestablished.

Recovery of the Canyon Creek fishery is not expected until regenerating ground cover stabilizes the watershed. Riparian vegetation such as narrow leaf cottonwood, willows and alders will return within 2-3 years in the areas that burned at moderate and high severity levels. The remaining vegetation such as ponderosa pine, spruce and Douglas-fir within the half-mile wide corridor along this stream would recover much more slowly. Potential impacts to wildlife found within this canyon are discussed in detail in the wildlife, fisheries and aquatics sections.

Removal of dead trees by helicopter yarding methods would not affect the potential eligibility of this stream as a wild and scenic river. As the vegetation and wildlife return to this area, the outstanding remarkable ecological and wildlife values for which it was nominated will likewise return. Recreational activities occurring in developed recreation sites and along Canyon Creek

would be temporarily impacted by noise from equipment and helicopters but will be of short duration.

Cumulative Effects

No additional cumulative effects unique to Alternative 2 were discovered beyond those effects disclosed in Effects Common to Alternatives 2, 3, 4 and 5.

Alternatives 3, 4 and 5

No additional direct, indirect and cumulative effects unique to Alternatives 3, 4 and 5 were discovered beyond those effects disclosed in Effects Common to Alternatives 2, 3, 4 and 5.

Transportation System

Introduction

This section provides a summary of transportation needs and anticipated impacts of salvage logging activities. Emergency road repair and stabilization was performed on some of the main roads within the fire area under Burned Area Emergency Rehabilitation (BAER) authorities. A roads analysis was performed in October 2002 identifying roads to be maintained, roads and or sections of roadways with potential for adverse impacts on streams and riparian areas, safety issues and road management strategies.

Methodology Used for Data Collection and Analysis

Proposed road treatments were analyzed in each alternative considered to determine possible effects to road conditions, maintenance, and commercial road use. Total numbers of trucks required to remove dead trees resulting from salvage logging activities (termed haul loads) and loads per day were based on a two year timeframe with normal operating seasons and 50 percent of the projected haul occurring during the first operating season. These assumptions and an estimated volume of 5,000 board feet per truckload were used for total number of truckloads and number of truckloads per day. Haul routes were analyzed based on topography, previous haul routes and anticipated market locations.

Tools used to disclose possible effects to the transportation system include GIS maps; INFRA Roads Database, Roads Deferred Maintenance data; technology and information from workshops, Water/Road Interaction Technology Series, professional judgment; and local knowledge. Additional information was obtained from *Evaluating the Effectiveness of Post Fire Rehabilitation Treatments*, USDA, September 2000; *Managing Roads for Wet Meadow Ecosystem Recovery*, Southwest Region FHWA-FLP-96-016; and *Geomorphologic Impacts of Culvert Replacement and Removal*, USFWS, February 2003,Version 2.0.

Regulatory Requirements

Forest Service Manual (FSM) 7700-Transportation System, describes the authority, objectives, policy, responsibility, and definitions for planning, construction, reconstruction, operation and maintenance of forest transportation system facilities.

Applicable laws in FSM 7701 include:

Coordination with Forest Planning – Title 36, Code of Federal Regulations, section 219.27 (36 CFR 219.27). Requires transportation access to be addressed in the land and resource management planning process.

Revegetation – Forest and Rangeland Renewable Resources Planning ACT of 1974 (16 U.S.C. 1601, PL 93-378) as amended by the National Forest Management Act of 1976 (16 U.S.C. 1608, PL 94-588). Directs that roads meet standards appropriate to intended uses, and prescribes the revegetation of temporary and undeveloped roads within 10 years of their last contracted or permitted use.

Applicable objectives in FSM 7702 include:

Providing long-term economical access to National Forest System lands for administration, protection, and utilization of National Forest lands and resources that is consistent with Forest Plan guidance.

Managing a forest transportation system within the environmental capabilities of the land.

Managing forest transportation system facilities to ensure user safety, convenience, and efficiency of operations in an environmentally responsible manner; and to achieve road related ecosystem restoration within the limits of current and likely funding levels.

Coordinating access to National Forest System lands with national, regional, statewide, local, and tribal government transportation needs.

National Forest System policy in FSM 7703 – Policy requires each national forest to determine and provide for the minimum forest transportation system that best serves current and anticipated management objectives and public uses of National Forest System lands as identified in the appropriate land and resource management plans (FSM 1920). In managing the forest transportation system for access, responsible officials must coordinate with other public and private transportation system agencies to integrate transportation information and to balance transportation facility investments and maintenance costs against the need to maintain land health and water quality.

FSM 7731.1 requires forests to: manage and control use of forest system roads to prevent damage to the roadway; abate unsafe traffic conditions; limit the use of vehicles that exceed design capacity such as width, weight, or length of loads; require appropriate investment sharing from commercial users; and reduce maintenance costs. In addition, forests are to manage and control use to meet other specific management direction such as protecting wildlife habitat or achieving semi-primitive recreation objectives.

Applicable laws in transportation system management include:

National Forest Roads and Trails Act of October 13, 1964 as amended (16 U.S.C. 532-38, PL 88-657). Authorizes road and trail systems for the National Forests.

Highway Safety Act of 1966 (23 U.S.C. 402 PL 89-564). Authorizes state and local governments and participating federal agencies to identify and survey accident locations; design, construct, and maintain roads in accordance with safety standards; apply sound traffic control principles and standards; and promote pedestrian safety.

Title 36, Code of Federal Regulations, Part 212 (36 CFR Part 212). Establishes requirements for the administration of the forest transportation system, including roads, trails, and airfields, and provisions for right-of-way acquisition. Describes a minimum road system and requires a science-based roads analysis to plan the road system and to set funding priorities.

Title 36, Code of Federal Regulations, sections 261.12 and 261.54 (36 CFR 261.12 and 261.54). Establishes prohibitions on forest transportation system roads that are enforceable by the Forest Service and other federal law enforcement officials.

Apache-Sitgreaves National Forests Land and Resource Management Plan – Management direction is provided at page 16, forestwide standards and guidelines are found at pages 104-106, 106-1, and 107. Management Area 1 has standards and guidelines at pages 142-143 (USDA, 1987).

Tonto National Forest Land and Resource Management Plan – Management direction is provided at page 21. Forestwide standards and guidelines occur at page 48 and page 159 in Management Area 5-D (USDA, 1985).

Affected Environment

The analysis area contains approximately 530 miles of National Forest System roads ranging from smooth gravel-surfaced roads to rough primitive, un-surfaced roads. These roads are classified as forest roads under the jurisdiction of the Forest Service and are needed for long-term motor vehicle access. Most of these system roads were planned and constructed during past commercial timber harvest activities and most are not considered all weather roads.

Current open road densities (Level 2 and above) are near forest plan standards and guidelines, averaging less than 2.0 miles/square mile. There are a number of unclassified roads in the analysis area that have been developed by repeated vehicle travel across country during hunting and wood gathering activities. The long-term needs of both unclassified and classified road management, including road decommissioning, reconstruction and realignment, are being addressed in other analyses and decision documents by the long-term rehabilitation team.

Main forest system roads link with improved county roads in several locations which in turn link to double-lane paved state highways to form a transportation system that provides access to National Forest System lands for a variety of uses from towns and communities in the surrounding area.

Forest system roads within the analysis area are managed in accordance with management objectives that are based on a variety of needs for access and forest resource use. This area contains roads that are operated and maintained by the Forest Service for use by passenger cars and high clearance vehicles; and non-motorized uses such as hiking, horse back riding and cross country skiing. The objective maintenance levels as defined in FSM 7702 (and miles of each level) for roads in the analysis area are summarized as follows:

Level 1 roads (139 miles) are used on an intermittent basis, receiving basic custodial care between periods of use to keep them stable, with functional drainage facilities; keeping resource damage at an acceptable level. Yearlong motorized use restrictions apply.

Level 2 roads (191 miles) are open for use by high clearance vehicles, although some of these roads may have seasonal use restrictions. Traffic is normally minor and they receive basic custodial maintenance. Roadways are kept free of vegetation to accommodate passage by high clearance vehicles.

Level 3 roads (61 miles) are open and maintained for travel by a prudent driver in a standard passenger car. These are typically low speed, single-lane roads with turnouts and spot surfacing.

Level 4 roads (139 miles) are open and provide a moderate degree of user comfort and convenience at moderate travel speeds. Most of these roads are double-lane and aggregate surfaced.

Level 5 roads (0 miles) are open and provide a high degree of user comfort and convenience. These roads are normally double-lane paved. Only Highway 260 meets this maintenance level objective and is under the jurisdiction of the State of Arizona.

Emergency roadwork was completed in September 2002 under BAER authorities. This work consisted of removing culverts, hardening drainage crossings and installing numerous grade dips to handle an expected increase in runoff flows as a result of lost groundcover. Emergency road maintenance work was performed on 129 miles of the existing 391 miles of open roads in the analysis area. This included the following Forest Development Roads (FDR) by number designation: 139, 125, 124, 87, 51, 50, 86, 132, 130, 219, 139, 161, 107, 146, 135, 136, 140, and

300 on the Apache-Sitgreaves and the 33, 34 and 188 roads on the Tonto National Forests. Reconstruction of roads within the analysis area damaged as a result of the fire and work performed under BAER authorities is a long-term rehabilitation effort to be considered in additional NEPA analysis and appropriate decision documents.

A deferred maintenance backlog exists on all roads in the analysis area. This backlog is a result of insufficient road maintenance dollars over the last several years and is needed to meet safety requirements, resource protection and road objective levels. There are currently 530 miles of open and closed roads in the analysis area that require some level of maintenance as shown in the following table:

Table 51 - Deferred maintenance cost summary by maintenance level within the analysis area

Maintenance Level	Analysis Area Miles	Average Cost per Mile	Total Analysis Area Cost
1	139	$2,000	$278,000
2	191	$13,422	$2,563,602
3	61	$73,359	$4,474,899
4	139	$72,977	$10,143,803
5	0	$60,596	0

Costs are derived from Deferred Road Maintenance Summary, Table RTEWK05L, located in the Forest Supervisor's Office in Springerville, AZ.

Commercial Road Use

Several roads located within the analysis area; FDR 51, 86 and 136, among others; provide access to private lands as well as recreational destinations during the summer. Mitigation measures are in place to minimize impacts to private landowners by keeping commercial traffic away from residential areas, which can become congested with summer recreation traffic. Logging traffic is also occurring from harvest on private lands scattered throughout the analysis area and will continue until this material has been removed by private land owners. Traffic levels are considered to be low and normally of short duration for this activity.

Aggregate and pit-run materials are available from private land sources within and adjacent to the analysis area. The location of these sources would depend on who purchasers the dead timber and where work would be performed. No toxins have been reported from these sources and none is anticipated.

Travel Restrictions, Signing and Dust Abatement

Access and travel management within the analysis area is currently managed through travel restriction order #01-377, signed August 27, 2002. Motorized vehicles, including off highway vehicles (OHVs), are restricted to open roads listed and mapped on the order. The remainder of the roads within the analysis area are closed to access by motorized vehicles, camping, and fuelwood cutting. Signing is minimal or lacking throughout much of the analysis area. No dust abatement is occurring on existing roads within the analysis area.

Temporary Roads

Access to some portions of proposed treatment areas exceed maximum skidding distances and would require the construction of temporary roads. Temporary roads may also be constructed to avoid more sensitive soils or to meet other environmental requirements such as avoiding unburned or underburned areas, and Mexican spotted owl protected activity centers (PACs) or northern goshawk post fledging areas (PFAs).

Trails

Over 106 miles of trails affected by the fire lie within the analysis area. All or portions of these trails are currently closed for user safety (see Recreation Section).

Environmental Consequences

Roads within the analysis area would be impacted to one degree or another by selection of any of the alternatives being considered. The environmental consequences for maintenance and commercial road use during salvage logging activities resulting from any of the alternatives are considered. Mitigation measures to reduce anticipated impacts through use of travel restrictions, dust abatement methods and additional sign installation are disclosed.

Alternative 1

Direct and Indirect Effects

No maintenance would be performed to stabilize and rehabilitate forest system roads. Conflicts between non-commercial use and commercial timber hauling would not occur with this alternative. Private landowners would continue to use these roads to remove dead trees from their property. However, this traffic is considered light and sporadic in nature.

Since no additional road reconstruction or maintenance would be performed, some roads within the analysis area would experience accelerated damage from erosion. Current road maintenance budgets and the backlog of deferred road maintenance would prevent needed maintenance and repairs on approximately 330 miles of Level 1 and 2 roads. These roads have the highest potential for damage from erosion and increased runoff. Channeling of existing roadways, washouts and mass movement of soils are expected to occur. Very limited road maintenance activities would continue on the main road system.

Temporary road construction and subsequent decommissioning activities would not occur in this alternative. Short-term impacts of these roads to soils and water from erosion and sedimentation would be avoided.

Cumulative Effects of Alternative 1

Appendix A displays past, present and reasonably foreseeable future activities occurring within and adjacent to the analysis area. Past activities considered in this analysis are the construction and maintenance of roads in conjunction with past timber sales, construction and maintenance of roads to provide access to private lands and state, county, and Forest Service maintenance and reconstruction activities.

Implementation of Alternative 1 would have cumulative effects when added to the effects of work performed under BAER authorities to remove culverts from stream crossings. Sediment and erosion rates displayed in the soils and hydrology section would continue to occur at the highest levels due to the lack of ground cover. The effects from past road construction and maintenance in

conjunction with past timber sales and private land access road construction and maintenance have been essentially negated by BAER work.

There would be no cumulative effects of road maintenance activities presently occurring in the Jersey Horse and Phelps Timber Sales, and State and County road maintenance by Alternative 1. No cumulative effects are expected to occur from implementing Alternative 1 to maintenance activities presently occurring that were authorized in the three Decision Memos approved December 23, 2002.

No cumulative effects are expected to occur by implementing Alternative 1.

Effects Common to Alternatives 2, 3, 4 and 5

Direct and Indirect Effects

There is potential for road damage to occur from commercial hauling of salvaged timber and aggregate surfacing or pit-run materials during spring and summer monsoon periods when road surfaces are subject to increased moisture and runoff. For all action alternatives, management to prevent road damage would include typical contract specifications and drawings with language to prevent such damage. Mitigation measures and use of BMPs are in place to offset impacts that may occur from implementing any one of the action alternatives. Certified personnel, capable of recognizing when conditions are approaching unacceptable levels, would administer these contracts and take corrective action to prevent damage.

A combination of road-related watershed improvements and deferred maintenance work would take place on existing roads. Aggregate surfacing and pit-run materials would be placed at locations to meet BMPs established for this project and identified in the roads analysis dated November 4, 2002 for roads located on sensitive soils and for roads located too close to streams to minimize sedimentation and erosion. Maintenance work would range from installing additional drainage structures and restoring natural channels, to improving drainage features and hardening road segments adjacent to drainages and drainage crossings.

In addition to proposed road treatments, annual road maintenance in conjunction with normal activities would continue throughout the entire project area on a priority basis as funding becomes available. An area Roads Analysis Process (RAP) has been completed for temporary road construction proposed within the analysis area and is available in the project record.

Each action alternative includes application of spot aggregate surfacing and pit-run materials to some existing roads. This material would not be produced on National Forest System lands but would be supplied from commercial sources located on private lands. It is likely that the sources would be near the analysis area, but the exact location is unknown and can only be determined by the contractor(s) furnishing these materials to the Forest Service. The amount of this material would vary by road as to quantity and locations. Soil type and proximity to drainages or meadows dictate road locations, which are designed to minimize erosion and sedimentation; and to provide adequate load bearing surfaces during wet weather.

Road maintenance treatments anticipated for identified system roads within the analysis area are described as follows:

Spot Surfacing – Crushed aggregate would be placed at locations along the roadway to improve load bearing where rutting is evident. Surfacing would also be placed on sections of the roadway adjacent to drainages and meadows to prevent erosion and sedimentation.

Spot Pit-run Materials – Pit-run rock materials would be used to re-establish road templates, armor roadway shoulders, construct drainage dips and stabilize existing roadbeds located on unstable soils.

Drainage Structures – This work would consist of installing and or maintaining drainage features, sediment traps, and hardening natural crossings to handle expected increased runoff from fire-damaged slopes.

Clearing – Trees would be removed and trimmed as needed to meet health and safety requirements for site distance and vertical clearance.

Dust Abatement – Water and or dust palliatives such as magnesium chloride and lignin sulfonate may be used on sections of roadway adjacent to private land and on heavy truck traffic sections to reduce dust.

Treatments should bring the roads into conformance with assigned maintenance levels and meet best management practices (BMPs) to minimize erosion and sedimentation. Deferred maintenance items would be completed based on priority, with emphasis on health and safety items. The following road maintenance treatments would occur in accordance with post-fire assessment recommendations, and deferred maintenance identified in condition surveys.

Table 52 - Road treatment activities by alternative

Proposed Road Treatment	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Spot Surfacing (miles)	130	108	130	130
Spot Pit-run Materials (miles)	212	174	189	193
Drainage Structures (miles)	319	281	290	293
Turnouts (miles)	151	142	136	139
Clearing (miles)	145	117	115	124
Dust Abatement (miles)	59	30	46	49

Treatments would only occur where needed in high priority areas and not over the entire number of miles indicated by each alternative. Alternatives 3 and 4 would require the least amount of road maintenance work while Alternatives 2 and 5 would require the most.

Road Conditions and Maintenance

Forest system roads used for commercial timber haul would receive maintenance commensurate with their use. Major haul routes would receive adequate maintenance and surfacing to facilitate

winter operations. Construction of turnouts would be done to meet safety requirements for log haul in accordance with deferred maintenance requirements. Road management would be needed that may include road closure; additional signing and or one-way directional haul routes due to the large amount of truck traffic. Maintenance would be in accordance with contract specifications and drawings. Certified contract personnel would monitor road conditions.

Reductions of annual maintenance budgets have not matched overall use and needs, as indicated by the large forest road deferred maintenance backlog. The effect of years of active road development from a large timber program throughout the project area and recent drop in timber sales activity has resulted in the current backlog (Apache-Sitgreaves and Tonto National Forests infra database). With all action alternatives, both Forests would continue to complete a small number of deferred maintenance projects. Road work related to ongoing timber sale activity within the analysis area would continue, allowing operation and maintenance efforts to occur on other roads.

Salvage logging would require use of Level 1 through Level 4 roads within the analysis area. Miles of roads to remain open after use or closed after use are displayed in the following table.

Table 53 - Summary of road maintenance levels by miles and alternative

Road Levels	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Existing open roads (Levels 2, 3, and 4) to remain open after use (miles).	249	221	223	234
Existing closed roads to be opened and re-closed after use (Level 1) (miles).	117	88	100	105

Alternatives 2 and 5 require the most roads for salvage logging activities, followed by Alternatives 4 and 3.

Commercial Road Use

There is potential for commercial and non-commercial motorized user conflicts across the entire analysis area from the projected volume of commercial truck traffic, and associated commercial hauling of aggregate and pit-run materials for road treatments for all action alternatives. Motorized user conflicts, having the following effects, would be mitigated through normal contract safety requirements and public notices:

- Lower-than-normal speeds on area roads.
- Travel delays.
- Dust and noise from truck traffic.
- Increased potential for motor vehicle accidents.

Forest system roads used for commercial timber haul would receive maintenance commensurate with their use. For commercial haul to occur during the winter operating season, the main haul

roads would be maintained at a level approaching an all weather road standard. Dry or frozen road conditions would be necessary in order to operate vehicles on the remainder of the system. Without these conditions, rutting and damage to road surfaces could occur in conjunction with salvage logging and maintenance activities. Normal contract specifications and drawings, and monitoring of conditions by contract administration would stop commercial haul traffic as needed to protect road surfaces.

All action alternatives would minimize commercial traffic on FDR 51, 86 and 136 by routing commercial operations to adjacent forest roads. This would minimize impacts to private landowners and move commercial traffic away from residential areas that can become congested with summer recreation traffic.

A high volume of commercial and heavy equipment traffic would impact State Highway 60 and State Highway 260 at intersections with forest roads. The biggest impact would be expected during the summer recreation season. Because the dead timber needs to be harvested before its value declines, truck traffic in excess of 200 roundtrips per day could be expected on several of the main haul roads. This could require traffic control and or dust abatement to meet safety requirements.

Several forest roads would have truck traffic anticipated to be in excess of 1,000 total trips during salvage logging activities. Dead trees that are salvaged in proximity to the main highway would be hauled out through the intersection of FDR 51 and SH 260. The remaining timber volume would be routed across FDRs 50 and 124, to FDR 144. The increase in commercial traffic could cause additional traffic control and signing needs, as well as the need for dust abatement to ensure safety. These routes would require additional turnouts and traffic management to meet health and safety requirements. The effects of commercial traffic to private landowners and lack of adequate sight distance at the intersection of FDR 51 and State Highway 260 would require mitigation.

Travel Restrictions

Access and travel management within the analysis area is currently managed by travel restriction order #01-377, signed August 27, 2002. This closure order would remain in effect until salvage logging and road maintenance work is completed. Additional closures and management restrictions would be used during salvage logging operations to protect logging operators, forest service personnel and other forest users. Travel management activities would be coordinated with Arizona Game and Fish to ensure that information is provided to visitors planning to hunt or fish within portions of the analysis area.

Dust Abatement

Treatments such as magnesium chloride and lignin sulfonate may be applied to the road surface in conjunction with grading and watering activities. Dust abatement treatments minimize dust that can reduce visibility and lead to decreased driver safety. Conditions such as location, surface type, weather and volume of traffic would be considered. The timber sale purchaser would complete this work on sections of roadway identified in the timber sale contract and as needed to meet safety requirements during hauling activities. Mitigation measures are in place to prevent impacts to the Chiricahua leopard frog and its habitat.

Sign Installation

Route numbering and directional signs damaged during the fire would be replaced to ensure clear signage. Travel restriction signs would be installed where public access is restricted and at road

junctions and other access points. Construction warning and traffic control signs shall be in accordance with the Manual on Uniform Traffic Control Devices, 2000 edition. Traffic control plans would need to be coordinated with existing timber sales and future sale activities to ensure public safety.

Temporary Road Construction

Temporary road construction would occur where skidding distance requirements cannot be met by the existing road system. Temporary roads would be constructed to minimum standards for access by harvesting equipment and log trucks. Temporary roads would also be used to minimize skidding through unburned and lightly burned areas (see Alternative Maps in Appendix G for locations). Temporary roads would be used for short durations, normally less than one season of operation and then closed and seeded in accordance with mitigation measures.

Table 54 summarizes temporary road construction proposed in action alternatives to salvage dead trees from treatment areas, by number of segments, average length of segments in feet and total miles and approximate acres within road prisms.

Table 54 - Summary of temporary road construction by alternative

Temporary Road Construction	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Number Segments	40	30	36	38
Average Length of Segments (feet)	2,627	2,499	2,669	2,640
Total Miles	19.9 mi.	14.2 mi.	18.2 mi.	19.0 mi.
Approximate Acres Within Road Prism	40	28	36	38

Alternative 3 requires the least amount of temporary road construction, followed by Alternatives 4 and 5, with Alternative 2 requiring the most.

New temporary roads would be located in areas requiring minimal cuts and fills. Total area of disturbance is normally less than two acres per mile of new construction. Alternative 2, which proposes the most miles of temporary road construction, would equal approximately 40 acres of disturbance. Alternative 5 proposes two miles less, followed by Alternative 4 and Alternative 3 proposes the least amount of disturbance.

Cumulative Effects Alternatives 2, 3, 4 and 5

Appendix A displays past, present and reasonably foreseeable future activities occurring within and adjacent to the analysis area. Past activities considered in this analysis are the construction and maintenance of roads in conjunction with past timber sales, construction and maintenance of roads to provide access to private lands and state, county, and Forest Service maintenance and reconstruction activities. Long-term rehabilitation efforts to be considered in additional NEPA analysis and appropriate decision documents include reconstruction of roads within the analysis

area damaged as a result of the fire and work performed during and after the fire under BAER authorities.

Road maintenance activities consisting of road maintenance and surface replacement on aggregate surfaced roads in conjunction with the Jersey Horse and Phelps Timber Sales would continue to occur. Future timber sales and activities in the area would require similar maintenance activities, consisting of road surface grading, spot surfacing with aggregate materials, spot placement of pit-run materials, sight distance clearing, maintenance of drainage structures and closure of temporary roads.

A road use agreement with the White Mountain Apache Tribe identified roads within the analysis area for hauling timber salvaged from the Rodeo-Chediski Fire off tribal lands. These same roads are proposed for hauling dead timber from treatment areas considered by action alternatives. Use by the Tribe was largely completed by June 2003 and the agreement terminated upon acceptance of final maintenance work, which included surfacing, turnouts, and drainage work on FDR 146, and portions of FDR 300.

The direct effects of the use and maintenance of these roads by the Tribe is that fewer miles would require maintenance under any of the of action alternatives. Other roads used during salvage operations would receive additional maintenance work as displayed in Table 52.

Salvage logging activities are occurring to remove dead trees along forest development roads within the analysis area under separate Decision Memos approved December 23, 2002. A complete listing of the roads involved, actions planned in conjunction with these decisions is available in the project record. These activities are of short duration and road maintenance is commensurate with use. Maintenance activities would benefit users, and reduce erosion and sediment. There are no anticipated cumulative effects of the salvage harvest and maintenance activities proposed in Alternatives 2, 3, 4 and 5 to roads and their facilities within and adjacent to the analysis area.

Temporary roads would have little or no effect on past, present or reasonably foreseeable future activities. Roads would be used for short duration, decommissioned and reseeded after use.

Alternative 2

Direct and Indirect Effects

This alternative proposes using helicopters to yard dead trees from slopes over 40 percent to landing areas. Landing areas would be less than one-half acre in size for decking, and have the potential to increase dust and sediment during activities. Haul activity on main roads in the Canyon Creek drainage may increase dust and additional maintenance on roads could produce sediment. Mitigation measures and BMPs would minimize these potential impacts (see Tables 1, 2 and Appendix B). Implementing Alternative 2 within the Canyon Creek drainage would reduce current road maintenance needs.

Cumulative Effects

There would be no cumulative effects from implementing Alternative 2 when added to past activities occurring within the Canyon Creek area since the fire and emergency BAER work essentially removed all traces of these activities.

Implementing Alternative 2 would have no cumulative effects when added to the effects of the OW Timber Sale, authorized by three Decision Memos approved December 23, 2002. This small

timber sale is anticipated to be completed prior to the time that Alternative 2 would be implemented.

Future timber sales and associated activities in the area would be required to complete commensurate maintenance activities and spot surface replacement on aggregate surfaced roads. There are no anticipated cumulative effects of the salvage harvest and maintenance activities proposed in Alternative 2 to roads and their facilities within and adjacent to the analysis area.

The direct, indirect and cumulative effects of Alternatives 3, 4 and 5 have been disclosed in the above discussions under Effects Common to Alternatives 2, 3, 4 and 5.

Social and Economic Setting

Introduction

The social environment is perhaps the most diverse and emotionally charged arena in ecosystem management. The social environment for this analysis comprises the people living in and adjacent to the Rodeo/Chediski Fire. In particular the social analysis will examine the communities in and around the Sitgreaves National Forest.

Forest resources play an important social role for the people of eastern Arizona. The goods, services, and uses available from the National Forests represent major components in the lives of many residents within this area. It appears that the public, as well as land managers, are struggling to come to grips with what some have claimed to be a fundamental shift in forest related values. "It is increasingly recognized that although traditional forest management was appropriate for the period in which it was developed, the social context for forestry has changed and our scientific understanding of forest ecosystems has grown" (Bengston, 1993). Ecosystem management can be viewed as a response to these changing values, or as a driving force that is creating value change. In either case, forest values play a critical role in identifying ecosystem management goals, setting the context for decision making, and guiding choices (Xu and Bengston, 1995, unpublished).

Geographically this region can be describe as largely rural with large tracts of open lands and small communities that rely on a commercial center to augment their lifestyles. Recent population trends have moved the Southwest to be more urban-oriented. This trend has affected the counties (Gila, Coconino, and Navajo, counties) in which the Rodeo/Chediski Fire burned.

Few generalizations can be made about the communities across the Southwest. They are as diverse as the people who live there and due to the increasing popularity of the Southwest as highly desirable living location the diversity is increasing. It should not be expected that all residents would have the same or even similar points of view on various issues.

Area of Analysis

The White Mountains of Arizona cover an expansive geographic area. The rim communities largely lie along State Highway 260 from Forest Lakes east to Pinetop/Lakeside and consist of Heber/Overgaard, Clay Springs, Pinedale, Linden, and Show Low. Plateau communities include: Snowflake, Taylor, Saint Johns and Holbrook. The White Mountain Apache communities of White River, McNary, and Hondah are also economically and socially tied to the area.

In addition to these communities there are the communities of Round Valley (Springerville, Eager, Greer, and Nutrioso) that are also associated with the White Mountains. The area is entirely rural with no large (>25,000) single population center, although Show Low serves as the commercial hub for the White Mountains.

Methodology Used for Data Collection and Analysis

This analysis utilizes principles and procedures outlined in *Social Impact Analysis, USDA Forest Service Course 1900-3* and *Guidelines for Conducting Social Assessments within the Human Dimensions Framework* (Bright, 1999; in press). Social analyses are conducted by the Forest Service to discover what effect the agency has on local communities and the people using natural resources. A Social Impact Analysis estimates how Forest Service policies and actions affect the quality of people's lives and social well-being. It helps resource managers examine the human dimension of ecosystem management as part of the decision making process.

Regulatory Requirements

The need to consider social and economic factors is intimated in the purpose of the National Environmental Policy Act (Sec. 2 [42 USC 4321] and specifically in the directive (A) under Sec. 102 [42 USC 4332] to “utilize a systematic, interdisciplinary approach which will ensure the integrated use of the natural and social sciences” in the planning and decision making that may have an impact on man’s environment. NEPA requires that unquantifiable and qualitative environmental amenities and values receive the same serious consideration as economic and technical factors.

40 CFR 1508.14 describes the human environment to include the natural and physical environment and the relationship of people with that environment. While economic or social effects are not intended by themselves to require preparation of an environmental impact statement (EIS), when an EIS is prepared and economic or social and natural or physical environmental effects are interrelated, then the EIS will discuss all the effects on the human environment.

Section 1970.45 of the USDA Forest Service Manual requires economic and social analyses in the development of proposals with major economic or social impacts. Sections 1972 and 1973 outline requirements for economic and social impact analysis, respectively, of programs and activities that could have significant impacts as required by the National Environmental Policy Act.

Section 1973.03 of the UDSA Forest Service Manual delineates the policy of initiating social impact analysis if the potential social effects of actions are important to the decision. The responsible official early in scoping makes this determination.

Affected Environment

Demographics

It is not anticipated that the proposal will actually impact any demographic measures, but to help define the scope of the impacts certain demographic features will briefly be described. Humans have been an integral part of the southwest for over 12,000 years. The Mogollon Rim Ecosystem has a long history of human use dating back at least 5,000-6,000 years through the Archaic Period. The first humans to use the area were small hunting and gathering groups moving through the area looking for game, water, and plant resources (CEEM Report, 1999). Small non-intensive agriculture farms were the staple for the community and family. The basic goal of the village economy was local subsistence, not commercial production (Raish, 1995).

In the 1870's and 1880's the railroad linked the Southwest to population centers of the east and west coasts. These new connections promoted and expanded new industries, including sheep and cattle ranching, mining, and timber. These types of industries helped "settle" the Southwest and opened it to more intensive use than the preceding subsistence economies (RM-GTR-295).

In the 1930s Southwest Lumber began moving into the Overgaard area and by 1938 the community of Overgaard was established by Chris Overgaard who moved his mill from South Dakota. The new industry attracted folks to the area to work in the mill and in the forest (Heber/Overgaard Plan, 1996). Many men from the Heber area also took also took jobs with the timber companies. In the 1940s, L. D. Porter consolidated smaller mills in the Heber area and began to compete with the Southwest Lumber Mill in Overgaard. Other business followed to support the growing population of the area. Through the 1940s both mills operated, but around 1952 the mill in Overgaard was closed down and moved to McNary. During this early logging

period most of the analysis area was logged over. The mill in Heber continued operation into the 1980s when it was closed down and moved outside of town.

Today Arizona has a population of approximately 5.1 million (Census 2000) with a projected population of 5.7 million in the year 2007. By the year 2025, non-Hispanic Whites are estimated to comprise 57.5 percent of Arizona's population. This composition is down from 2000 levels of 63.8 percent. In Arizona, the Hispanic population is estimated to grow by 137.5 percent between 1995 and 2025 ranking it as the 5th largest gain in the Nation during this period (Census Bureau, Population Division).

Approximately two-thirds of the states populations reside in the Phoenix metro area. It is also one of the faster growing areas in the state, especially in the young working ages (25-40). The majority of this population is within three hours of the Rodeo/Chediski Analysis area by vehicle. Forecasters predict that Arizona will continue its rapid rate of growth at annual rate of 2.4 percent, compared to a national rate of 0.8 percent (AZ-SCORP, Draft, 1994).

The affected social area for the Rodeo/Chediski Fire Salvage lies within a four county area consisting of Apache, Coconino, Gila and Navajo Counties. The majority of the fire area is within Navajo County. The U.S. Census Bureau estimates the population of Navajo County to be approximately 97,470 in 2000. American Indians (Native Americans) make up 49 percent of the county's population. Applied Geographic Solutions (AGS) projects the county's population to be 114,000 by the year 2007. All four of these counties are very rural; contain a large land base and a low population density of 10 people or less per square mile, as compared to the overall population density for the state, which is over 40 people per square mile.

Throughout the White Mountains, the Census defined class of “White,” is the predominate ethnic group or race, except in the White Mountain Apache communities.

The U. S. Census Bureau estimated the community of Heber/Overgaard to have a population of 2,722 full-time residents in 2000 (Table 55). The local electrical company estimates the total population of full and seasonal residents to be closer to 8,000 in 1996 (Heber/Overgaard General Plan, 1997), with approximately 60 percent being seasonal. The Census Designated Place estimates that 59.1 percent of the homes are in fact seasonal (Census, 2000).

Table 55 - Demographics of the White Mountain communities (Census, 2000)

Community	Total Population	White	American Indian	Hispanic	Median Age	Average Family Size
Heber/Overgaard	2,722	91.10%	2.50%	6.10%	48.3	2.79
Show Low	7,695	83.70%	5.00%	10.30%	36.6	3.07
Pinetop-Lakeside	3,582	83.60%	3.40%	11.40%	41.1	2.92
Holbrook	4,917	48.10%	26.30%	23.30%	29.6	3.47
Snowflake	4,460	83.20%	7.60%	8.00%	27.6	3.81
Taylor	3,176	83.20%	6.70%	9.20%	25.5	3.81

Community	Total Population	White	American Indian	Hispanic	Median Age	Average Family Size
Eagar	4,033	79.80%	4.80%	14.00%	33.1	3.38
Springerville	1,972	66.80%	7.70%	25.20%	36.7	3.18
St Johns	3,269	68.80%	7.20%	23.20%	30.8	3.55
White River	5,220	2.90%	96.60%	0.50%	20.9	4.45
McNary	349	5.70%	86.00%	5.70%	18.8	4.18
Payson	13,620	91.30%	2.50%	5.20%	48.9	2.71
Young	561	94.80%	0.90%	3.40%	48.4	2.71

Attitudes, Beliefs, and Values

These attributes are often reflected in how people respond to a proposal. They help shape the way people think. Attitudes reflect people's evaluations of something as favorable or unfavorable. They can be strong and well formed or weak and broad, and are generally developed through a variety of learning processes. Beliefs represent what people believe to be true - a person's subjective probability that an object has one or more attributes. Values represent what people hold close and dear to them. They are generally regarded as important life goals or standards. People's value systems can be viewed as the building blocks of their attitudes and beliefs (PNW-GTR-385, 1996).

Many people view forests as having inherent worth in and of themselves, independent of their utility to humans. They believe in protecting forests because they feel it is important, independent of any utilitarian motive.

This view contrasts with values towards forests that have led to the natural resource management policies for publicly owned forests that provide for resource extraction for commodity production.

Following the Rodeo-Chediski Fire, the Forest Service contracted with Washington State University, Department of Natural Resources, to complete an inductive case study for the communities most affected by the fire. In-depth, semi-structured interviews were conducted with seventy-five residents from the rim communities. Categories of interview topics ranged from management of the fire, impacts on the local communities, and attitudes towards salvage and current forest conditions. Carroll (2003, in press) states residents of the study area interviewed generally wanted the burned timber to be salvaged if possible.

Recent history indicates that numerous factors play a role in shaping forest policy. Public attitudes about salvage activities will be very diverse and the opinion expressed will generally reflect their personal value system. Certain segments of the population believe that post-fire logging may harm forests as burned trees play a vital role in forest rejuvenation. Others believe the burned area poses a threat to communities for the possibility of another fire. Still others want to take advantage of the economic returns, while others just find the current situation unwanted and unsightly.

Lifestyle

Lifestyles include style and perceived "quality of life" for individuals or groups. This may include employment or work patterns, leisure and recreation behavior, how and where people practice their religion, and visitation patterns with friends and family.

In the rural areas of the Southwest, where sparse populations dominate the landscape, most residents live close to where they work and have a direct or indirect tie to the natural resources for their livelihood. Most rural residents believe resource utilization would be less disruptive to their local communities than most other forms of economic development. Rural residents tend to be willing to live at a lower income if the only means of acquiring higher incomes is to live in highly urbanized areas. Community and family are essential to their quality of life.

In a survey completed by Apache County Development (Cosgrove, 1998), which covered Greenlee, Apache and Navajo counties, respondents rated the importance of the surrounding natural environment to the quality of life in their community as a 6 on a scale of 1 to 7. This was the highest rated variable in the survey. The respondents also rated preserving the existing ways of life and values as a 5.7 on the scale. The Rodeo-Chediski Fire has threatened this way of life by drastically changing the natural environment. Over 470 structures were loss as a result of the fire and emotional stress associated with the event will linger for most residents. Most of those individuals interviewed by Carroll who had lost their homes planned on rebuilding. Residents wanted to stay in the area because of their attachment to the area and finances (Carroll 2003, in press).

Because the forested environment serves as a draw for the area seasonal homes are very popular within the rim area, comprising 60 percent of homes in the analysis area.

Social Organization

Social organization represents how people organize to meet their needs, including elements of community cohesion and stability. There are many factors that can generate a sense of community. Various solidarity groups reflect patterns of associations. Common interests often drive why people associate together in society. And of course, locality contributes to people's perception of community.

Of particular interest to this proposal are the small local communities in the vicinity of the proposed activities, where local residents are actively pursuing economic development possibly related to tourism and recreation.

The rim communities of the White Mountains contain a significant percentage of seasonal residents. Occasionally there is conflict between the values that seasonal and/or retired residents possess and those that are integrated into the resident culture

Economic Factors

Employment

The following analysis focuses on data for Navajo County because the majority of the direct impacts of the fire occurred within this county and much of the salvage activity would take place within Navajo County communities. With population changes and growth, employment within the analysis area has also been changing. Linked to the increases in recreation, tourism and second home ownership, employment in construction, services, and trade have increased in the

last 10 years while jobs in mining and manufacturing have declined. These trends are consistent with much of the rural west. In some cases, the change appears to be fairly large, as in the case of agriculture, but the gains and losses in actual job numbers is relatively small. While the large growth in the services and trade has increased the number of job opportunities in the county, these jobs tend to be seasonal or part time and often do not have high wages or benefits associated with declining mining and manufacturing jobs.

Table 56 – Employment change by major industry from 1991 to 2000 for Navajo County

	Total Jobs 1991	Total Jobs 2000	Difference 1991-2000	Percent Change 1991-2000
Services and Trade	15,774	21,401	5,627	36%
Government	5,829	7,176	1,347	23%
Construction	1,319	2,232	913	69%
Manufacturing	1,736	1,286	-450	-26%
Mining	1,115	964	-151	-14%
Farm and Agricultural	580	805	225	39%

Table 57 – Total personal income change in real 2000 dollars from 1991 to 2000 for Navajo County in millions of dollars

	Total Income 1991	Total Income 2000	Difference 1991-2000	Percent Change 1991-2000
Non-labor*	$404.59	$581.19	$176.60	44%
Services and Trade	$336.13	$442.31	$106.19	32%
Government	$194.73	$243.37	$48.65	25%
Construction	$66.06	$66.68	$0.62	1%
Manufacturing	$31.91	$53.02	$21.12	66%
Mining	$60.96	$45.50	-$15.46	-25%
Farm and Agricultural	$11.92	$4.19	-$7.73	-65%

***Non-labor income includes retirement and disability, income maintenance, unemployment, property income from rent, dividends, and interest from investments.**

Several sectors show an opposite trend in labor income as compared to employment. In terms of farm and agriculture, employment increased, but total labor income associated with this sector declined over the same time period. In agriculture, trends in commodity prices have more to do with overall sector performance than other county trends. Navajo County saw a decline in manufacturing employment, but labor income over the same time period did increase. This may indicate that remaining opportunities are higher paying.

Navajo County shows an increase of just over 40 percent in real non-labor income between 1991 and 2000, the majority of this income is age related, associated with retirement payments. Retirees in a community can have a significant social and economic contribution. Economically, their income is an import of money into the community, there is not an associated job or export of product for wages. While this import of non-labor income can provide a buffer against resource dependent industry economic cycles, often the jobs supported by non-incomes are in retail and service sectors which tend to be lower paying. Retirees also have time and other resources to become involved in a community in terms of leadership, building community capacity, or other social programs that improve the well being of the entire community.

Per Capita Income

Annual per capita personal income (PCPI) in Arizona in 2000 was $24,988 compared to $29,469 nationally. The PCPI for each of the analysis area counties was less than the state average in 2000. Table 58 below displays the 2000 per capita personal income and average annual growth rate between 1990 and 2000 and the change between 1999 and 2000 for the analysis area counties. Over the last decade, Gila County's PCPI shows the greatest increase, but between 1999 and 2000 the county's increase was just over a percent less than the 10- year average. Navajo County shows a similar trend with a higher growth rate for the 10-year period, and a much lower rate in the last year. Both Arizona as a whole and Coconino County show the opposite trend, with PCPI increasing significantly in the last year as compared to the 10-year period. These trends may be related to the movement of retirees into areas, and community growth associated with employment in higher paying sectors.

Table 58 - Per capita income and percent change for the analysis area counties and communities, 2000

Area	2000 per capita Personal Income in dollars	1990-2000 percent change	1999-2000 change
United States	29,469	4.2	5.8
State of Arizona	24,988	3.8	5.2
Coconino County	21,918	3.2	5.4
Gila County	18,375	4.6	3.4
Navajo County	14,105	3.4	2.0

Source: REIS, 2002.

Forest Related Industry

The IMPLAN Pro model also allows specific models of analysis areas to be built in order to better represent the potential impacts to the analysis area (MIG, 2000). In this case, the communities directly surrounding the salvage area have been separated out to highlight economic activity likely to occur in the area due to salvage activities without influence from larger more distance communities like Flagstaff.

The following analysis uses the most recent data available for current economic conditions. Table 59 displays employment and labor income by sector with logging and sawmills employment summarized separately. Government, services, and trade are the largest employment contributors. Logging and sawmills currently support about one percent of the workforce, 155 jobs in logging and 19 in sawmills. There are others involved in finished products such as wood flooring and cabinets; these are included in the manufacturing sector. These have not been separated out for this analysis as only direct employment related to timber harvesting was considered.

For labor income, government, services, and trade are again the largest contributor. In the case of trade the contribution is much smaller, only 14 percent of labor income compared to 22 percent of employment. This highlights the lower wages or seasonal work associated with this sector. Logging and sawmills is again a small contributor with the average logging wage at $19,344 and the average sawmill wage at $25,355. These lower logging wages probably are due to the seasonal nature of timber harvesting work in the area.

Table 59 – Employment and labor contributions by sector within the analysis area, 1999

Sector	Employment contribution in percent	Labor income contribution in percent
Government	25%	33%
Services	26%	24%
Fire	6%	4%
Trade	22%	14%
TCPU	5%	7%
Logging and sawmills	1%	0.4%
Manufacturing	4%	6%
Construction	9%	10%
Mining	1%	1%
Agriculture	1%	1%

Source: IMPLAN, 2002

Environmental Consequences

Effects to people and to the functioning of their communities are complex and closely interrelated. Some effects such as income and employment changes are quantifiable, while effects to lifestyle, personal values and attitudes are harder to quantify and explain.

Effects Common to All Alternatives

The magnitude of change to the forest setting caused by the Rodeo-Chediski Fire has placed tremendous stress on the social organizations of the adjacent communities as demonstrated in news articles and in the recently completed case study on the Rim Communities of the White Mountains (Carroll, 2003). Salvage logging of dead trees would present additional change to the environment. Some people could view this change as additional stress on the environment while others could see this as a necessary step in the healing process and a sign that something is being done. Because community members may view this treatment from a variety of perspectives ranging from complete objection to complete support, additional stress will likely occur to the social fabric of the White Mountains.

Strong tension will likely arise between the various stakeholder groups regardless of what action is taken. Each group is likely to seek political and administrative solutions provided they have the organizational capacity to pursue such an endeavor.

Cumulative Effects Common to all Alternatives

The first emotional impact associated with the Rodeo-Chediski Fire for most area residents was the anticipation of fire as the summer of 2002 progressed and forest conditions became dryer and dryer.

The second set of emotionally charged events was the evacuations. Although most accounts suggest that the evacuations themselves were largely well planned and smoothly executed, they were nonetheless difficult experiences for those involved (Carroll, 2003).

The third phase was returning to the area and dealing with the immediate aftermath of the fire. The return for those whose homes or neighborhoods were burned was devastating. Little was recognizable; the landscape, neighborhoods and homes were destroyed. Smoke and ash limited visibility. Homes and businesses that were not destroyed suffered damage from smoke and ash; food had rotted. Residents faced a huge cleanup task (Carroll, 2003).

The fourth set of emotions is the clean up and adaptation to the new environment. One striking theme in the case of burned neighborhoods is the extent to which visual resource damage-burned trees and landscapes-resulted in deep emotional impacts for residents. A number of interviewees from Carroll's study (2003) said the loss of treasured views was far greater that the loss of homes themselves—"because the homes can be replaced" but the landscape may not in a human lifetime look or feel the same. Another emotional reaction was that of landowners (particularly older ones) confronting and being overwhelmed by acres of dead trees on their own property to be removed, and in many cases, having no idea of how to get it done.

Currently the residents of the White Mountains are in a transition from the fourth phase to the fifth phase of emotions that deals with uncertainties of the future of the forested landscape. They mourn the loss of their special areas as well as the forest landscape. They lament the fact that the big trees would never come back in their lifetime, or even their children's lifetimes (Carroll, 2003). It is within this context that the discussion of whether or not to salvage the dead trees occurs.

The complexity of the social environment is increased by the juxtaposition of the Fort Apache Indian Reservation by the large presence of seasonal homes in the affected communities, and the sheer magnitude of the fire and the loss of homes. Public trust of the federal government is likely to swing from one extreme to another in short periods of time and based upon relatively insignificant issues.

Business income lost during and following the fire is likely in the hundreds of millions of dollars. Forest recovery efforts have offset a portion of these dollars, creating new jobs and indirectly contributing to the overall economy. Emergency rehabilitation efforts have generated approximately 250 jobs through the investment of over 10 million dollars into the economy, the majority in forestry and agriculture related industries (IMPLAN, 2002). Salvage operations on the Fort Apache Indian Reservation could result in a total of almost 150 million board feet of timber salvaged. This would result in the support of several hundred of jobs over the next two years.

The tribally owned mill in White River would utilize approximately 50 percent of the volume. The majority of these jobs are already in place but would be supported by this salvage material for the next two years. The magnitude of salvage would swamp the local job pool. It is estimated at least half the skilled forest workers needed would be imported into the area and secondary products jobs and indirect support functions would be exported with the materials to other regions in the United States. The local area economy should realize approximately 300 new jobs over the two years from other proposed and active salvage harvest.

Alternative 1

Direct and Indirect Effects

Some argue that nature should “run its course” because humans do not have perfect knowledge of how the environment and all its complexities function. They are concerned about unknown effects resulting from silvicultural practices, such as salvage logging. Some question whether long-term forest health would depend on having “unhealthy” elements in the forest, such as snags and prefer a conservative approach, leaving disturbances and recovery in the hands of nature. Carroll (2003) states local environmentalists expressed more concern with long-term habitat conditions and water quality than salvaging dead material. Alternative 1 would better meet the values of those individuals whom believe the fire area should be allowed to recover in a more natural manner.

Alternative 1 would not generate any additional jobs directly associated with salvage harvest or indirect restoration mitigation activities. This alternative would not return any revenue to the United States Treasury. As with all alternatives the cost of preparing the environmental impact statement is a “sunk cost” as it occurs prior to the decision being made.

Cumulative Effects

The no action alternative would provide the opportunity to use the large area of moderately and severely burned acres as a control to study the differences in recovery of the biological environment in contrast to other proposed salvage harvest on National Forest lands and adjacent tribal lands. This would address the values of those individuals whom would like to compare the effects of management activities versus non-management activities.

As stated previously, the salvage of dead material and the associated improvements from previously proposed salvage projects on National Forest System lands burned in the Rodeo-Chediski Fire would create almost 250 jobs (IMPLAN, 2002). Other proposed salvage operations on the Fort Apache Indian Reservation could result in a total of almost 150 million board feet of

timber to be salvaged. This would result in the support of several hundred of jobs over the next two years.

The Fort Apache's tribally owned mill in White River would utilize approximately 50 percent of the volume. The majority of these jobs are already in place but would be supported for by this salvage material for the next two years. The magnitude of salvage would swamp the local job pool. It is estimated at least half the skilled forest workers needed would be imported into the area and secondary products jobs and indirect support functions would be exported with the materials to other regions in the United States. The local area economy should realize approximately 300 jobs over the next two to three years from other proposed and active salvage harvest.

Alternative 2, 3, 4 and 5

Direct and Indirect Effects

According to Carroll (2000) many people believe management actions aid forest recovery from fire disturbance. Key topics of this issue included ecological recovery, fuel reduction, threats of insect and disease epidemics, and commodity extractions. The last topic is commonly referred to as "salvage logging" a major issue because of the size of the fires, the volume of standing snags left behind, and the economic incentives. Many view these standing snags as a usable and commercially valuable resource. Standing snags also pose a threat relative to fuel loading and could be a factor in insect and disease problems in the forest. Many political coalitions and stake-holder groups therefore advocate for salvage logging to "make the most" of a resource that is deteriorating, which then would reduce the risk of snags becoming fuel for future fires and a source for insect and disease epidemics. Others simply see the standing dead or dying trees from the fire as an economic resource and believe its value will deplete rapidly as the trees deteriorate.

Carroll (2003) indicates that residents (both full-time and seasonal) of the study area interviewed generally want the burned timber to be salvaged if possible. Salvage logging is seen as a means for employment of many people and the provision of a reasonably steady income flow for a number of years. Beyond the need for more employment in the county and a presumed return of the logging industry, most residents think that the loss of salvageable timber to insect and disease damage is wasteful and wrong.

Alternative 2 would salvage wood products from approximately 45,109 acres. The costs of the various treatments total approximately 2.5 million dollars while generating 2.37 million dollars in the sale of the salvage material, including saw timber, fuelwood, and miscellaneous products. Table 60 compares Alternatives 2-5 for costs of activities, volume harvested, acres harvested, revenue generated through the sale of forest products, financial efficiency, and estimated number of jobs created by alternative.

Approximately 238 jobs (IMPLAN) would be generated through the implementation of Alternative 2, of which 119 would be in the forest products industry. The remainder of the jobs would be in other industries and would be indirect or induced effects of the additional forest products jobs. The highest percentage of these jobs would be created during the first year of implementation, which would be the period of greatest activity. Approximately 70 of the direct jobs and 50 of the indirect jobs would occur within the first year for Alternative 2, declining thereafter. Alternatives 3 through 5 would display a similar trend over the period of salvage operations.

Table 60 - Comparison of economic effects

	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Cost of Activities	$2,556,354.00	$1,385,154	$1,819,454	$2,311,354
Salvage Prep	*$1,480,500*	*$813,300.00*	*$1,041,600.00*	*$1,333,500.00*
Road Improvements*	*$1,056,000*	*$552,000*	*$758,000*	*$958,000*
Mitigation Activities.	*$19,854*	*$19,854*	*$19,854*	*$19,854*
Volume Harvested (Million Board Feet)	109.4	58.6	78.6	99.6
Net Acres Treated	34,926	23,316	31,794	33,008
Revenue from Sale of Forest Products	$2,366,000	$1,160,200	$1,669,800	$2,091,600
Benefit to Cost Ratio for USFS	1.58	1.39	1.57	1.55
Benefit to Cost Ratio for All Partners	0.93	0.84	0.92	0.90
Estimated Number of Jobs	238	128	171	217

*** Note: The cost of road improvements will be borne by the purchaser.**

Cost of activities, volumes harvested, net acres treated, revenue from sale of forest products, benefit to cost ratio for all partners and estimated number of jobs are highest in Alternative 2, followed by Alternatives 5, 4 and 3. Benefit to cost ratio for the Forest Service is highest in Alternative 2, followed by Alternatives 4, 5 and 3.

Cumulative Effects

The implementation of any of the action alternatives would generate additional emotional events involving the residents of the White Mountains. Residents and others who see utilitarian value in the wood products would view salvage logging as a positive step in the recovery of the local economy and an affirmation of their value system.

As stated previously, the salvage of dead material and the associated improvements from previously proposed salvage projects on National Forest System lands burned in the Rodeo-Chediski Fire would create almost 250 jobs (IMPLAN 2002). Other proposed salvage operations on the Fort Apache Indian Reservation could result in a total of almost 150 million board feet of timber and additional employment opportunities, with a cumulative result of several hundred jobs over the next two years.

The effects of the action alternatives would be for the most part in addition to the jobs being created by other efforts surrounding the aftermath of the Rodeo-Chediski Fire. A portion of these jobs would overlap if the other proposed activities and the actions proposed here occur at the same time. Due to the large scale of the salvage harvest, and the need to recover the wood while it still has economic value, the local labor pool would be exhausted and a large percentage of the

jobs would use outside sources of labor. Skilled forest workers would need to be imported into the area and secondary products jobs and indirect support functions would be exported with the materials to other regions in the United States. The local area economy should realize approximately 300 jobs over the next two to three years from these activities and other proposed and active salvage harvests. The cumulative effects on jobs for the local market are similar to the "no action" alternative as the local economy can only absorb a finite number of new jobs in this short period of time. The local economy may see a short-term peak in temporary woods workers, but this industry would likely decline back to current numbers after the salvage operations are concluded. This workforce, who may be local, would then have to find other sources of employment.

Environmental Justice

Executive Order 12898 (February 11, 1994) directs federal agencies to focus attention on the human health and environmental conditions in minority and low-income communities. The purpose of the Executive Order is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. The principle behind Environmental Justice is simple; people shouldn't suffer disproportionately because of their ethnicity or income level.

The Council on Environmental Quality provides guidance under the National Environmental Policy Act for Environmental Justice [CEQ 1997]. This guidance helps address Federal agency's responsibilities and provides definitions for "minority," "minority population," and "low-income population." It also defines what is meant by disproportionately high adverse "health effects" and "environmental effects."

The population within the affected environment around Heber-Overgaard is relatively homogenous and predominately white non-Hispanic (91percent). Minority populations within the area are well below the average for the state and county, and therefore do not meet criteria for "Minority Population" as defined by CEQ.

Low-income is more difficult to determine at the community scale at this time due to the release schedule of this social characteristics by the Census Bureau. Navajo County had 28 percent of the population below the poverty level in 1997. The per capita personal income was $13,440 in 1998, which was only 53 percent of the State average. Information from Heber-Overgaard Unified School District (1997) indicates that approximately 26 percent of the children between the ages of five and 17 within the School District are considered "poor." This data indicates there appears to be a segment of the population within the Heber-Overgaard area that would be considered poor, however it is unclear whether this indicator is scattered throughout the community or whether there is a geographic association of individuals that could be considered a separate "community."

The human health and environmental effects associated with the project are generally considered within acceptable norm for the area. None of the effects were deemed to be significant as employed by NEPA and specified in the CEQ Regulations on Environmental Justice. Thus even if an independent low-income community exists in the area it would not be considered disproportionately affected as defined by the Regulations. None of the proposed projects present an environmental justice issue as lands treated were done so based upon severity of burned area, thus there does not appear to be a disparate impact to any particular population.

Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Soils and Hydrologic Resources

Soil productivity – The loss of soil productivity would continue at post-fire levels with Alternative 1. Alternatives 2, 3, 4 and 5 would enhance soil productivity by incorporation of woody material resulting from slash created by salvage logging within treatment areas.

Erosion and Sediment Transport – Alternative 1 would produce the highest soil erosion rates of all alternatives considered in detail. Alternatives 2, 3, 4 and 5 would provide some degree of ground cover from salvage logging slash, reducing erosion rates to near tolerance levels.

Soil Quality – Alternative 1 would do nothing to actively improve or restore soil quality, as measured by the following soil condition guidelines: ability to accept, hold and release water; ability to resist erosion and degradation; and ability to accept, hold, and release nutrients. Alternatives 2, 3, 4 and 5 would improve soil quality as the ability to accept, hold and release water would be improved by addition of ground cover. Additional ground cover provides surface roughness to slow runoff down and allow greater time for infiltration before leaving the site. The ability to resist erosion and degradation would be enhanced as well as the ability to accept, hold and release nutrients through the addition of organics created from salvage logging.

Watershed Conditions -- Alternative 1 would do nothing to improve infiltration across the burned area. High runoff rates would be maintained, resulting in less available soil moisture to sustain plant growth. Alternatives 2, 3, 4 and 5 have the effect of slightly reducing post-fire peak flows; equilibrium conditions across watersheds would be achieved at a faster rate than without treatments.

Stream Channel Condition -- Stream channels are expected to incur the greatest amount of long-term damage from continuous high watershed discharges predicted for Alternative 1, although there appears to be little difference in discharge peaks between the Alternatives 2, 3, 4 and 5. Alternative 2 would not measurably affect stream channel condition in Canyon Creek and its tributary, Mule Creek, due to the steepness of terrain and presence of erosive soils.

Post-fire flooding -- Alternative 1 would continue to generate the highest possible peak discharge from the entire burned area. Alternatives 2, 3, 4 and 5 show slightly reduced peak flows after treatment when compared to post-fire peak flows.

Fire and Fuels

Alternatives 2, 3, 4 and 5 would slightly increase the fire hazard and fuel loading in the short-term above current post-fire levels. In the long-term, removal of large woody fuels would reduce fuel loading over a large area with a subsequent reduction in future fire intensity and severity. Under Alternative 1, the risk of a catastrophic fire would increase over time.

Wildlife

Big Game Habitat -- Alternative 1 would be less favorable for antelope compared to action alternatives because natural recovery; without removal of the dense, small dead trees; would take longer in pinyon-juniper stands that burned at high severity levels. Alternatives 2, 3, 4 and 5 would allow for faster recovery of forage, especially within those areas that burned at high severity levels.

Snags and Down Logs -- Alternative 1 provides the largest amount of short- and long-term habitat for cavity nesters. Alternatives 2, 3, 4 and 5 would provide sufficient snag densities to keep high densities of cavity nesters within the analysis area until natural snag recruitment begins in the treated acres, although snag longevity would vary among alternatives.

Heritage Resources

Under Alternative 1, the potential for the destruction of heritage resources is high if dead standing trees are allowed to fall and uproot naturally. Alternatives 2, 3, 4 and 5 protect heritage sites by prohibiting the use of mechanized equipment within site boundaries and felling dead trees that would otherwise rot and fall, damaging sites when root wads pull out of the ground.

Recreation

Alternative 1 would not impact recreation opportunities in the short-term. However, as dead trees begin to rot and fall down, hunting, hiking, and driving for pleasure opportunities would become difficult or limited. Recreation opportunities in the analysis area would be temporarily impacted by salvage activities in the short-term, as proposed by Alternatives 2, 3, 4 and 5. Area closures to protect forest visitors during salvage logging activities; and the associated noise, increased traffic and dust; would temporarily displace visitors to other forested areas.

Transportation

Temporary road construction and subsequent decommissioning activities would not occur under Alternative 1. Short-term impacts of these temporary roads to soils and water from erosion and sedimentation would be avoided. A combination of road-related watershed improvements and deferred maintenance work would take place on existing roads under Alternatives 2, 3, 4 and 5.

Unavoidable Adverse Effects

Soil and Hydrologic Resources

Under Alternative 1, there would be no negative impacts from logging activities such as soil compaction, allowing further recovery of subsoil compaction from previous activities. However, this benefit would be more than offset by lack of ground cover, increased surface crusting that reduces infiltration, higher overall erosion rates from bare ground, higher runoff and channel erosion rates, and slower recovery of riparian areas. Canyon Creek would potentially maintain higher levels of sediment, impacting this important fishery for an unknown period of time until conditions stabilize.

Fire and Fuels

There would be a long-term increase in fire hazard and fuel loading with implementation of Alternative 1.

Visuals

Alternative 1 would result in a less visually diverse landscape then under alternatives proposed for salvage logging treatments. Some evidence of logging activities, such as slash and stumps, would be apparent to those walking and driving through the project area with Alternatives 2, 3, 4 and 5.

Transportation

Temporary road construction and subsequent decommissioning activities would not occur under Alternative 1. Short-term impacts of these temporary roads to soils and water from erosion and sedimentation would be avoided.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line right-of-way or road.

Soils and Hydrologic Resources

On-site soil erosion, as a result of the fire effects, would cause an irreversible loss of soil productivity. Increased soil erosion will occur at rates exceeding natural soil formation rates. This condition would gradually reduce in Alternatives 2, 3, 4 and 5 as slash from salvage logging provides approximately 30 percent ground cover while vegetative recovery reestablishes a protective ground cover and soil erosion rates diminish over time.

Increased sedimentation will result in an irretrievable loss of watershed condition and associated fisheries habitat. The increased sediment yield will reduce fish habitat until the watersheds of Canyon Creek and its tributary, Mule Creek, reestablish protective ground cover. Proposed management activities in Alternatives 2, 3, 4 and 5 would reduce the potential and risk of irretrievable loss of watershed condition and associated fish habitat as a result of the beneficial effects of additional slash created by salvage logging in areas burned at moderate and high intensity levels.

Vegetation

There would be an irretrievable loss of wood fiber with all alternatives. The greatest loss would occur with Alternative 1, and least loss would occur with Alternative 2.

Heritage Resources

Under Alternative 1, the potential for the destruction of heritage resources is high if dead standing trees are allowed to fall and uproot naturally. Information contained in sites would be irretrievably loss.

Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs “to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with other environmental review laws and executive orders.” See also Chapter 1 under Involvement of Other Agencies.

National Historic Preservation Act

The Forest Service is required to consult with the Arizona State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (ACHP) under the requirements of Section 106 of the National Historic Preservation Act (16 U.S.C. 470(f). The SHPO advises and assists the agency in carrying out historic preservation responsibilities.

Forest archaeologists and heritage resource specialists have worked with the SHPO to coordinate plans for heritage resource protection, approve appropriate levels of field surveys, evaluate the effects on cultural resource sites, and develop monitoring plans.

U.S. Fish and Wildlife Service

Prior to decision, under the requirements of Section 7 of the Endangered Species Act, consultation with the US Fish and Wildlife Service is required to determine the biological significance of the proposed activities on any species designated threatened and endangered, or proposed species and other "at-risk" species.

In accordance with the ESA Consultation Process (USFWS, et al., August 2001), USFWS biologists have been involved in project planning throughout the analysis process. Fish and Wildlife Service representatives attended field tours and ID team meetings. Informal and formal consultation has occurred between the USFWS and the Forest Service concerning potential impacts to protected species.

Arizona Department of Environmental Quality

The Arizona Department of Environmental Quality (ADEQ) is mandated to protect the health and welfare of Arizona citizens from adverse effects of air pollution (CAA, Sec.118; Arizona Revised Statutes (ARS) 49:5011). The State Implementation Plan describes how the State carries out its responsibilities under the CAA. This project will comply with the State Implementation Plan.

Wild and Scenic Rivers Act

The Wild and Scenic Rivers Act requires all Federal agencies to consider the wild and scenic values of potential national wild, scenic and recreational river areas in all planning for the use and development of water and related resources.

A segment of Canyon Creek was identified as eligible for potential wild, scenic, recreational river designation in the 1993 Resource Information Report (USDA, 1993). The segment, located within a half-mile wide corridor approximately 5.4 miles in length, begins at Canyon Creek Springs and continues to the boundary of the Fort Apache Reservation. The segment meets eligibility requirements because it is free flowing, free of impoundments and has outstanding remarkable wildlife and ecological values. This segment has not been officially designated as part of the Wild and Scenic Rivers system to date.

Removal of dead trees by helicopter yarding methods would not affect the potential eligibility of this stream as a wild and scenic river. As the vegetation and wildlife return to this area, the outstanding remarkable ecological and wildlife values for which it was nominated will likewise return.

Compliance with Executive Order 12898, Environmental Justice

Executive Order 12898 (February 11, 1994) directs federal agencies to focus attention on the human health and environmental conditions in minority and low-income communities. The purpose of the Executive Order is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. The principle behind Environmental Justice is simple; people shouldn't suffer disproportionately because of their ethnicity or income level.

The human health and environmental effects associated with the project are generally considered within acceptable norm for the area. None of the effects were deemed to be significant as employed by NEPA and specified in the CEQ Regulations on Environmental Justice. Thus even if an independent low-income community exists in the area it would not be considered disproportionately affected as defined by the Regulations. None of the proposed projects present an environmental justice issue as lands treated were done so based upon severity of burned area, thus there does not appear to be a disparate impact to any particular population.

Chapter 4. Consultation and Coordination

Preparers and Contributors

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service person during the development of this Draft Environmental Impact Statement:

Id Team Members

Douglas R. Beal, USDA Forest Service, Apache-Sitgreaves NF, Forest Silviculturist, ID Team Member

Contribution: Vegetation and timber volume analysis

Education: Bachelor of Science degree in Forest Management from University of Idaho in 1972; Masters of Science degree in Forest Management from University of Idaho in 1977

Experience: Forest Service – 29 years in timber management

Lester R. Buchanan, Retired USDA Forest Service, Santa Fe National Forest, ID Team Member

Contribution: Fuels Management, Air Quality

Education: Two years of accounting (1955 – 1957), Oklahoma A & M, Stillwater, Oklahoma.

Technical Fire Management (1983 – 1984) at the University of Washington, Seattle, Washington.

Other relevant education and training; Prescribe Fire Management, Fire Behavior for the Fire Specialist, The Art of Fuel Modeling, Air Quality and Smoke Management, Advanced Fire Behavior and Fire Behavior Analyst.

Experience: Forest Service – 31 years in timber management, recreation, fire and fuels management, and administration.

Robert T. Csargo, USDA Forest Service, Apache-Sitgreaves NF, Wildlife Staff, Lakeside Ranger District

Contribution: Reviewed all pertinent Arizona Game and Fish Department's documents regarding the effects of the Rodeo-Chediski fire, and the effects of the Forest Service's Rodeo-Chediski Fire Salvage Project on aquatic resources.

Education: Associate of Arts; Hibbing Community College, Hibbing, MN; 1977; Bachelor of Science, Wildlife and Fisheries Management; University of Minnesota, 1988.

Experience: Forest Service – 4 years on the initial attack fire crew on Black Hills NF; 8 years as Wildlife Staff on the Clifton RD of the Apache-Sitgreaves NF; 4 years as the Forest Fuels Wildlife Biologist on the Coronado NF.

Elizabeth A. Puschel Dykstra, USDA Forest Service, Apache-Sitgreaves NF, ID Team Member

Contribution: Recreation and visual resources analysis

Education: Bachelor of Science degree in Natural Resource Management from University of Wisconsin – Stevens Point in 1982.

Masters of Arts degree in Resource Planning from University of New Mexico in 1992.

Experience: Forest Service – 14 years in recreation facility and trail management, outdoor recreation planning, recreation special use permit administration, interpretative services and public information, wilderness management, fire suppression and pre construction engineering.

Genice F. Froehlich, USDA Forest Service, Apache-Sitgreaves NF, Planning team leader/Wildlife Staff, Lakeside Ranger District, ID Team Member

Contribution: Reviewed lists of threatened, endangered, and Region 3 Forest Service sensitive species for potential habitat and presence. Reviewed the Birds of Conservation Concern 2002 and Arizona Partners in Flight for Migratory Bird Treaty Act species

Analysis of Effects to Wildlife Species

Reviewed and made final determinations for Wildlife Biological Evaluation and Wildlife Report

Education: Associate of Arts, Science and Mathematics; Lake Tahoe Community College; 1985

Bachelor of Science, Wildlife and Fisheries Biology; University of California, Davis; 1987

Master of Science, Wildlife Management; University of Arizona; 1990.

Experience: Forest Service – 13 years in wildlife management. Consultant to the 1993 and current member of the Mt. Graham red squirrel Recovery Team (Technical Team); NEPA planning.

Joseph A. Hamrick, Jr., USDA Forest Service, Apache-Sitgreaves NF, Lakeside Ranger District, Silviculturist, ID Team Member

Contribution: Silviculture/Forestry, Vegetation analysis

Education: Bachelor of Science degree in Watershed Management (Forestry) University of Arizona (School of Renewable Natural Resources) - 1981. Silviculture Certification Program: TREES IV (Tri-Regional Education in Ecology and Silviculture) Northern Arizona University; Utah State University; & Colorado State University – 1984/1985.

Experience: Forest Service – Approximately 23 years experience in Forest Management & Silviculture (Apache-Sitgreaves National Forests). Southwestern Region, Certified Silviculturist – 17 Years.

Jimmy E. Hibbetts, Retired, USDA Forest Service, Apache-Sitgreaves NF, ID Team Leader

Contribution: Coordination with Program Manager to complete EIS; Developed and maintained administrative record; Scientific Literature Review; Analysis of Forest Plan Requirements for Snag Retention

Analysis of Public Comments

Private land uses and activities

Analysis of retardants used during suppression activities

Education: Bachelor of Science degree in Forest Management from Northern Arizona University in 1962

Experience: Forest Service – 37 years in timber management, recreation, special uses, administration, planning, litigation and appeals

Debbie Hom, USDA Forest Service, GIS Support (on Detail to the Apache-Sitgreaves National Forests)

Contribution: Geographic Information Systems (GIS) support to complete the Draft Rodeo-Chediski Fire Salvage EIS.

Education: Bachelor of Arts degree in Biological Sciences from California State University, Sacramento in 1987.

Experience: USDA Forest Service – 15 years in wildlife biology and GIS coordination.

Earl H. "Duke" Klein, USDA Forest Service, Tonto NF, Wildlife Biologist, ID Team Member

Contribution: Pre- and Post-fire conditions for Wildlife Habitat

Analysis using Habitat Quality Index Model; Scientific Literature Review

Developed Wildlife Concerns

Snag/downed log retention analysis and relationship to Forest and Recovery Plan direction

Wildlife Specialists Report/MIS Analysis (Pre/Post fire)

Threatened and Endangered Species Evaluation (Pre/Post fire)

Draft Wildlife Alternative GIS analysis for Wildlife

Education: Bachelor of Science degree in Wildlife Science from Oregon State University in 1978

Experience: Certified Wildlife Biologist since 1987 with over 25 years experience as a wildlife biologist, including experience in the private and international sectors, and state and Federal governments. The last 14 years have been with the U.S. Forest Service as a NEPA Specialist, Ecosystem Planning Team Leader and District Wildlife Biologist.

Pamela J. Klein-Taylor, USDA Forest Service, Apache-Sitgreaves NF, Lakeside Ranger District GIS Coordinator, ID Team Member

Contribution: Geographical Information System support

Education: Bachelor of Science degree in Natural Resources/Environmental Education from Michigan State University.

Experience: Forest Service – 20 years in natural resources, computers and administration.

Collis J. Lovely, USDA Forest Service, Apache-Sitgreaves NF, ID Team Member

Contribution: Hydrology and Water Quality

Watershed and Stream Channel Conditions

Water Resource Facilities and Improvements

Pre and Post Fire Conditions Analysis

Effects Analysis of proposed actions

Education: Bachelor of Science Watershed Management, College of Agriculture, 1968; Master of Science Hydrology, College of Earth Sciences, 1976, University of Arizona

Experience: Over thirty years experience in drainage design, master planning and floodplain management, hydrology and watershed management for the City of Scottsdale, private-consulting firms, the USDI Bureau of Land Management and USDA Forest Service.

Gary L. Miller, USDA Forest Service, Apache-Sitgreaves NF, Transportation Planner, ID Team Member

Contribution: Road management recommendations

Transportation planning

Maintenance and logging costs

Education: Bachelor of Science degree in Civil Engineering from the University of Arizona in 1980

Design and layout of logging systems at Oregon State University in 1985

Registered Civil Engineer, State of Arizona, 1984

Experience: Forest Service – 27 years in transportation planning, road layout, construction and maintenance, and project engineering

Henry Provencio, USDA Forest Service, Apache-Sitgreaves NF, Wildlife Biologist, ID Team Member

Contribution: Wildlife Report

Biological Assessment and Evaluation

Education: Bachelor of Science degree in Wildlife Conservation Biology, Arizona State University in 1997

Experience: Forest Service – 3 years in Wildlife and Fuels Management

Roger Poirier, USDA Forest Service, Washington Office, Content Analysis Team, Writer-Editor

Contribution: Writing, editing, and coordination of EIS; Analysis of Public Comments

Education: B.S. Microbiology, University of Montana, 1995.

Experience: Forest Service – 6 years in NEPA, public participation, and public comment analysis.

Denise Amber Ryan, USDA Forest Service, Tonto NF, ID Team Member

Contribution: Heritage Resources

Education: Bachelor of Arts degree in Anthropology from Arizona State University in 1985; Master of Arts degree in Anthropology from Arizona State University in 1988

Experience: Forest Service – 15 years in archaeology

Julie Schaefers, USDA Forest Service, Rocky Mountain Regional Office, Social Science, ID Team Member

Contribution: Social and Economic analysis

Education: B.S. Forest Recreation Resource Management, Oregon State University, 1989. M.S. Forest Resource Economics, Colorado State University, 1994.

Experience: Forest Service – 13 years in recreation management, forest planning, and social/economic analysis.

David Seesholtz, USDA Forest Service, Southwestern Region, Regional Social Science Coordinator

Contribution: Social & Economic Impact Analysis

Education: Bachelor of Science degrees in Forest Resource Management & Wildlife Biology, University of Washington, 1985.

Experience: Forest Service – 16 total years in the Forest Service as Collaborative Planner, Public Affairs, National Environmental Policy Act Coordinator, District Ranger, and Regional Social Scientist.

Tom Subirge, USDA Forest Service, Apache-Sitgreaves National Forests, ID Team Member

Contribution: Effects analyses of proposed actions regarding soil and watershed resources.

Preparation of Best Management Practices to mitigate anticipated impacts of proposed actions.

Recommendations for treating coarse woody debris.

Cumulative effects analysis (watershed)

Education Bachelor of Science: U. of Montana 1975, Forest Resource Management (geology and chemistry minors)

Master of Science: U. of Arizona 1980, Soil and Water Engineering.

Experience State of South Dakota Forestry Division: 2 years timber management. US Forest Service – 23 years soil scientist, watershed specialist, hydrology, riparian specialist (Regional instructor), aerial photo analysis, reclamation, bioengineering, hazardous materials mitigation, resource monitoring, ground and surface water issues, noxious weeds, BAER Team IC.

Kristin Whisennand, USDA Forest Service, Region 5, T.E.A.M.S Enterprise Unit, Technical Writer-Editor.

Contribution: Writing, Editing, preparing DEIS for publication.

Education: B.A. Anthropology, Dartmouth College, 1984.

Experience: Forest Service - 5 years in NEPA, public participation, and public comment analysis; 7 years in heritage resource management.

Federal, State and Local Agencies

City/Municipal/Local Government

City of Show Low
Clay Springs Fire Department
Forest Lakes Fire Department
Heber-Overgaard Fire Board
Heber-Overgaard Fire Department
Heber-Overgaard Sanitation District
Heber-Overgaard School Board
Heber Water Company
Linden Fire Department
Pinetop Fire Department
Show Low Fire Department
Show Low Irrigation District
Silver Creek Irrigation District, Snowflake
Timberland Acres Road Improvement District, Show Low
Timberland Acres Water Improvement District, Show Low
Town of Eagar
Town of Springerville

County Government

Apache County Board of Supervisors, St. Johns
Coconino County Board of Supervisors, Flagstaff
Eastern AZ Counties Organization, St. Johns
Natural Resources Conservation Service Center, Holbrook
Natural Resources Conservation Service, Little Colorado River Plateau, Holbrook
Navajo County Board of Supervisors, Holbrook
Navajo County Cooperative Extension Services, Holbrook
Navajo County Development Services, Holbrook
Navajo County Parks and Recreation Department, Holbrook
Northern AZ Council of Governments, Flagstaff

Environmental Interest Groups and Other Organizations

Agave Chapter House, Overgaard
American Indian Christian Mission, Show Low
American Legion, Overgaard
Arizona Desert Bighorn Society, Phoenix
Arizona Safari Outfitters, Pinetop
Arizona Wildlife Federation, Fountain Hills
Arizona Wildlife Foundation, Mesa
Arizona Wildlife Society, Phoenix
Audubon Society, Sedona

Bird Watchers, Mesa
Bison Ranch Cabin Owner's Association, Overgaard
Bison Ridge, Overgaard
Buckskin Artist's Draw, Heber
Camp Ponderosa, Heber
Camp Shadow Pines, Phoenix
Cedar Valley Outfitters, Clay Springs
Center for Biological Diversity, Tucson
Cheney Ranch, Show Low
Excellex, Lakeside
Fellowship Christian Church, Overgaard
First Baptist Church, Overgaard
Forest Conservation Council, Western Regional Office, Santa Fe, NM
Forest Lakes Homeowners Association, Forest Lakes
Forest Guardians, Phoenix
Forest Guardians, Santa Fe, NM
Forest Trails Unit 1 Homeowner's Association, Overgaard
Forest Trails Unit 2 Homeowner's Association, Overgaard
Forest Trails Unit 3 North Homeowner's Assocation, Overgaard
Fort McDowell YTC, Fountain Hills
Grand Canyon Trust, Flagstaff
Heber Country Store, Heber
Heber Overgaard Chamber of Commerce
High Country Pines Homeowner's Association, Heber
HOST, Overgaard
LDS Church - Heber First Ward
LDS Church - Heber Ward
Lions Club, Overgaard
Mogollon Airpark Homeowner's Association, Overgaard
Mogollon Estates Homeowner's Association, Overgaard
Native Forest Network, Silver City, NM
North American Bear Society, Scottsdale
OHV GROUP, Show Low
Our Lady of Assumption Church, Overgaard
Overgaard Homeowner's Association, Pine Meadows, Overgaard
Overgaard Market, Overgaard
Pacific Rivers Council, Eugene, OR
Park Valley, Show Low
People for the USA, Heber
Pinecrest Lakes Property Owner's Association, Overgaard
Pinetop Chamber of Commerce, Pinetop
Predator Protector, Bozeman, MT

Rocky Mountain Elk Foundation, Flagstaff
SBA-ONRSA, Denver, CO
Section 31 Homeowner's Association
Sheriff's Auxillary, Heber-Overgaard, Navajo County, Heber
Show Low Chamber of Commerce
Sierra Club, Grand Canyon Chapter, Flagstaff
Sierra Club, Grand Canyon Chapter, Phoenix
Sky Island Alliance, Tucson
Sonoran Biodiversity, Tucson
Southwest Forest Alliance, Flagstaff
The Nature Conservancy, Lakeside
Timberland Acres Road District, Show Low
Torreon Summit Development, Show Low
Treasures and Trifles Hardward, Overgaard
White Mountain Audubon Society, Pinetop
White Mountain Conservation League, Pinetop
White Mountain Open Trails, Show Low
White Mountain Regional Development Corporation, Show Low
Wilderness Society, Denver, CO
Winslow Chamber of Commerce

Federal Government

Bureau of Indian Affairs, Phoenix Area Office, Phoenix
Bureau of Indian Affairs, Fort Apache Agency, Whiteriver
Bureau of Indian Affairs, San Carlos Agency, San Carlos
Senator Jon Kyle, Phoenix
Senator John McCain, Phoenix
USDA, Forest Service, Apache-Sitgreaves Supervisor’s Office, Springerville
USDA, Forest Service, Black Mesa RD, Overgaard
USDA, Forest Service, Lakeside RD, Lakeside
USDA, Forest Service, Tonto Supervisor’s Office, Phoenix
USDA, Forest Service, Pleasant Valley RD, Pleasant Valley
USDA, Forest Service, Southwestern Region, Albuquerque, NM
USDA, Forest Service, Chief’s Office, Washington, DC
USDI, Fish and Wildlife Service, Phoenix

Industry Interests

Arizona Beefgrowers, Phoenix
Arizona Cattleman's Association, Phoenix
Arizona Public Service, Snowflake
Bordges Timber, Inc, Shingle Springs, CA
Collins Park Milling, Eagar
Doug Jones Sawmill, Grand Junction, CO

Forest Energy Corporation, Show Low
Fort Apache Timber Company, Whiteriver
Frontier Communications, Show Low
Holliday Logging, Eagar
Hook F Cattle Company, Holbrook
Navapache Electric Cooperative, Inc., Lakeside
OW Ranch, Forest Lakes
Perkins Ranch, Show Low
Precision Pine and Timber, Heber
Reidhead Brothers Lumber Mill, Nutrioso
Rio Grande Forest Prodiucts, Espanola, NM
Sierra Forest Products, Terra Bella, CA
Sierra Pacific Industries, Loyalton, CA
Sierra Pines, Show Low
Silver Creek Forest Products, Heber
Simpson Sawmill, Alpine
Southwest Forest Products, Phoenix
Stoltze Aspen Mill, Sigurd, UT
Tri-Star Logging, Inc., Snowflake
Utah Forest Products, Inc, Escalante, UT
W.B. Contracting, Eagar
Wally Smith Logging, Overgaard
Westwood Forest Products, Inc., Everett, WA

Newspapers, Radio and Television Stations

City 4 TV, Show Low
Channel 11, White Mountain News, Show Low Pine Graphics Weekly, OvergaardTRACKS, Lakeside
White Mountain Independent, Show Low

Schools/Universities

Northern Arizona University Ecological Restoration Institute, Flagstaff
University of Arizona, Department of Anthropology, Tucson

State Government

AZ Congressman J.D. Hayworth, District 6 Representative, Mesa
AZ Department of Environmental Quality, Phoenix
AZ Department of Public Safety, Holbrook
AZ Department of Transportation, Show Low
AZ Department of Water Resources, Phoenix
AZ Game and Fish Department, Clay Springs,Mesa, Pine, Pinetop, Phoenix
AZ State Land Department, Prescott
AZ State Parks, Show Low
AZ State Representative Jake Flake, Phoenix

Tribes

Fort McDowell Indian Community, Fountain Hills

Hopi Tribe, Kykotsmovi

Navajo Nation, Window Rock

Navajo Nation Historic Preservation Department, Window Rock

Ramah Navajo Chapter, Ramah, NM

San Carlos Apache Tribe, San Carlos

San Carlos Apache Tribe, Historic Preservation Department, San Carlos

Salt River Pima-Maricopa Indian Community, Scottsdale

Tonto Apache Tribe, Payson

White Mountain Apache Tribe, Whiteriver

White Mountain Apache Tribe, Office of Cultural Resources, Whiteriver

Yavapai-Apache Nation, Camp Verde

Yavapai-Prescott Tribe, Prescott

Zuni Pueblo, Zuni, NM

Zuni Pueblo, Heritage and Historic Preservation Office, Zuni, NM

Individuals

Bill Arendell

Don Bawden

Bill Baxter

Thomas and Barbara Bayer

Bill Beecroft

Steve Bingham

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Martha Butzin

Jack D. Carlisle

Caren Christenson

Jim Clark

Letha Cline

Elaine & Kirk Crandell

Bill & Marilyn Crawford

Reta Cruse

Mark Cullinane

Gerry & Mary Daley
Julius Dallman
Frank Damato
Dave Dannelley
Angela DeCaigny
Roy Dechant
Eric & Mary Ellen DeFrancis
Janis Dickerson
Barrett Edgar
Elwin Ellsworth
Rick Erman
Heather Ewing
Damato Frank
Chris Garbin
Billy Garvin
George Geisler
Larry Gibson
Kyle Gourdoux
Frank Greer
Eugene & Eva Hall
Steve Hall
Bill Hallobeck
Eric Hamblin
Gary Hamm
Dick Hancock
Ginny Handorf
Maxine Heimerl
Renell Heister
John Holman
Rick Honsinger
Midge & Glenn Hoogstra
Gene Jeardoe
Vernon L. Jensen
Tom Jernigan
Dick Jones
Doug Kemp
Paul Knauth
Charles Lail
Tom Lazzelle

Tom Lewis
Rodney Lilley
Dakota Livesay
Trisha London
Dennis Malcolm
Deborah Martin
Tommie Martin
Ben Mason
Dave Mauer
Bob Mayer
Sarah McEnaney
R. Keith Merrill
Betty Milton
Mary Mockelstrom
Bob Moore
Dorothy and Jim Murphy
Bill and Judy Newton
Natalie Niehaus
Shawn Nixon
Charlotte Novak
Peter Noyes
Stephanie Ohmsatte
Jim Olsson
Richard Ostermeier
Andrew J. Orahoske
Roger Owens
Billy Owens
Chadeen Palmer
Shirley Pancher
Anthony Peiffer
Lee Peterson
Tom Phillips
Pinnion, Miyah
Wayne Porter
Gail Potts
Jacquelyn Puckett
Janet Quackenbush
George Reed
Doug Reiman

Pat Robertson

Ed Rogers

Andre Rousseau

Terry Rutherford

Grace Scholz

Sam Seay

Robert Secrist

Cy;nthia Sidrane

Theodore Smith

Quinn Smith

Jim Steitz

Don Steuter

Rachel Thomas

Lorna Thurman

Laurence Turley

Melvin Turley

Jikm Vollmer

Duane Walker

George and Marie Warner

Sylvia Weber

Katheryn Websmeir

John Whinery

Donald Wilson (Fountain Hills)

Donald Wilson (Mesa)

Dave and Beverley Wolfe

Don and Donita Wood

Lewis Tenney

Distribution of the Environmental Impact Statement

This environmental impact statement has been distributed to individuals who specifically requested a copy of the document. In addition, copies were sent to the following Federal agencies have jurisdiction by law or special expertise with respect to any environmental impact involved and any appropriate Federal, State, or local agency authorized to develop and enforce environmental standards. They are as follows:

Environmental Protection Agency

Director, Environmental Coordination, Forest Service, USDA

Head, Acquisitions and Serials Branch, USDA
Office of Environmental Affairs, USDI

Glossary

Action Alternatives – Alternatives that propose a definitive action.

Adverse effect – An effect to one or more of the characteristics of an historic property that render it eligible for listing on the National Register of Historic Places.

Advisory Council on Historic Preservation (ACHP) – The federal agency responsible for overseeing the management and protection of heritage resources in compliance with the NHPA.

Airshed, Class I – This is a special designation that dictates the degree of regulatory protection of air quality that the area receives. Class I areas are those that receive the highest level of regulatory protection. They include all international parks, national parks greater than 6,000 acres, and wildernesses greater than 5,000 acres that were in existence on or before August 7, 1977.

Airshed, Class II – This is a special designation that dictates the degree of regulatory protection of air quality that the area receives. Class II areas receive less regulatory protection than Class I areas. They include all areas that have not been designated as a Class I area.

Alluvial – Pertains to material that is transported and deposited by running water.

Alternative – One of many plans, policies, or projects proposed for decision-making.

Ambient Air Quality – The quality of the air as measured by its concentrations of airborne pollutants. The U.S. Environmental Protection Agency has established air quality standards for concentrations of specific airborne pollutants, which when exceeded would cause or contribute to adverse impacts on human health or welfare.

Appropriate Management Response – Specific actions taken in response to a wildland fire to implement protection and fire use objectives.

Aquatic – Growing, living in, or frequenting water.

Archaeology – The scientific study of the life and culture of people who lived in the past.

Aspect – Facing a given cardinal direction.

Basal Area (BA) – A measurement of how much a site is occupied by trees or plants. In Forestry, basal area refers to the area of ground surface occupied by tree stems (using the cross-sectional area of a tree stem at exactly 4.5 ft. from the ground) and is generally expressed as ft^2/acre.

Best Management Practices (BMPs) – A practice or a combination of practices that is determined by a State (or designated area-wide planning agency) after problem assessment, examination of alternative practices, and appropriate public participation to be the most effective, practicable (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.

Biological Evaluation – a documented Forest Service review of Forest Service program or activities in sufficient detail to determine how an action or proposed action may affect any threatened, endangered, proposed, or sensitive species.

Browse – Twigs, leaves, and young shoots of trees and shrubs which animals eat. In particular, those shrubs that big game animals (deer, elk, etc.) eat.

Buffer – A forested strip used to conserve sensitive ecosystems or wildlife habitat, or potentially unstable slopes.

Burning Window – The period of time when all weather conditions are met for safe burning.

Canopy – The uppermost, more or less continuous mass of tree branches and foliage in a forested area.

Capable Habitat – Habitat that does not provide the characteristics of suitable spotted owl habitat; is not occupied by spotted owls but has the capability of attaining the characteristics of suitable habitat at some time in the future through standard, prescribed management treatments or natural processes.

Chaparral – Refers to tough-leaved evergreen shrubs that form a dense brushy growth. The term is derived from the Spanish word "chaparro" referring to dwarf evergreen oaks.

Clean Air Act – Established to protect and enhance the quality of the Nation's air through air pollution prevention and control.

Clean Water Act – Establishes policy to restore and maintain the chemical, physical, and biological integrity of the Nation's waters.

Closed Road – Closures can be full time or seasonal. Some example of seasonal or short time closures and may include: 1) fire closures and 2) closures where saturated soils would lead to road damage with traffic use. A full time closure is usually a gated road that is only opened for special activities, perhaps once in 5-10 years. An example of this would be a timber sale road that would be used for the term of the sale but closed for the rest of the time.

Closure – An administrative order restricting either the location, timing, or type of use in a specific area.

Clump – A group of 3-7 trees (in the same age class) that has interlocking crowns.

Coarse-textured Soil – The texture exhibited by sands, loamy sands, and sandy loams.

Code of Federal Regulations (CFR) – A codification of the general and permanent fuels published in the Federal Register by the Executive departments and agencies of the Federal Government.

Commercial Thinning – A silvicultural practice of cutting and removing timber that is merchantable (useful for wood products) to improve the growth of the trees that remain. This practice is usually employed in overcrowded stands.

Community – Two or more populations of plants or animals interacting in the same habitat.

Competition – The demand by two or more organisms for the same resource or element (i.e., sunlight, moisture, nutrients)

Consultation/consulting parties – A portion of the review process under Section 106 of the National Historic Preservation Act during which consulting parties consider ways to resolve adverse effects on historic properties. The consulting parties include, at a minimum, the responsible Federal agency and the State Historic Preservation Officer (SHPO). Other interested parties, such as the Advisory Council on Historic Preservation (ACHP), Indian tribes, and local governments, may also be invited to consult.

Council on Environmental Quality (CEQ) – An Executive Office of the President whose members are appointed by the President. CEQ recommends national policies to promote the improvement of the quality of the environment.

Critical Habitat – Habitat of federally listed threatened or endangered species, on which are found those physical and biological features that are essential to conservation of the species and which may require special management considerations or protection. This habitat may currently be occupied, or determined by the Secretary of the Interior to be essential, for areas outside the specie's current range.

Crown – The upper part of a tree or other woody plant carrying the main branch system and foliage surmounting a "clean stem" at the crown base.

Crown Density/Crown Closure – Crown density or crown closure is used to describe how much of the area above an acre of land is covered by tree crowns. Crown density or crown closure is usually shown as a percent of the area covered by tree crowns. Crown density/crown closure is important for evaluating fire risk. When tree crowns are very thick and are interlocking, fires can spread rapidly through the crowns and are virtually impossible to stop until the fire reaches less dense areas and drops back to the ground.

Crown Fire – A fire that spreads though the tops of trees or tall shrubs. A crown fire in trees is generally dependent on the intensity of the surface fire, the height of the trees' crown base from the ground, and the density of the tree crowns. Generally, fire spread rate for a crown fire is faster than the supporting surface fire.

Cumulative Effects – The impacts on the environment that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

DBH – The diameter at breast height (dbh) of a standing tree at a point 4.5 feet from ground level.

Dead and Down – Fallen trees or portions of fallen trees.

Desired Future Condition (DFC) – A portrayal of land or resource conditions, which are expected to result if goals and objectives are fully achieved.

Discount Rate – An interest rate that represents the cost or time value of money in determining present value of future costs and benefits.

Dispersed Recreation – A general term referring to recreation use outside of developed recreation sites; this includes activities such as scenic driving, hunting, backpacking, camping, and recreation in primitive environments.

Disturbed Site – A historic or prehistoric site that has been impacted by either natural or artificial causes.

Diversity – The distribution and abundance of different plant and animal communities and species within the area covered by a land management plan.

Duff – The more or less firm organic layer on top of mineral soil, consisting of fallen vegetative matter in the process of decomposition, including everything from pure humus below to the litter on the surface; a general, non-specific term.

Dwarf Mistletoe – Flowering parasitic plants that depend on their hosts for water and nutrients. Dwarf mistletoes are related to true mistletoe (Christmas mistletoes) that is found on hardwoods such as oaks and cottonwoods. Dwarf mistletoes are smaller, leafless, and more damaging than true mistletoes. It slowly weakens and kills infected trees and spreads to neighboring host trees.

Ecosystems – A community, including all the component organisms, together with the environment, forming an interacting system.

Effect (Impact), Physical, Biological – The change, positive or negative, in the physical or biological conditions that directly or indirectly results from an activity, project, or program.

Effect (Impact), Social – The change, positive or negative, in social and cultural conditions which directly or indirectly results from an activity, project, or program.

Eligible Property – A property that meets the National Register of Historic Places criteria, although the property may not be formally listed in the National Register.

Endangered Species – A plant or animal species in danger of extinction within the foreseeable future throughout all or a significant portion of its range if factors contributing to its decline continue. This is a designation made by the USFWS.

Environmental Assessment (EA) – A comprehensive evaluation of alternative actions and their predictable short-term and long-term environmental effects, which includes physical, biological, economic, social, and environmental design factors and their interactions. An EA is not as far-reaching as an EIS.

Environmental Justice – The fair treatment and meaningful involvement of all people in the development, implementation, and enforcement of environmental laws regardless of race, color, national origin, or income.

Ephemeral Stream – A stream or a portion of a stream that flows briefly in direct response to precipitation in the immediate vicinity.

Erosion – The wearing away of the land's surface by running water, wind, ice and other geological agents. It includes detachment and movement of soil or rock fragments by water, wind, ice or gravity.

Ethnography -- The branch of anthropological study which deals with the descriptive study of oral history and traditions of modern aboriginal cultures and societies, frequently incorporating settlement patterning and land-use strategies, traditional life ways and resource utilization, religions traditions and identifying places of traditional importance.

Feasible – Capable of being successfully carried out, operationally, economically, and socially.

Fertility (soil) – The status of a soil with respect to the amount and availability of nutrients to plants necessary for plant growth.

Fifth- and sixth-field Watersheds – Watersheds delineated using the USGS Hydrologic Unit Code delineation system. Fifth-field watersheds are larger than sixth-field watersheds.

Fine fuels – Fuels that are less than one-quarter inch in diameter such as grass, leaves, pine needles, and some kinds of slash which when dry ignite readily and are consumed.

Fire Intensity Level (FIL) – An indicator of the difficulty to contain a wildfire.

Fire Management Plan (FMP) – A strategic plan that defines a program to manage wildland and prescribed fires and documents the fire management program in the approved land use plan. The plan is supplemented by operational plans, such as preparedness plans, preplanned dispatch plans, prescribed fire plans, and prevention plans.

Fire Regime – The ecologically significant kinds of fire activity that characterize a specific region over long time periods and change the vegetation.

Fire Use – The combination of wildland fire use and prescribed fire application to meet resource objectives.

Fire Line – Same as fuel break and/or control line.

Floodplain – The portion of a stream valley, adjacent to the channel, which is covered with water when the stream overflows its banks at flood stages.

Forage – All browse and non-woody plants available to livestock or wildlife for grazing and feeding.

Forest Development Road (FDR) – A road wholly, or partially within or adjacent to and serving a part of the National Forest System and which ahs been included in the Forest Development Road System.

Forest Health – A condition where biotic and abiotic influences on the forest (i.e., insects, diseases, atmospheric deposition, silvicultural treatments, harvesting, etc.) do not threaten management objectives for a given area now or in the future.

Forest Plan – A document, required by Congress, assessing the economic, social, and environmental impacts, which describes how land and resources will secure and provide the maximum benefits of multiple use and sustained yield within the physical and biological capabilities of the land.

Forest Service Sensitive Species – A native plant or animal species for which population viability is a concern. Such concern may be prompted by a significant current or predicted downward trend, either in population numbers or the availability of habitat capable of supporting the existing distribution of the species.

Fragmentation – Habitat fragmentation is a process that occurs wherever a large, contiguous habitat is transformed into smaller patches that are isolated from each other by a landscape matrix unlike the original. This matrix can differ from the original habitat in either composition or structure. The crucial point is that it functions as either a partial or total barrier to dispersal for species associated with the original habitat. A clear threat to population viability is when the process of fragmentation occurs that isolates pairs and populations versus fragmentation within the home range of the individual pairs.

Fuel – Combustible wildland vegetative materials, living or dead. The organic materials that will support the start and spread of a fire: duff, litter, grass, weeds, forbs, brush, trees, and dead wood materials, including blowdown.

Fuel Laddering – Fuel laddering is used to describe the vertical continuity of forest fuels. A situation where there is a lot of fuel on the ground with brush or small trees with limbs to the ground and tops reaching up to the crowns of the larger trees provides a "ladder" for fires to climb from the ground to the crowns of the trees and create a disastrous crown fire that is virtually impossible for fire fighters to stop. A fire burning on the ground is usually manageable by fire fighters but fuel ladders often provide a means for fires to reach the crowns and race out of control.

Fuel Loading – The amount of vegetative material present on a site, measured in terms of the dry weight of fuels per unit area and is usually expressed in tons per acre. Fire intensity and resistance to control is directly related to the tonnage of fuel available to burn. Fuel loadings of 3-5 tons of fuel per acre are normally light enough to give fire fighters a chance to control a fire.

Fuel Management – The practice of evaluating, planning, and treating wildland fuel to reduce flammability and to reduce its resistance to control through mechanical, chemical, biological, or manual means, including prescribed fire and wildland fire use in support of land management objectives.

Fuel Model – fuel models categorize surface fuels. These categories are based on fuel descriptors to assist in the description of different fuel profiles and are used in fire behavior prediction models.

Fuel Profile – The mosaic of fuel as it occurs on an area of land over time and space.

Fuel Treatment – The manipulation of wildland fuel, such as lopping, chipping, crushing, piling and burning, or removal for the purpose of reducing its flammability or resistance to control.

Fuel Break – Any natural or constructed barrier used to segregate, stop, and control the spread of fire or to provide a control line from which to work.

Ground Cover– The percent of matter that cover the ground, which includes live vegetative cover, litter, plant basal area and rock.

Habitat – The environment of and the specific place where an organism lives; features that determine whether a specific site provides suitable habitat for a particular species may include climatic regime, vegetation age or structure, presence of specific plant or animal species, and presence of inorganic features, such as caves or soil chemistry.

- **Breeding Habitat** – The habitat type or types upon which a wildlife species depends for reproduction.
- **Foraging Habitat** – The habitat type or types within which a wildlife species finds the food it needs.
- **Wintering Habitat** – Areas where species find shelter or warmer weather during the winter or non- breeding season.

Hardwood – All broad-leaved trees, including "soft" hardwoods, such as aspen.

Heritage Resource – A district, site, building, structure, or object that contains evidence of past human activities.

Historic – Sites or features that were established during the time in which written records were kept. This definition must be applied from a regional or local perspective.

Historic Property – A district, site, building, structure, or object significant in American history, architecture, engineering, archeology, or culture, which meets the requirements for National Register of Historic Places eligibility.

Humus – Well-decomposed plant organic matter partly mixed with mineral soil, generally considered to be the lower part of the duff layer.

Hydrologic Characteristics – Features of a watershed relating to the flow of water, such as infiltration, evapotranspiration, runoff, water yield, peak flows, and bankfull discharge.

Indirect Employment – Employment in the economic sectors that provide inputs to the directly affected sectors.

Infiltration – The rate of movement of water from the atmosphere into the soil; that portion of rainfall or surface runoff that moves downward into the subsurface rock and soil; the entry of water from precipitation, irrigation, or runoff into the soil profile.

Initial Attack – An aggressive initial suppression action consistent with firefighter and public safety and values to be protected.

Intensity (fire) – Rate at which a fire produces thermal energy. It is related to the amount and rate of surface fuel consumption and is dependent on weather conditions, topography, and fuel loading.

Interdisciplinary Team (IDT) – A group of individuals with different training assembled to solve a problem. An interdisciplinary team is assembled because no single scientific discipline is sufficient to adequately identify and resolve issues and problems. Team member interaction provides necessary insight to all stages of the process.

Intermittent Stream – Streams with well-defined channels, banks and beds that flow only certain times of year, when they receive water from springs or runoff.

Irregular Spacing – Individual or clumps of trees that are not uniformly spaced. The spacing varies, depending on tree size and which would allow them to grow without much competition.

Irretrievable Commitments – Losses of production or use of renewable natural resources for a period of time. For example, timber production from an area is irretrievably lost during the time an area is allocated to a no-harvest prescription; if the allocation is changed to allow timber harvesting, timber production can be resumed. The production lost is irretrievable, but is not irreversible.

Irreversible Commitments – Decisions causing changes that cannot be reversed. For example, if an unroaded area is allocated to allow timber harvest and timber is actually harvested, that area cannot, at a later date, be allocated to wilderness. Once harvested, the ability of that area to meet wilderness criteria has been irreversibly lost. Often applies to nonrenewable resources.

Issue – A subject or question of widespread public discussion or interest regarding management of National Forest System lands.

Key Habitat – The habitat type known or suspected to be the current limiting factor or of greatest management concern for a species or species group in the vicinity of the project area. Key habitat typically includes breeding habitat if the species is known to breed in northern Minnesota, but

may include foraging or roosting habitat. Key habitat is used for analysis of the potential effects of the different alternatives on wildlife species.

Knutson-Vandenberg (K-V) Act – The Knutson-Vandenberg Act was enacted in 1930 and amended by the National Forest Management Act of 1976, requires purchasers of national forest timber to make deposits for reforestation, protection, and improvement of forest resources. This allows a portion of the receipts from timber sales to be held in a trust fund for use by the Forest Service in planting, seeding, timber stand improvement, fish and wildlife habitat improvement, soil and watershed protection, or other related natural resource protection activities (such as monitoring) within the sale area boundary. Amounts withheld for this purpose are determined through a priority listing of activities in a K-V Plan developed in conjunction with the timber sale offering which establishes the maximum amount to be collected. Actual collections depend upon the bid price and may include all revenue from the sale except for minimum required deposits to the federal treasury up to the total amount identified in the K-V Plan.

Large woody debris – Large pieces of wood in stream channels or on the ground and includes logs, pieces of logs, and large chucks of wood; provides streambed stability and/or habitat complexity. Also called coarse woody debris or down woody debris.

Leaching – The action of percolating liquid (as water) which dissolves, separates, and passes out the soluble components.

Levels of Road Maintenance

- Level 1 – This level is assigned to intermittent service roads during the time management direction requires that the road be closed or other wise blocked to traffic. Basic custodial maintenance is performed to protect the road investment and to keep damage to adjacent resources to an acceptable level. Drainage facilities and run off patterns are maintained. Road being maintained at this level must be closed or blocked to traffic.
- **Level 2** – This level is assigned where management direction requires that the road be opened for limited passage of traffic. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Road in this level are normally characterized as single lane, primitive type facilities intended for use by high clearance vehicles. Passenger car traffic is not a consideration.
- **Level 3** – The level is assigned where management direction requires the road to be open and maintained for safe travel by a prudent driver in a passenger car. Traffic volumes are minor to moderate; however, user comfort and convenience are not considered a priority. Roads in this level are characterized by low speed, single lane with turnouts, and spot surfacing. Some roads may be fully surfaced with either native or processed material.
- **Level 4** – The level is assigned where management direction requires the road provide a moderate degree of user comfort and convenience at moderate travel speeds. Traffic volumes are normally sufficient to require a double lane aggregate surface road. Some roads may be single lane and some may be paved.
- **Level 5** – The level is assigned where management direction requires the road provide a high degree of user comfort and convenience. These roads are normally double lane, paved facilities. Some may be aggregate surfaced.

Litter – A surface layer of loose organic debris consisting of freshly fallen or slightly decomposed organic materials.

Lop and Scatter– Cutting branches and tops of felled trees so that the material lies low on the ground. The purpose is to reduce the height of flames in case of fire and to increase soil contact for nutrient cycling.

Management Area– An area that has common direction to achieve a specific goal. The entire Forest is divided into management areas. Each is described, and the policies and prescriptions to their use are listed.

Management Indicator Species (MIS) – A wildlife species whose presence in a certain location or situation at a given population level indicates a particular environmental condition. Population changes are believed to indicate effects of management activities on a number of other wildlife species.

Mid-flame Wind Speed– The wind speed at a level equal to the average height of flames.

Mineral Soil – Soil layers that are not primarily composed of organic matter. Typically refers to soil layers below the "O" horizon or below the litter, duff, and humus layers.

Mitigation – Measures designed to counteract environmental impacts or to make impacts less severe.

Monitoring – The periodic evaluation of management practices to determine how well objectives were met and how closely prescriptions/standards were applied.

Multiple Use – The management of all various renewable surface resources of the National Forests so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some land will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.

National Environmental Policy Act (NEPA) – An act to declare a National policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation and to establish a Council on Environmental Quality.

National Fire Danger Rating System– System used to rate current and expected fire danger from low to extreme, based upon weather, fuels, and risk.

National Historic Preservation Act (NHPA of 1966) – Established federal government policy and programs on historic preservation, including the creation of the National Register of Historic Places through which the policy is implemented.

National Register (of Historic Places) – A list, maintained by the Keeper of the Register within the National Park Service, of properties that have been evaluated and found to meet one of several specific criteria of significance listed at 36 CFR 60.4.

Natural Ignition– An ignition resulting from any natural cause, generally lightning.

No Action – The most likely condition expected to exist in the future if current management direction were to continue unchanged.

Non-attainment Area– A geographic area designated by the EPA as not in compliance with the National Ambient Air Quality Standards.

Nonpoint Source Pollution (NPS) – Water pollution that originates from many indefinable sources and normally includes agricultural and urban runoff, and runoff from construction activities. Nonpoint source pollutants are generally carried over, or through, the soil and ground cover via stream flow processes. The following activities are considered to be nonpoint sources: nursery operations, site preparation, burning, pest and fire control, harvest operations, surface drainage, and road construction and maintenance from which there is natural runoff.

Old Growth – The later stages of forest stand development which include a variety of characteristics, such as: more than one tree species, multiple canopy layers, many large trees and old trees, snags and dead & down logs in various stages of decay, trees with broken tops and deformities, deep shade but also sunny openings, clumps and patches representing different age/size classes, the appearance of minimal disturbance by man.

Opening – A break in the forest canopy with less than 10% crown closure. The existence of grasses, forbs, shrubs and seedlings less than one inch in diameter at breast height.

Organic Matter– Consists of loose organic debris, and all sizes of dead woody material that lie on the soil surface.

Particulate Matter (PM) – Fine particulate matter (less than 2.5 microns in diameter) that is the primary cause of visibility impairment.

Patented Land – Private land transferred out of Federal ownership under various authorities.

Perennial Stream – Streams with well-defined channels, banks, and beds that exhibit essentially continuous flows.

Permit – A special use authorization that provides permission without conveying an interest in the land, to occupy and use National Forest System land or facilities for specified purposes and is both revocable and terminable.

Post-fledgling Family Area (PFA) – Within the nesting home range, the area (approximately 420 acres) of concentrated use by the goshawk family after the young leave the nest. The 420 acres are exclusive of the suitable and replacement nest areas.

PP/Oak – Ponderosa Pine with Oak.

Preferred Alternative – The alternative recommended for implementation as the Forest Plan based on the evaluation completed in the planning process (see proposed action).

Prehistoric – Sites or features that were established before written records were kept. This definition must be applied from a regional or local perspective.

Preparedness – Activities that lead to a safe, efficient, and cost-effective fire management program in support of land and resource management objectives through appropriate planning and coordination.

Prescribed Fire or Prescribed Burn – Any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, and NEPA requirements must be met, prior to ignition.

Pre-suppression – Activities required in advance of fire occurrence to ensure an effective suppression action. It includes: 1) recruiting and training fire forces, 2) planning and organizing attack methods, 3) procuring and maintaining fire equipment, and 4) maintaining structural improvements necessary for a fire program.

Proposed Action – The original proposal for agency actions that is sent to the public at the start of an analysis process.

Protocol – A formalized methodology to monitor and inventory animal species.

Public Involvement – A process of developing specific information necessary to describe the location, timing, activities, outputs, effects, accountability and control of a project.

Recreation Opportunity Spectrum (ROS) – A land classification system which categorizes National Forest land into six classes, each class being defined by its setting and by the probable recreation experience and activities it affords. The six classes in the spectrum are primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, rural, and urban.

Recreation Visitor Days (RVD) – Recreational use of National Forest System land that aggregates twelve hours. It may consist of one person for 12 hours, two persons for six hours or any combination that totals 12 hours.

Responsible Official – The Forest Service official responsible for administering a single region and has decision making authority.

Riparian Areas – Geographically delineable areas with distinctive resource values and characteristics that are comprised of the aquatic and riparian ecosystems:

- riparian ecosystems (FSM 2526.05) a transition between the aquatic ecosystem and the adjacent terrestrial ecosystem, identified by soil characteristics or distinctive vegetation communities that require free or unbound water.
- soils and plant species that are dependent on the water table (saturated zone) and/or its capillary zone.
- aquatic ecosystems – the stream channel, lake or estuary bed, water, biotic communities and the habitat features that occur therein (FSM 2526).

Roaded Natural Area (RNA) – A classification of the Recreation Opportunity Spectrum that characterizes a predominantly natural appearing environment with moderate evidences of the sights and sounds of man. Such evidences usually harmonize with the natural environment. Opportunities exist for both social interaction and moderate isolation from sights and sounds of man.

Runoff – In forest areas, that portion of precipitation that flows across a drainage area on the land surface and in open channels.

Scarify – Minor surface disturbance used commonly for creating a seedbed.

Scoping Process – Activities used to determine the scope and significance of a proposed action, what level of analysis is required, what data are needed, and what level of public participation is appropriate.

Section 106 of the NHPA – Requires federal agencies, prior to taking action to implement an undertaking, to take into account the effects of their undertaking on historic properties and afford the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment regarding such an undertaking.

Sedimentation – The process of depositing sediment. Sediment is mineral and organic material that is in suspension and transported by water.

Semi-Primitive Motorized ROS Class (SPM) – A classification of the Recreation Opportunity Spectrum characterized by few and/or subtle modifications by man, and with a high probability of isolation from the sights and sounds of man.

Sensitive species – A species that is vulnerable or declining and could become endangered or threatened without active management or removal of threats. This is a designation made by the Forest Service.

Seral – A plant and animal community that is a transitional stage of succession, being either short or long term. If left alone, the seral stage will pass, and another plant and animal community will replace it. Aspen represents a seral stage that would eventually be replaced by conifers such as spruce.

Site/Archaeological Site – A heritage resource that contains physical manifestations of purposeful prehistoric or historic human activity consisting of one or more features, with or without artifacts; one or more formal tools found in association with other cultural material; the occurrence of diverse cultural materials in densities beyond the level of one or a few accidentally lost artifacts; or physical manifestations of human activity that, in the professional opinion of an archaeologist, are indicative of purposeful human activity.

Slash – Residual tops, branches, and unmerchantable boles left after a commercial timber sale.

Snags – Standing dead trees at least 15 feet in height and more than 6 inches in diameter at breast height.

Soil Productivity – The ability of a soil to provide nutrients, water, and structure for plant growth.

Special Uses – A permit, term permit, lease, or easement that allows occupancy, use, rights, or privileges of National Forest.

Stand – An aggregation of trees occupying a specific area and sufficiently uniform in composition, age arrangement, and condition as to be distinguishable from the forest in adjoining areas.

Standards and Guidelines – Bounds or rules within which all management practices will be carried out in achieving planned goals and objectives. The term “standards” is interpreted to mean the same thing as “standards and guidelines.”

State Historic Preservation Officer (SHPO) – The state agency responsible for overseeing the management and protection of heritage resources in compliance with the NHPA.

Succession – A directional change in species composition of the forest over time, as when one species or species group replaces another.

Suitable Habitat – Habitat that is currently usable for nesting, roosting, and feeding by spotted owls. Suitable nesting, roosting, and primary foraging habitat characteristics include, but are not limited to:

- moderately closed to closed canopy; generally greater than 70% closure.
- multi-storied stands containing several canopy layers.
- mixed conifer, Douglas-fir/white fir, or Ponderosa pine with a dense Gambel oak or other hardwood understory.
- a component of large trees, often old remnants in younger stands or mature or overmature stands.
- shaded, cool, moist canyon sites and mountain slopes often with rock outcrops, cliffs, or talus.
- standing dead, and down woody material.
- diverse stands with a mix of small openings, not of uniform density throughout.

Suitable foraging habitat is often the same as listed above, but it may have a more open canopy. It may also include pinyon-juniper, rocky slopes, and small openings.

Surface Fire – A fire that burns only in surface fuels, such as litter, down woody material, and small vegetation.

Tailings – The spoils or by-product of mining activities where the material is dumped and forming piles or fans adjacent to the activity area.

Threatened & Endangered (T&E) – A species or subspecies of animals or plants whose prospects of survival and reproduction are in immediate jeopardy, or likely to become so within the foreseeable future. The Secretary of Interior in accordance with the 1973 Endangered Species Act identifies threatened species.

Traditional cultural property (TCP) – A particular kind of historic property comprising a specific definable area that members of a community or ethnic group associate with a variety of traditional social, religious, and economic activities, and that meet the criteria listed in National Register Bulletin No. 38.

Trail – A travel way designed for pedestrian and/or horse riders. Also includes a travel way to accommodate off-road vehicles.

Under Burning – Under burning is a fuels management technique that uses prescribed fire to burn the ground fuels and small brush underneath larger trees. Under burning reduces the fuel loading on an area and reduces fuel laddering and the potential for fires to reach the tree crowns and race out of control.

Under Story – The tree, shrub, and other plant species growing within the shade provided by a tree canopy. Under story vegetation is made up of grass, forbs, brush and small trees growing between the larger trees and under the main canopy.

Undertaking – Any project, activity, or program that can result in changes in the character or use of historic properties, if any such historic properties are located within an area of potential effects and if the activity is under the direct or indirect jurisdiction of federal agency or licensed or assisted by a federal agency.

Viable population – The estimated number and distribution of reproductive individuals that ensures the continued existence of a species in the planning area. Habitat for the species must also be well distributed so that those individuals can interact with others.

Visual Quality Objectives (VQO's) – The degree of acceptable alteration of the characteristic landscape.

- P (Preservation) – In general, human activities are not detectable to the visitor.
- R (Retention) – In general. human activities are not evident to the casual Forest visitor.
- PR (Partial Retention) – In general, human activities may be evident but must remain subordinate to the characteristic landscape.
- M (Modification) – Human activity may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in middle ground or background.

Water Yield – Runoff, including groundwater outflow that appears in the stream, plus groundwater outflow that leaves the basin underground. Water yield is the precipitation minus the evapotranspiration.

Watershed– An area that, because of topographic slope, contributes water to a specified surface water drainage system, such as a stream or river.

Wildfire – An unwanted wildland fire.

Wildland Fire – Any non-structure fire, other than prescribed fire, that occurs in the wildland.

Wildland Fire Suppression – An appropriate management response to wildland fire that results in curtailment of fire spread and eliminates all identified threats from the particular fire. All wildland fire suppression activities provide for firefighter and public safety as the highest consideration, but minimize loss of resource values, economic expenditures, and/or the use of critical firefighting resources.

Wildland/Urban Interface – An array of complex problems arising from residential development in and near forests. Conflicts often have socio-political dimensions as well as environmental.

Appendix A – List of Past, Present, and Reasonably Foreseeable Activities

Introduction

Cumulative effects are those impacts on the environment that may result from the incremental effects of an action when it is added to other past, present, and reasonably foreseeable future actions, regardless of which agency or person undertakes them (See 40 CFR Part 1508.7).

The Council on Environmental Quality (CEQ) regulations for implementing the NEPA describes how Federal agencies must handle instances where information relevant to evaluating reasonably foreseeable adverse impacts of the alternatives is incomplete or unavailable. Federal agencies must make clear that such information is lacking, and decide whether this incomplete or unavailable information is "essential to a reasoned choice among alternatives," (40 CFR, Part 1502.22). If the information is deemed essential to a reasoned choice among the alternatives, it must be included or addressed in the EIS.

Knowledge about the biological, physical and social aspects of ecosystems is, and always will be, incomplete. The ecology, inventory and management of large landscapes are complex and constantly changing. For example, analysis of the impacts of alternatives under consideration on specific plant or animal species prompts questions about population dynamics and habitat relationships. Key relationships and basic data are well established for only a few ecosystems and species known to occur within the Rodeo-Chediski analysis area.

Process Utilized by the ID Team

Past, present and reasonably foreseeable future activities displayed in the following tables are activities and natural events that have already occurred, are currently occurring, or are likely to occur in the vicinity of the proposed Rodeo-Chediski Fire Salvage Project and that may contribute cumulative effects. The area encompassing these activities and events includes the entire burn perimeter on the Apache-Sitgreaves and Tonto National Forests, including State lands and private property, unless otherwise stated. For certain issues the area considered in cumulative effects analysis may also include proposed activities in burned areas on the neighboring Fort Apache Indian Reservation, so these are also identified on the list of present and reasonably foreseeable future activities.

The past and present activities and natural events have contributed to the existing condition, as described in the affected environment sections of Chapter 3. These activities, as well as reasonably foreseeable activities, may produce environmental effects on issues or resources relevant to the proposal. Therefore, the past, present and reasonably foreseeable activities have been considered in the cumulative effects analysis for each resource area.

The activities listed as reasonable and foreseeable were extracted from both National Forests' schedule of proposed activities (SOPAs) that are issued quarterly, and from interviewing forest program managers. All relevant projects are listed that are likely to occur within the analysis area throughout 2003 and beyond. In order to spatially display the activities that could contribute cumulative effects, the past, present and reasonably foreseeable activities listed in the spreadsheets were mapped and are available in the project file.

This comprehensive listing of projects is intended to demonstrate that relevant past, present and reasonably foreseeable activities are identified and considered in the analysis of cumulative effects. However, these listings cannot stand alone, and are supported by cumulative effects analysis for each resource area in the effects discussion of Chapter 3. The effects of the activities

listed in the spreadsheets are not the effects that must be disclosed. What must be disclosed is how each of the listed activities, individually and in combination with other activities, might contribute to the effects caused by this project.

Because cumulative effects vary in time and space, each resource area has defined a specific cumulative effects analysis area in their effects discussion that is pertinent to their specific resource and the issues addressed. To strengthen documentation that the appropriate past, present, and reasonably foreseeable actions are considered, each resource area has addressed all of the listed activities in the environmental effects discussion. For each activity listed in the spreadsheets, each resource area has disclosed why or why not specific activities or types of activities would contribute to cumulative effects, and what those effects might be.

Alternatives were analyzed by the ID Team using the question of whether the missing information is "essential to a reasoned choice among alternatives." While new information could add precision to estimates or better specify relationships; it would be unlikely to significantly change the understanding of the basic relationships that information was deemed essential to making a reasoned choice among the alternatives being considered. Where appropriate, text indicates what information is incomplete or unavailable. Existing scientific evidence relative to the significant effects will be summarized in instances where estimates are developed by theoretical approaches or research methods generally accepted in the scientific community.

Rationale Used

The following rationale was used to determine specific activities or treatments that should be mapped and discussed in each resource area of the EIS. This rationale describes why each of the activities should be described and mapped in the project record for the EIS. The rationale used was:

- Current and reasonably foreseeable treatments and activities will be mapped and the effects described by resource area, broken down by 6th code watershed.
- Past treatments and activities occurring in moderately burned and/or severely burned areas will be mapped and the effects described in detail by resource area, broken down by 6th code watersheds only if there is on-the-ground evidence that the treatment is still functioning or the activity will be affected by any of the alternatives being considered.
- Past treatments and activities occurring in moderately burned and/or severely burned areas no longer considered to have any contributing effects due to time and/or distance will be identified but not mapped or described in detail by resource area.

A detailed listing of the activities and treatments that has occurred during the past 25 years was compiled for both forests. Likewise, current activities and treatments were listed as well as reasonably foreseeable future treatments and activities, sorted by 6th code watersheds.

Results

A comprehensive listing of projects intended to demonstrate that relevant past, present, and reasonably foreseeable activities were identified in the analysis of cumulative effects. However, these listings cannot stand alone, and are supported with cumulative effects analysis by each resource area in the effects discussion of Chapter 3. The effects of the activities listed in the spreadsheets are not the effects that must be disclosed. What must be disclosed is how each of the listed activities, individually and in combination with other activities, might contribute to the effects caused by this project.

In order to strengthen documentation that appropriate past, present and reasonably foreseeable actions are considered, each resource specialist has addressed all of the selected activities in their environmental effects discussion. Because cumulative effects vary in time and space, each resource specialist has defined specific cumulative effects that are pertinent to their analysis and the issues being addressed. For each activity listed in the spreadsheets, each resource specialist has disclosed why or why not specific activities or types of activities would contribute to cumulative effects, and what those effects might be.

Past Activities on National Forest Lands

Table 61 - Past activities by treatment, watershed, and time period for the Pleasant Valley Ranger District, Tonto National Forest

Watershed Name	Subwatershed Name	Treatment Type	Period of Treatment	Acres
Canyon Creek	Upper Canyon Creek	Valentine Timber Sale	1998	557
		Canyon Timber Sale	1991	369
Canyon Creek Total				**926**
Cherry Creek	Cherry Creek	Redlake Timber Sale	1990	238
		Cherry Timber Sale	1991	614
		TSI	1994	392
		Broadcast burn	1994	215
		Broadcast burn	1996	177
Cherry Creek Total				**1082**

Table 62 - Past grazing management activities that occurred within the analysis area

Allotment Name	Average Stocking 1977-2002 AUMs	Current Capacity in Balance with Permitted Use (Estimated Capacity in AUMs)	Total Acres of Pastures within Burned Area	Acres of Moderate and Severe Fire Intensity within Allotment
Black Canyon #	379	Yes (122)	15,182	3,139
Capps*	128	No (65)	1,830	237
Clay Springs#	336	Yes (592)	16,840	8,094
Heber*#	2447	No (1389)	84,211	34,825

Allotment Name	Average Stocking 1977-2002 AUMs	Current Capacity in Balance with Permitted Use (Estimated Capacity in AUMs)	Total Acres of Pastures within Burned Area	Acres of Moderate and Severe Fire Intensity within Allotment
Juniper Ridge*	115	No (32)	3,449	1,815
Linden*	2515	No (1143)	15,925	4,169
Long Tom*#	1170	No (180)	76,058	1,464
Park-Day #	160	Yes (136)	4170	783
Pinedale*	1046	No (1103)	33,757	10,070
Town Tank	112	Yes (20)	3,528	2,730
Verde, Sundown, Willow Wash #	1181	Yes (826)	37,289	16,312
OW	257	No (175)	4,408	1,836
Red Lake	1405	No (900)	2,329	446
Heber-Reno Sheep Driveway*	840 (cattle equivalent)	No (480)	3,957	2,212

*** Preliminary capacity only, allotment analysis currently in progress.**

 # Stocking estimates within burned pastures only on these allotments.

"Total Acres of Pastures Within the Burned Area" column depicts the acreage of that entire pasture where any portion of the pasture burned.

"Yes" in Current Capacity in Balance with Permitted Use column indicates that a recent Environmental Analysis and Allotment Management Plan have been completed and the resulting new Grazing Permit is being implemented.

Table 63 - Past activities by treatment, watershed, and time period for the Black Mesa Ranger District, Apache-Sitgreaves National Forests

Watershed	Subwatershed	Treatment Type	Period of Treatment	Acres
Black Canyon	Baca Canyon	Thinning	1993-1997	134
		Chipping	1998-2002	67
		Lop & Scatter	1993-1997	34

Watershed	Subwatershed	Treatment Type	Period of Treatment	Acres
		Removal Harvest	1983-1987	104
		Seed Cut Harvest	1993-1997	168
		Thinning	1983-1987	104
		Thinning	1998-2002	67
	Baca Canyon Total			**678**
	Bear/Turkey Canyon	Intermediate Harvest	1988-1992	280
	Bear/Turkey Canyon Total			**280**
	Black Canyon above Heber	Thinning	1977-1982	438
		Thinning	1983-1987	560
		Thinning	1988-1992	86
	Black Canyon above Heber Total			**1084**
	Black Canyon Lake	Chipping	1993-1997	74
		Chipping	1998-2002	283
		Individual Tree Harvest	1993-1997	108
		Intermediate Harvest	1983-1987	177
		Intermediate Harvest	1988-1992	13
		Lop & Scatter	1993-1997	156
		Lop & Scatter	1998-2002	329
		Piling	1998-2002	97
		Removal Harvest	1988-1992	18
		Seed Cut Harvest	1988-1992	100
		Seed Cut Harvest	1993-1997	122
		Seed Cut Harvest	1998-2002	342
		Thinning	1998-2002	387
	Black Canyon Lake Total			**2206**
	Lower Pierce	Intermediate Harvest	1998-2002	530

Watershed	Subwatershed	Treatment Type	Period of Treatment	Acres
	Lower Pierce Total			**530**
	Middle Buckskin	Thinning	1977-1982	40
		Thinning	1983-1987	180
	Middle Buckskin Total			**220**
	Middle Pierce Wash	Intermediate Harvest	1983-1987	286
		Intermediate Harvest	1988-1992	504
		Thinning	1977-1982	143
	Middle Pierce Wash Total			**933**
	Oklahoma Flat Draw	Intermediate Harvest	1988-1992	104
		Thinning	1993-1997	70
	Oklahoma Flat Draw Total			**174**
	Rocky Draw	Final Removal	1988-1992	243
		Intermediate Harvest	1988-1992	212
		Seed Cut Harvest	1988-1992	372
		Thinning	1983-1987	219
		Thinning	1993-1997	421
	Rocky Draw Total			**1467**
		Intermediate Harvest		240
	Ross Draw Total			**240**
	Upper Buckskin Wash	Final Removal Harvst	1988-1992	561
		Intermediate Harvest	1988-1992	220
		Intermediate Harvest	1993-1997	63
		Seed Cut Harvest	1988-1992	339
		Thinning	1988-1992	230
		Thinning	1993-1997	52
	Upper Buckskin Wash Total			**1465**

Watershed	Subwatershed	Treatment Type	Period of Treatment	Acres
	Upper Pierce Wash	Intermediate Harvest	1983-1987	35
		Intermediate Harvest	1988-1992	257
		Removal Harvest	1983-1987	95
		Removal Harvest	1988-1992	49
		Thinning	1977-1982	85
	Upper Pierce Wash Total			**521**
	West Fork Black Canyon	Final Removal Harvest	1988-1992	34
		Intermediate Harvest	1983-1987	651
		Intermediate Harvest	1988-1992	424
		Intermediate Harvest	1993-1997	80
		Removal Harvest	1983-1987	12
		Seed Cut Harvest	1983-1987	227
		Seed Cut Harvest	1988-1992	392
		Thinning	1988-1992	389
	West Fork Black Canyon Total			**2209**
Black Canyon Total				**12007**
Canyon Creek	Bull Flat Canyon	Intermediate Harvest	1983-1987	357
		Removal Harvest	1983-1987	1150
		Thinning	1983-1987	640
	Bull Flat Canyon Total			**2147**
	Canyon Creek	Chipping	1998-2002	508
		Final Removal	1988-1992	856
		Intermediate Harvest	1983-1987	1162
		Intermediate Harvest	1988-1992	2337
		Intermediate Harvest	1993-1997	739

Watershed	Subwatershed	Treatment Type	Period of Treatment	Acres
		Intermediate Harvest	1998-2002	24
		Partial Removal Harvest	1993-1997	15
		Piling	1998-2002	108
		Planting	1988-1992	50
		Removal Harvest	1983-1987	93
		Removal Harvest	1988-1992	241
		Seed Cut Harvest	1988-1992	111
		Seed Cut Harvest	1993-1997	586
		Site Preparation	1988-1992	50
		Thinning	1977-1982	255
		Thinning	1988-1992	1341
		Thinning	1993-1997	345
		Thinning	1998-2002	432
	Canyon Creek Total			**9253**
	Hells Canyon	Intermediate Harvest	1983-1987	260
		Removal Harvest	1983-1987	824
		Thinning	1983-1987	91
		Thinning	1988-1992	620
	Hells Canyon Total			**1795**
	Valentine Creek	Intermediate Harvest	1988-1992	33
		Intermediate Harvest Total		33
		Seed Cut Harvest	1993-1997	40
		Thinning	1993-1997	73
	Valentine Creek Total			**146**
Canyon Creek Total				**13341**

Watershed	Subwatershed	Treatment Type	Period of Treatment	Acres
Carrizo Creek	Buckskin Canyon	Final Removal Harvest	1988-1992	179
		Intermediate Harvest	1988-1992	184
		Thinning	1983-1987	251
	Buckskin Canyon Total			**614**
	Phoenix Park Canyon	Intermediate Harvest	1988-1992	87
	Phoenix Park Canyon Total			**87**
Carrizo Creek Total				**701**
Chevelon Creek	Wildcat Canyon	Chipping	1993-1997	10
		Chipping	1998-2002	231
		Final Removal Harvest	1988-1992	444
		Final Removal Harvest	1993-1997	1935
		Intermediate Harvest	1988-1992	223
		Intermediate Harvest	1993-1997	174
		Lop & Scatter	1993-1997	42
		Partial Removal Harvest	1988-1992	57
		Piling	1998-2002	22
		Planting	1977-1982	50
		Planting	1983-1987	75
		Seed Cut Harvest	1988-1992	52
		Seed Cut Harvest	1993-1997	84
		Thinning	1988-1992	87
		Thinning	1993-1997	743
		Thinning	1998-2002	757
	Wildcat Canyon Total			**4986**
Chevelon Creek Total				**4986**

Watershed	Subwatershed	Treatment Type	Period of Treatment	Acres
Cottonwood - Dodson	Bagnal Wash	Chipping	1998-2002	146
		Intermediate Harvest	1998-2002	99
		Lop & Scatter	1998-2002	99
		Mechanical Fuel Compaction	1998-2002	92
		Thinning	1983-1987	127
		Thinning	1993-1997	193
		Thinning	1998-2002	146
	Bagnal Wash Total			**902**
	Cottonwood Wash	Piling	1998-2002	12
		Thinning	1998-2002	12
	Cottonwood Wash Total			**24**
	Lower Cottonwood Wash	Lop & Scatter	1998-2002	56
		Piling	1998-2002	94
		Thinning	1998-2002	150
	Lower Cottonwood Wash Total			**300**
	Middle Cottonwood	Clearcut Harvest	1988-1992	40
		Final Removal Harvest	1988-1992	247
		Intermediate Harvest	1988-1992	113
		Intermediate Harvest	1993-1997	761
		Intermediate Harvest	1998-2002	589
		Lop & Scatter	1998-2002	260
		Mechanical Fuel Compaction	1998-2002	10
		Piling	1998-2002	275
		Seed Cut Harvest	1988-1992	65

Watershed	Subwatershed	Treatment Type	Period of Treatment	Acres
		Site Preparation	1988-1992	40
		Thinning	1983-1987	3471
		Thinning	1988-1992	396
		Thinning	1993-1997	507
		Thinning	1998-2002	910
	Middle Cottonwood Total			**7684**
	Stinson Wash	Chipping	1998-2002	153
		Clearcut Harvest	1988-1992	39
		Final Removal Harvest	1988-1992	88
		Intermediate Harvest	1998-2002	247
		Lop & Scatter	1998-2002	201
		Piling	1998-2002	592
		Planting	1977-1982	25
		Planting	1983-1987	467
		Site Preparation	1988-1992	39
		Thinning	1983-1987	756
		Thinning	1988-1992	223
		Thinning	1993-1997	280
		Thinning	1998-2002	808
	Stinson Wash Total			**3918**
	Town Draw	Intermediate Harvest	1998-2002	61
		Mechanical Fuel Compaction	1998-2002	61
	Town Draw Total			**122**
	Upper Cottonwood Wash	Clearcut Harvest	1988-1992	149
		Final Removal Harvest	1988-1992	515

Watershed	Subwatershed	Treatment Type	Period of Treatment	Acres
		Group Selection Harvest	1998-2002	414
		Intermediate Harvest	1988-1992	139
		Intermediate Harvest	1993-1997	26
		Intermediate Harvest	1998-2002	339
		Lop & Scatter	1998-2002	762
		Piling	1998-2002	456
		Site Preparation	1988-1992	149
		Thinning	1988-1992	460
		Thinning	1993-1997	62
		Thinning	1998-2002	835
	Upper Cottonwood Wash Total			**4306**
	Upper Day Wash	Final Removal Harvest	1988-1992	205
		Intermediate Harvest	1983-1987	260
		Intermediate Harvest	1988-1992	497
		Intermediate Harvest	1993-1997	378
		Planting	1977-1982	57
		Removal Harvest	1983-1987	549
		Removal Harvest	1988-1992	350
		Thinning	1977-1982	1246
		Thinning	1988-1992	56
		Thinning	1993-1997	34
	Upper Day Wash Total			**3632**
	Upper Town Draw	Final Removal Harvest	1988-1992	115
		Thinning	1988-1992	115
		Thinning	1993-1997	115
	Upper Town Draw Total			**345**

Watershed	Subwatershed	Treatment Type	Period of Treatment	Acres
	West Fork Cottonwood	Clearcut Harvest	1988-1992	105
		Final Removal Harvest	1988-1992	621
		Final Removal Harvest		
		Intermediate Harvest	1988-1992	214
		Intermediate Harvest	1993-1997	99
		Intermediate Harvest	1998-2002	447
		Lop & Scatter	1998-2002	90
		Piling	1998-2002	645
		Site Preparation	1988-1992	105
		Thinning	1988-1992	758
		Thinning	1993-1997	112
		Thinning	1998-2002	544
	West Fork Cottonwood Total			**3740**
	Willow Wash	Intermediate Harvest	1998-2002	194
		Lop & Scatter	1998-2002	119
		Piling	1998-2002	75
		Planting	1977-1982	110
		Planting	1983-1987	38
		Removal Harvest	1983-1987	80
		Thinning	1983-1987	44
	Willow Wash Total			**660**
Cottonwood - Dodson Total				**25633**
Phoenix Park	Lower Decker Wash	Final Removal Harvest	1988-1992	45
		Final Removal Harvest	1993-1997	36
		Intermediate Harvest	1998-2002	484

Watershed	Subwatershed	Treatment Type	Period of Treatment	Acres
		Lop & Scatter	1998-2002	222
		Reforestation w/ site preparation	1993-1997	120
		Removal Harvest	1988-1992	66
		Thinning	1977-1982	456
		Thinning	1993-1997	505
	Lower Decker Wash Total			**1934**
	Lower Phoenix Park Wash	Intermediate Harvest	1983-1987	47
		Intermediate Harvest	1993-1997	89
		Intermediate Harvest	1998-2002	181
		Thinning	1977-1982	1185
		Thinning	1993-1997	89
	Lower Phoenix Park Wash Total			**1591**
	Upper Decker Wash	Final Removal Harvest	1988-1992	477
		Final Removal Harvest	1993-1997	51
		Intermediate Harvest	1983-1987	310
		Intermediate Harvest	1988-1992	513
		Intermediate Harvest	1993-1997	282
		Removal Harvest	1983-1987	401
		Removal Harvest	1993-1997	83
		Seed Cut Harvest	1988-1992	28
		Thinning	1977-1982	2473
		Thinning	1983-1987	215
		Thinning	1993-1997	187
	Upper Decker Wash Total			**5020**
	Upper Phoenix Park Wash	Final Removal Harvest	1988-1992	676

Watershed	Subwatershed	Treatment Type	Period of Treatment	Acres
		Final Removal Harvest	1993-1997	424
		Intermediate Harvest	1983-1987	596
		Intermediate Harvest	1988-1992	405
		Intermediate Harvest	1993-1997	641
		Partial Removal Harvest	1993-1997	83
		Removal Harvest	1983-1987	194
		Removal Harvest	1988-1992	61
		Thinning	1977-1982	3994
		Thinning	1988-1992	469
		Thinning	1993-1997	50
		Thinning	1998-2002	56
	Upper Phoenix Park Wash Total			**7649**
Phoenix Park Total				**16194**

Table 64 - Past activities by treatment, watershed, and time period for the Lakeside Ranger District, Apache-Sitgreaves National Forests

Watershed Name	Subwatershed Name	Ground/Understory Treatment	Treatment Type	Period of Treatment	Acres
Cottonwood - Dodson	Dodson Wash		Commercial overstory	1977-1982	452
		Broadcast Burn	Fuels	1998-2002	7
		Fuelwood Thinning	Fuelwood	1993-1997	491
		Fuelwood Thinning	Fuelwood	1988-1992	3,640
	Dodson Wash Total				**4,591**
	Lewis/Lons Canyons	Broadcast Burn	Fuels	1993-1997	430
			Fuels	1998-2002	178

Watershed Name	Subwatershed Name	Ground/Understory Treatment	Treatment Type	Period of Treatment	Acres
		Lop & scatter	Commercial overstory	1977-1982	3
			Commercial salvage Thin	1993-1997	43
			Commercial Thin from below	1993-1997	122
		Lop & scatter Total			168
		Thin & Lop	Pre-commercial	1993-1997	3
		Thin & pile	Pre-commercial	1977-1982	511
		Thin & slash	Pre-commercial	1977-1982	112
		Tree planting	Reforestation	1998-2002	13
		Unknown	Commercial overstory	1977-1982	2
			Commercial Thin from below	1977-1982	38
		Unknown Total			40
		Wildfire Burn	Wildfire	1993-1997	102
	Lewis/Lons Canyons Total				**2,261**
	McCleve Canyon	Burn Machine piles	Fuels	1993-1997	58
		Lop & scatter	Commercial Thin from below	1993-1997	1
		Machine pile to landing	Commercial Thin from below	1993-1997	58

Watershed Name	Subwatershed Name	Ground/Understory Treatment	Treatment Type	Period of Treatment	Acres
		Thin & scatter	Commercial intermediate/ seed cut	1993-1997	4
	McCleve Canyon Total				**121**
	Middle Cottonwood		Commercial overstory	1977-1982	7
		Broadcast Burn	Fuels	1998-2002	18
		Lop & scatter	Commercial overstory	1977-1982	10
		Machine pile Total			1
		Thin & Lop	Pre-commercial	1977-1982	9
		Thin & pile	Pre-commercial	1977-1982	6
	Middle Cottonwood Total				**52**
	Mortenson Wash	Broadcast Burn	Fuels	1993-1997	6
		Burn hand piles	Fuels	1998-2002	58
		Fuelwood Thinning	Fuelwood	1998-2002	27
		Lop & scatter	Commercial overstory	1977-1982	67
			Commercial Thin from below	1993-1997	75
		Lop & scatter Total			142
		Machine pile	Commercial overstory	1977-1982	256
		Thin & Lop	Pre-commercial	1983-1987	431
				1993-1997	529

Watershed Name	Subwatershed Name	Ground/Understory Treatment	Treatment Type	Period of Treatment	Acres
			Pre-commercial Total		960
		Thin & pile	Pre-commercial	1977-1982	265
				1983-1987	206
				1993-1997	53
			Pre-commercial Total		524
		Thin & slash	Pre-commercial	1977-1982	450
		Unknown	Commercial overstory	1977-1982	108
	Mortenson Wash Total				**2,531**
	Pinedale Wash		Commercial overstory	1977-1982	769
		Broadcast Burn	Fuels	1998-2002	1,058
		Lop & scatter	Commercial overstory	1977-1982	1,197
			Commercial Thin from below	1993-1997	189
		Lop & scatter Total			1,769
		Machine pile	Commercial overstory	1977-1982	2
		Machine pile to landing	Commercial Thin from below	1993-1997	134
		Remove slash	Commercial Thin from below	1993-1997	87

Watershed Name	Subwatershed Name	Ground/Understory Treatment	Treatment Type	Period of Treatment	Acres
		Thin & Lop	Pre-commercial	1977-1982	418
		Thin & pile	Pre-commercial	1977-1982	780
		Thin & scatter	Commercial intermediate/ seed cut	1993-1997	42
		Thin & slash	Pre-commercial	1977-1982	1,088
		Unknown	Commercial overstory	1977-1982	538
		Wildfire Burn	Wildfire	1993-1997	624
	Pinedale Wash Total				**7,307**
	Town Draw		Commercial overtory	1977-1982	71
		Fuelwood Thinning-commercial	Fuelwood	1988-1992	12
	Town Draw Total				**83**
	Upper Cottonwood Wash		Commercial overstory	1977-1982	0
		Broadcast Burn	Fuels	1993-1997	500
				1998-2002	0
			Fuels Total		500
		Lop & scatter	Commercial salvage Thin	1993-1997	136
			Commercial Thin from below	1993-1997	1
		Lop & scatter Total			137

Watershed Name	Subwatershed Name	Ground/Understory Treatment	Treatment Type	Period of Treatment	Acres
		Lop & scatter 2ft	Commercial overstory 12+	1988-1992	214
			Commercial overstory 14+	1988-1992	182
		Lop & scatter 2ft Total			395
			Commercial overstory 14+	1988-1992	257
			Commercial overstory 17+	1988-1992	85
		Lop & scatter 3ft Total			642
					5
			Commercial overstory 14+	1988-1992	187
			Commercial overstory 17+	1988-1992	131
			Commercial seed cut	1988-1992	123
			Commercial Thin from above	1988-1992	175
		Machine pile Total			742
		Thin & chip	Pre-commercial	1993-1997	59
		Thin & Lop	Pre-commercial	1993-1997	104
		Thin & pile	Pre-commercial	1977-1982	4
				1983-1987	17
				1988-1992	95
				1993-1997	122

Watershed Name	Subwatershed Name	Ground/Understory Treatment	Treatment Type	Period of Treatment	Acres
			Pre-commercial Total		238
		tree planting	Reforestation	1998-2002	146
		Wildfire Burn	Wildfire	1993-1997	234
	Upper Cottonwood Wash Total				**3,197**
	Upper Town Draw		Commercial overstory	1977-1982	1
		Broadcast Burn	Fuels	1998-2002	14
		Lop & scatter	Commercial overstory	1977-1982	11
		Thin & Lop	Pre-commercial	1977-1982	10
		Thin & pile	Pre-commercial	1977-1982	1
	Upper Town Draw Total				**38**
	Water/Bear Canyon		Commercial overstory	1977-1982	2
		Broadcast Burn	Fuels	1998-2002	143
		Burn Machine piles	Fuels	1993-1997	18
		Lop & scatter	Commercial overstory	1977-1982	1
			Commercial salvage Thin	1993-1997	407
			Commercial Thin from below	1993-1997	708
		Lop & scatter Total			1,116
		Machine pile	Commercial overstory	1977-1982	634

Watershed Name	Subwatershed Name	Ground/Understory Treatment	Treatment Type	Period of Treatment	Acres
		Machine pile Total			634
		Machine pile to landing	Commercial Thin from below	1993-1997	125
		Thin & Lop	Pre-commercial	1983-1987	12
				1993-1997	3
			Pre-commercial Total		14
		Thin & pile	Pre-commercial	1977-1982	468
				1983-1987	19
			Pre-commercial Total		487
		Thin & scatter	Commercial intermediate/ seed cut	1993-1997	94
		Thin & slash	Pre-commercial	1977-1982	1
				1983-1987	25
		tree planting	Reforestation	1998-2002	266
		Wildfire Burn	Wildfire	1993-1997	480
	Water/Bear Canyon Total				**3,405**
Cottonwood - Dodson Total					**23,587**
Show Low Creek	Bagnal Draw	Broadcast Burn	Fuels	1998-2002	217
		Burn hand piles	Fuels	1998-2002	226
		Chipping	Fuels	1998-2002	59

Watershed Name	Subwatershed Name	Ground/Understory Treatment	Treatment Type	Period of Treatment	Acres
		Lop & scatter	Commercial seed cut	1993-1997	37
			Commercial Thin	1993-1997	539
			Commercial Thin from below	1993-1997	501
		Lop & scatter Total			1,077
		Remove slash	Commercial seed cut	1993-1997	6
			Commercial Thin	1993-1997	47
			Commercial Thin from below	1993-1997	48
		Remove slash Total			102
		Thin & chip	Fuels	1998-2002	322
		Thin & Lop	Pre-commercial	1977-1982	53
				1983-1987	64
				1993-1997	23
				1998-2002	1,010
			Pre-commercial Total		1,150
		Thin & pile	Fuels	1998-2002	92
			Pre-commercial	1983-1987	11
				1998-2002	327

Watershed Name	Subwatershed Name	Ground/Understory Treatment	Treatment Type	Period of Treatment	Acres
			Pre-commercial Total		338
		Thin & scatter	Commercial intermediate/ seed cut	1993-1997	34
		Thin & slash	Pre-commercial	1983-1987	1,514
	Bagnal Draw Total				**5,132**
	Bull Hollow Canyon	Broadcast Burn	Fuels	1993-1997	1,068
		Fuelwood Thinning	Fuelwood	1977-1982	111
				1993-1997	1,288
				1998-2002	328
			Fuelwood Total		1,726
		Fuelwood Thinning-commercial	Fuelwood	1988-1992	721
	Bull Hollow Canyon Total				**3,516**
	Lower Hog Wash	Broadcast Burn	Fuels	1998-2002	12
		Burn hand piles	Fuels	1998-2002	13
		Chipping	Fuels	1998-2002	25
		Lop & scatter	Commercial Thin	1993-1997	124
		Remove slash	Commercial Thin	1993-1997	24
		Thin & chip	Fuels	1998-2002	19
		Thin & pile	Pre-commercial	1998-2002	39

Watershed Name	Subwatershed Name	Ground/Understory Treatment	Treatment Type	Period of Treatment	Acres
		Thin & slash	Pre-commercial	1983-1987	297
	Lower Hog Wash Total				**553**
	Lower Linden Draw	Broadcast Burn	Fuels	1993-1997	260
				1998-2002	30
			Fuels Total		290
		Burn hand piles	Fuels	1998-2002	21
		Fuelwood Thinning	Fuelwood	1988-1992	841
				1998-2002	415
			Fuelwood Total		1,256
		Juniper push	forage creation	1993-1997	296
		Thin & Lop	Pre-commercial	1993-1997	23
		Thin & pile	Fuels	1993-1997	53
	Lower Linden Draw Total				**1,940**
	Timberland Estates	Burn hand piles	Fuels	1998-2002	15
		Thin & Lop	Pre-commercial	1993-1997	4
		Thin & pile	Fuels	1993-1997	73
			Pre-commercial	1983-1987	16
		Thin & slash	Pre-commercial	1983-1987	12
	Timberland Estates Total				**121**
	Upper Hog Wash	Broadcast Burn	Fuels	1998-2002	235

Watershed Name	Subwatershed Name	Ground/Understory Treatment	Treatment Type	Period of Treatment	Acres
		Burn hand piles	Fuels	1998-2002	37
		Lop & scatter	Commercial Thin	1993-1997	233
		Remove slash	Commercial Thin	1993-1997	40
		Thin & Lop	Pre-commercial	1998-2002	32
		Thin & pile	Pre-commercial	1998-2002	38
		Thin & slash	Pre-commercial	1983-1987	299
	Upper Hog Wash Total				**914**
	Upper Linden Draw	Burn hand piles	Fuels	1998-2002	196
		Lop & scatter	Commercial Thin	1993-1997	676
		Remove slash	Commercial Thin	1993-1997	73
		Thin & Lop	Pre-commercial	1998-2002	361
		Thin & pile	Fuels	1993-1997	146
			Pre-commercial	1998-2002	188
		Thin & slash	Pre-commercial	1983-1987	520
	Upper Linden Draw Total				**2,160**
Show Low Creek Total					**14,336**

Current Activities on National Forest Lands

The Jersey Horse (ongoing since 2000) and the Phelps (ongoing since 2001) Timber Sales were both burned over by the fire. The contracts of both sales were modified to include the

commercial sized trees killed by the fire. Both timber sales are nearing completion and will soon be closed.

The three Decision Memos approved December 23, 2003 authorize treatment of dead trees by four commercial timber sales; the Ridge, Ross, Yarrow and OW Timber Sales. They also authorize additional treatments of non-commercial sized dead trees posing threats to the public safety and private property.

Current Activities on Private Lands

Private landowners began cleanup of their property, as soon after the fire as it was safe to return. Others have yet to begin. Most merchantable sized trees were cut down, given away as firewood, or piled and burned along with small sub-merchantable sized timber, due to the glut of burned timber available on much larger inholdings, in particular on the Fort Apache Indian Reservation. However, some of the private landowners were successful in selling larger merchantable trees to the local mill in Heber, AZ. Most dead timber will be salvaged or disposed of on-site by the end of the summer of 2003.

This information was summarized and considered during selection of runoff curves to predict post-fire discharge and the effects of adding slash as ground cover from treatments proposed in action alternatives. Table 5 displays the private land parcels, including sub-watersheds and burn severity classes affected by the fire.

Table 65 - Private land ownership within and adjacent to the Rodeo-Chediski Fire

Parcel #	Subwatershed Name	Name	Road Access	Burn Severity	Acres	Misc.
T-01	Canyon Creek	OW Ranch	County/Pvt. 1.2 mi.	Low	72 L	72 T
T-02	Canyon Creek	Canyon Creek Fish Hatchery	County/State 0.2 mi	L/H	9 L, 1 H	10 T AG&F
A-03	Canyon Creek and not identified	Forest Lakes	State/County/ Private 18 mi	Outside	358 ac and 689 outside	0.25 to 1.0 lots 1,047 T
A-04	Canyon Creek	Forest Lakes South	State/County/ Private 3.0 mi	Outside	144	144 T 0.25 ac lots
A-05	Canyon Creek	Rim Resort Mobile Home Park	State/County/ Private 0.7 mi	Outside	62	62 T 0.25 ac lots
A-06	Baca/Bear/ Turkey Canyon	Black Canyon Ranch (Gibson)	County 0.4 mi	L/M/H	67 L, 5 M, 53 H	115.4 T
A-06a	Baca Canyon	Baca Cemetery	Forest none	L	0.7 L	0.7 T

Parcel #	Subwatershed Name	Name	Road Access	Burn Severity	Acres	Misc.
A-07	Not identified	Ellsworth Ranch	Forest 1.4 mi	Outside	159	159 T
A-08	Not identified	Walnut Ranch	Forest 0.5 mi	Outside	107.7	107.7 T
A-09	Middle Buckskin	Crandall Ranch	Forest 0.9 mi	L/H	60 L. 1 H	60.9 T
A-10	Black Canyon, Lower Buckskin, Mid. Buckskin, Mid. Pierce Wash, OK Flat, Ross Draw	Heber/Overgaard	State/City 140.5 mi.	L/M/H and outside	8,046 out, 497 L, 167 M, 527 H	9,237 T
A-11	Middle Pierce Wash	Halter Cross Ranch	County/ private1.5.0 mi	Outside	70.3	70.3 T
A-12	Middle Pierce Wash	Halter Cross Ranch	County/ Private 0.9 mi	L/M/H	50 L, 27 M, 64 H	140.6 T
A-13	Lower Phoenix Park Wash	Blevens Ranch	County/State 0.9 mi	L/M	84 L, 5 M	89 T
A-14	Upper Day Wash	Bear Springs (AZ State)	Forest 0.1 mi	L/M/H	12 L, 6 M, 4 H	22.7 T AG&F
A-15	Upper Day Wash, Lower Decker Wash	Aripine	State/Private 9.8 mi	L/M/H and Outside	95 L, 34 M, 113 H	655 Out 897 T
A-16	Lower Decker Wash	Unknown	County no roads	Outside	5.2	5.2 T
A-17	Lower Decker Wash	Unknown	County no road	Outside	2.6	2.6 T
A-18	Lower Decker Wash	Unknown	County 0.7 mi	Outside	172	172 T
A-19	Middle Day Wash	North of LDS Ranch	County 1.0 mi	L/M and Outside	100 out, 58 L, 7 H	165 T
A-20	Middle Day Wash, Upper Day Wash, Willow Wash	LDS Ranch	County 1.5 mi	L/M and Outside	115 L, 39 M	19 Out 173 T

Parcel #	Subwatershed Name	Name	Road Access	Burn Severity	Acres	Misc.
A-21	Upper Day Wash	Sundown Girls Ranch	County 1.7 mi	L/M/H	268 L, 125 M, 33 H	426 T
A-22	Upper Day Wash, Willow Wash	Camper Land Mobile Home Park	State/Private 1.4 mi	L/M/H	146 L, 6 M, 8 H	160 T
A-23	Upper Day Wash, Willow Wash	Pope Ranch	Forest 0.5 mi	L/M/H	35 L, 24 M, 1 H	60 T
A-24	Stinson Wash, Willow Wash	Smith Ranch	Forest 0.4 mi	L/M	47 L, 7 M	54 T
A-25	Stinson Wash, West Fork Cottonwood	W. Cottonwood Ridge	Forest 0.3 mi	L/M/H	24 L, 30 M, 105 H	159 T
A-26	West Fork Cottonwood	Deer Springs	Forest 0.3 mi	M/H	13 M, 27 H	40 T
A-27	Stinson Wash	Williams Ranch	State 0.0 mi	L	80 L	80 T
A-28	Stinson Wash	Albert's Ranch	County/Forest 0.5 mi	L/M	152 L, 8 M	160 T
A-29	Stinson Wash	Richard's Ranch	County 1.0 mi	L/M	157 L, 21 M	178 T
A-30	Stinson Wash	Clay Mine	County 0.7 mi	L/M/H	28 L, 52 M, 85 H	165 T
A-31	Stinson Wash	Deer Springs Inn	County 0.9 mi	L/M/H	94 L, 101 M, 123 H	318 T
A-32	Middle Cottonwood	Russell Point	Forest 0.8 mi	L/M/H	16 L, 47 M, 25 H	88 T
A-33	Stinson Wash	Webwood Acres	County 0.2	M/H	2 L, 4 H	6 T
A-34	Lower Cottonwood Wash	E. J. Smith Ranch	State/County 1.2 mi	L/M and outside	108 L, 20 M	480 Out 608 T

Parcel #	Subwatershed Name	Name	Road Access	Burn Severity	Acres	Misc.
A-35	Middle Cottonwood	Lewis Ranch	Forest 0.02 mi	L/M/H	56 L, 3 M, 3 H	62 T
A-36	Middle Cottonwood	Bryant Ranch	Forest/County 0.5 mi	L/M/H	85 L, 24 M, 62 H	171 T
A-37	Middle Cottonwood	Gourd Flat	Forest 0.1 mi	L/M/H	5 L, 19 M, 16 H	40 T
A-38	Cottonwood Wash, Lower Cottonwood Wash, Middle Cottonwood, Town Draw	Clay Springs	State/County 17.7 mi	L/M/H and outside	222 L, 38 M, 54 H	3,018 outside 3,332 T
A-39	Middle Cottonwood, Town Draw	Junior Williams	Forest 1.0 mi	L/M/H	124 L, 23 M, 13 H	160 T
A-40	Dodson Wash, Mortenson Wash, Pinedale Wash	Pinedale	State/County 9.0 mi	L/M/H and outside	469 L, 100 M, 68 H	328 Out 965 T
A-41	Dodson Wash, Mortenson Wash	North Pinedale	State/County 2.1 mi	L/M	38 L 14 M	390 Out 442 T
A-42	Dodson Wash, Town Draw	Aunt Lottie - Pinedale	State/County 7.6 mi	L/M and outside	409 L, 61 M	896 Out 1,366 T Low Density
A-43	Mortenson Wash	Turkey Hill	County 0.3 mi	L/M/H	9 L, 48 M, 23 H	80 T
A-44	Mortenson Wash	Brown Ranch	Private 0.4 mi	L/M	94 L, 13 M	107 T, 2 own
A-45	Mortenson Wash	Mountain Dale Estates and adjacent lands.	County 2.7 mi	L/M	281 L, 65 M	346 T

Parcel #	Subwatershed Name	Name	Road Access	Burn Severity	Acres	Misc.
A-46	Lewis Canyon, Lons Canyon	Unknown	County/ Pvt. 0.4 mi	L/M	57 L, 4 M	61 T
A-47	Lewis/Lons/ Water/Bear Canyons	Peterson Homestead	County 2.4 mi	L/M/H	174 L, 15 M, 10 H	199 T
A-48	Water Canyon, Bear Canyon	Pinedale Estates	County 2.8 mi	L/M	120 L, 2 M	122 T
A-49	Water Canyon, Bear Canyon	Unknown	Forest 0.1 mi	L/M	71 L, 1 M	72 T
A-50	Show Low Creek	Unknown	Forest 0.0 mi	M/H	7 M, 13 H	20 T
A-51	Upper Linden Draw, Not identified	Tomich	County/Pvt. 1.3 mi	L/M/H	64 L, 79 M, 220 H	363 T
A-52	Upper and Lower Linden Draw	Timberland Acres & Adj.	County/Pvt. 15.9 mi	L/M/H	444 L, 453 M, 59 H	956 T
A-53	Bagnal Draw, Lower Hog Wash, Lower Linden Draw, Upper Linden Draw, Not identified	Linden & Adj.	State/County/ Pvt.70.7 mi	L/M/H	242 L, 127 M, 16 H	6,138 Out, 6,523 T (south of Hwy 260)
A-54	Dodson Wash	Capps Ranch	County 0.8 mi	L/M/H and outside	46 L, 64 M, 3 H	49 Out, 162 T
A-55	Bull Hollow Canyon, Lower Linden Draw, not identified	Burton & Adj.	County 13.1 mi	outside	1,483	1,483 T Outside 6 parc.
A-56	Bagnal Draw, Lower Hog Wash, not identified	Show Low	State/City 370.9 mi	outside	24,988	24,988 Outside

Parcel #	Subwatershed Name	Name	Road Access	Burn Severity	Acres	Misc.
Subtotals						
T01-T02						**82**
A-03 to A-25						**13,529**
A-26 to A-50						**9,187**
A-51 to A-56						**34,474**
Grand Totals						**57,273**

Includes: Canyon Creek Fish Hatchery under special use permit to the AG&F Department and Bear Springs owned by the State (AG&F Department). Road access column displays maintenance responsibility and miles of road within private land boundaries.

Current Activities on Reservation Lands

Due to the uplift of the Mogollon Rim, only very small portions of watersheds within the fire perimeter actually contribute to flows on the Reservation lands to the south, as nearly all of the Mogollon Rim slopes north. Nearly all of the Apache-Sitgreaves National Forests flows north, and the only area of any size that flows south is off the Tonto National Forest, specifically in the Canyon Creek area. The areas that do flow south on the Apache-Sitgreaves National Forests are not planned for treatments in any of the alternatives, so no additional treatment-generated flows or sediment would be generated to affect Reservation lands. In addition, the amount of area which contributes flow to the south is insignificant on the Apache-Sitgreaves National Forests, and likely immeasurable in actual effects. The Canyon Creek area of the Tonto National Forest does contribute to Reservation flows. However, this area is only proposed for treatment in one alternative.

The Reservation has had substantial activities on its lands recently; as a result of the fire as well as salvage logging that has already occurred. It would be difficult to track or distinguish discharge and sediment from the Tonto National Forest impacting Reservation lands, from those resulting from the Reservation itself.

Future Activities on National Forest Lands

The following table displays reasonably foreseeable future activities taken from the quarterly SOPA for the Apache-Sitgreaves and Tonto National Forests.

Table 66 - Reasonably foreseeable future activities by treatment, watershed, and time period across the analysis area

Watershed Name	Subwatershed Name	Ground/Under-story Treatment	Treatment Type	Planned Date	Acres
Black Canyon	Black Canyon Lake	Chip/lop	Salvage	2003	142
	West Fork Black Canyon	Chip/lop	Salvage	2003	385
Black Canyon Total					**527**
Canyon Creek	Canyon Creek	Chip	Salvage	2003	131
	Valentine Creek	Chip	Salvage	2003	3
Canyon Creek Total					**134**
Chevelon Creek	Wildcat Canyon	Chip/lop	Salvage	2003	111
Cottonwood - Dodson	Middle Cottonwood	Lop	Salvage	2003	229
	Stinson Wash	Lop	Salvage	2003	1,429
	West Fork Cottonwood	Lop	Salvage	2003	7
	Willow Wash	Lop	Salvage	2003	11
Cottonwood - Dodson Total					**1,676**
Cottonwood - Dodson	Cottonwood Wash	Cottonwood	Forage Maint. & Fuels Treatments	2003-2004	446
		Rattlesnake	Broadcast Burn	2003-2008	726
	Cottonwood Wash Total				**1,172**
	Dodson Wash	Bull hollow area	Broadcast Burn	2003-2008	824
		Lons burn block 1	Fuels Maintenance	2003-2008	7
		Rattlesnake	Broadcast Burn	2003-2008	2,406

Watershed Name	Subwatershed Name	Ground/Under-story Treatment	Treatment Type	Planned Date	Acres
	Dodson Wash Total				**3,237**
	Lewis/Lons Canyons	Lons prescribed burn	Fuels Maintenance	2003-2008	608
	Middle Cottonwood	Lons burn block 1	Fuels Maintenance	2003-2008	18
	Mortensen Wash	Bull hollow area	Broadcast Burn	2003-2008	694
		Lons prescribed burn	Fuels Maintenance	2003-2008	6
		Town tank	Fuelwood Thinning	2003-2008	0
		Town tank salvage	Fuelwood Thinning Salvage	2003-2008	1
	Mortensen Wash Total				**701**
	Pinedale Wash	Lons burn block 1	Fuels Maintenance	2003-2008	1,058
	Town Draw	Cottonwood	Forage Maint. & Fuels Treatments	2003-2008	148
		Rattlesnake	Broadcast Burn	2003-2008	6,734
	Town Draw Total				**6,882**
	Upper Cottonwood Wash	Lons burn block 1	Fuels Maintenance	2003-2008	0
	Upper Town Draw	Lons burn block 1	Fuels Maintenance	2003-2008	14

Watershed Name	Subwatershed Name	Ground/Under-story Treatment	Treatment Type	Planned Date	Acres
	Water/Bear Canyon	Lons burn block 1	Fuels Maintenance	2003-2008	1
		Lons prescribed burn	Fuels Maintenance	2003-2008	142
	Water/Bear Canyon Total				**143**
Cottonwood - Dodson Total					**13,832**
Show Low Creek	Bagnal Draw	Bagnal maintenance	Fuels Maintenance	2003-2008	257
		Fools hollow ridge	Fuels – thin & chip <6" dbh	2003	285
		Show Low south defense zone	Fuels Maintenance	2003-2008	206
		Show Low south prescribed	Broadcast Burn	2003-2008	268
	Bagnal Draw Total				**1,016**
	Bull Hollow Canyon	Bull hollow area	Broadcast Burn	2003-2008	5,006
		Community	Broadcast Burn	2003-2008	2,149
	Bull Hollow Canyon Total				**7,156**
	Lower Hog Wash	Show Low south defense zone	Fuels Maintenance	2003-2008	199
		Show Low south prescribed	Broadcast Burn	2003-2008	0
	Lower Hog Wash Total				**199**
	Lower Linden Draw	Bull hollow area	Broadcast Burn	2003-2008	330

Watershed Name	Subwatershed Name	Ground/Under-story Treatment	Treatment Type	Planned Date	Acres
		Community	Broadcast Burn	2003-2008	1,219
		Timberland	Fuels Maintenance	2003-2008	6
		Town tank	Fuelwood Thinning	2003-2008	68
		Town tank salvage	Salvage	2003-2008	393
	Lower Linden Draw Total				**2,016**
	Timberland Estates	Timberland	Fuels Maintenance	2003-2008	44
		Town tank salvage	Salvage	2003-2008	33
	Timberland Estates Total				**78**
	Upper Hog Wash	Show Low south defense zone	Broadcast Burn	2003-2008	113
	Upper Linden Draw	Show Low south defense zone	Broadcast Burn	2003-2008	34
		Timberland	Fuels Maintenance	2003-2008	107
		Town tank	Fuelwood Thinning	2003-2008	62
		Town tank salvage	Salvage	2003-2008	135
	Upper Linden Draw Total				**338**
Show Low Creek Total					**10,916**
Grand Total					**24,748**

Appendix B – Best Management Practices

Introduction

Best Management Practices (BMPs) are defined as "A practice or a combination of practices, that is determined by a State (or designated area-wide planning agency) after problem assessment, examination of alternative practices and appropriate public participation to be the most effective, practicable (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals."

Best Management Practices are the primary mechanism to enable the achievement of water quality standards set forth by the Environmental Protection Agency (1987) under the Clean Water Act. This appendix identifies and describes in detail those BMPs that are applicable for use in meeting soil and water quality objectives as set forth in a memorandum of understanding between the Forest Service and the State of Arizona. Best Management Practices include, but are not limited to structural and non-structural controls, operations and maintenance procedures. They can be applied before, during and after pollution-producing activities in order to reduce or eliminate the introduction of pollutants into waterways (Title 40, CFR 130.2).

Implementation

The District Ranger is responsible for ensuring the factors identified in the following soil and water conservation practices are incorporated into the correct Timber Sale Contract provision, that the provisions are included in the Timber Sale Contract(s) or public works contracts through the inclusion of specific contract clauses and implemented on the ground. Specific Timber Sale Contract clauses are often included in the BMPs for further reference, and the clauses start with a "B" or a "C" followed by number (e.g. B6.4).

Unless otherwise specified, the Presale Forester is responsible for insuring that the factors identified in the following soil and water conservation practices are incorporated into the correct Timber Sale Contract B and/or C provision and that the provisions are included in the Timber Sale Contract(s).

The contracting officer, through his/her official representatives out on the ground (sale administrator (TSA) and/or engineering representative (ER) on timber sale contracts and contracting officers representative (COR) on public works contracts), is responsible for insuring that the clauses are properly administered.

Applicable Best Management Practices

The information presented in this appendix is derived from applicable sections of Forest Service Handbook (FSH) 2509.22. In instances a boxed section follows which are mitigation measures specifically designed by the Rodeo-Chediski Salvage Project ID Team, which specify more detail than given in the FSH requirements. Many of these will fit under several different FSH guidelines. These mitigation measures also appear in Chapter 2, Table 2.1. Applicable BMPs are presented out of Chapters 20 and 40 of FSH 2509.22.

CHAPTER 20 – RESOURCE MANAGEMENT ACTIVITIES

24 - TIMBER MANAGEMENT

24.1 - Timber Harvest Unit Design

1. Objective. To ensure that timber harvest cutting unit design will secure favorable conditions of water flow and water quality.

2. Explanation. This is an administrative and preventative practice. The proposed timber harvest units are evaluated to estimate the response of the watersheds involved to the proposed timber sale. This includes a field examination of the ability of the watershed to absorb the impacts of the proposed harvest. Characteristics to be evaluated can include the recovery from past harvests; the protection of channels; the number, size, and location of harvest units; estimated location and size of roads and skid trails; logging system design; the condition of the protective ground cover in filter strips; and the potential natural recovery rate of the watershed. Where adverse water quality impacts and undesirable stream flows can result, the harvest unit design should be modified, and/or the natural recovery rate can be accelerated using watershed treatment measures.

3. Implementation. The hydrologic survey and evaluation of proposed timber harvest is accomplished through the integrated resource management (IRM) planning process. Incorporate prescriptions to assure acceptable conditions of water flow into the project plan.

24.11 - Use of Terrestrial Ecosystem Survey Timber Harvest Limitation Rating

1. Objective. To identify severe and moderate erosion hazard areas and other soil limitations in order to adjust treatment measures to prevent downstream water quality degradation.

2. Explanation. This is a preventative practice. The Region 3 Terrestrial Ecosystem Survey (TES) contains a timber harvest limitation rating which evaluates the potential erosion and soil disturbance hazards due to timber harvest. Moderate and severe ratings point to the need to consider various mitigation measures to improve and maintain water quality in order to comply with Federal and state water quality standards, such as minimizing the use of ground disturbing equipment or restrictions on operating season.

3. Implementation. Timber Harvest Limitation ratings are available through published TES surveys or can be made by soil scientists or other personnel specifically trained to perform these evaluations. Such information is then utilized in the IRM project design process.

24.12 - Use of Sale Area Maps for Designating Water Quality Protection Needs

1. Objective. To delineate the location of protection areas and available water sources as a guide for both the Purchaser and the Sale Administrator, and to ensure their recognition and proper consideration and protection on the ground.

2. Explanation. The following features are designated on the Sale Area Map, which is an integral part of the Timber Sale Contract:

a. Location of non-riparian ephemeral and intermittent stream courses to be protected with filter strips.

b. Wetlands (wet meadows, lakes, pot holes, and other riparian areas) that have a riparian streamside management zone or a filter strip to protect them.

c. Boundaries of harvest units.

d. Specified roads.

e. Roads where log hauling is prohibited or restricted (for example, roads located in filter strips and stream courses).

f. Structural improvements.

g. Areas where method of skidding and yarding is designated.

h. Sources of rock for road work, rip-rapping, and so forth.

i. Water sources available for Purchaser's use.

j. Other features required by Division "C" contract provisions.

This is an administrative and preventative practice.

3. Implementation. The IRM process results in identification of these and other features. The Sale Preparation Forester will include them on the Sale Area Map at the time of contract preparation. The areas are reviewed on the ground by the Purchaser and the Sale Administrator prior to harvesting.

24.13 - Limiting the Operating Period of Timber Sale Activities

1. Objective. To ensure that the Purchaser conducts operations, including but not limited to erosion control work, road maintenance, and log landing drainage in a timely manner, within the time period specified in the Timber Sale Contract.

2. Explanation. The C6.3 "Plan of Operation" provision is required in all Timber Sale Contracts. This provision states that the Purchaser must submit a general plan of operation which will set forth planned periods for and methods of road construction, timber harvesting, completion of slash disposal, erosion control work, and other contractual requirements. Forest Service written approval of the Plan of Operation is a prerequisite to the commencement of the Purchaser's operation.

The contract provision B6.31 "Operation Schedule" requires that the Purchaser shall provide an annual schedule of anticipated activities such as road maintenance and erosion control work.

Provision B6.6 can be used to suspend operations because of wet or saturated soils in order to protect soil and water resources.

3. Implementation. Limited operating periods are identified and recommended during the IRM process. The sale preparation officer prepares the contract to include provision C6.314. Provisions B6.3, B6.31, and C6.3 are all mandatory provisions of the Timber Sale Contract. Provision C6.3 is only mandatory for sales over a two-year contract period. The Purchaser must submit a general plan and annual plans to the Forest Service. The Purchaser may commence operations only after written Forest Service approval of the general plan under C6.3.

24.14 - Protection of Extremely Unstable Lands

1. Objective. To provide for special treatment of unstable areas or soils with severe erosion hazard and thereby avoid unacceptable erosion and sedimentation.

2. Explanation. This practice is an administrative and preventative control. Where extremely unstable lands (landslide areas) and highly erodible soils (severe erosion hazard) are delineated, they are taken out of suitable forestlands and are reclassified as unsuitable forestland. Using existing harvesting technologies, unsuitable forestlands cannot be managed for timber production because irreversible damage to soils, productivity, or watershed conditions may occur. Timber harvesting is deferred until improved harvesting technologies are developed and proven.

24.16 - Streamside Management Zone (Filter Strip) Designation

1. Objective. To designate a zone along streams (including ephemeral and intermittent streams, wet areas, meadows, riparian areas, or any area that has the hydrological characteristics of carrying water on or near the surface and that the delivery of sediments to this area can effect water quality) where management actions are designed to minimize adverse effects on water and related resources.

2. Explanation. Factors such as stream class, existing ground cover conditions, soil erosion hazard, channel aspect, channel stability, side slope steepness, and slope stability are considered in determining the constraints of activities and width of streamside management zones. Fisheries habitat condition and its estimated response to the proposed activities are also evaluated in determining the need for and width of the streamside management zone. The streamside management zone is not a zone of closely managed activity. It is a zone that acts as an effective filter and absorptive zone for sediment; maintains shade; protects aquatic and terrestrial riparian habits; protects channel and stream banks; and promotes floodplain stability.

3. Implementation. Identify the streamside management zone requirements during the IRM process. Contracted projects are implemented by contractors or operators. Compliance with environmental analysis criteria, contract specification, and operating plans is assured by the Contracting Officers Representative or Timber Sale Administrator.

24.17 - Determining Tractor Loggable Ground

1. Objective. Comply with Federal and state water quality standards when tractor logging.

2. Explanation. This practice is intended to minimize soil erosion, subsequent sedimentation and water quality degradation. The Timber Harvest Limitation rating provided by the TES is the basic method of determining tractor loggable ground.

3. Implementation. The TES is utilized by a trained and qualified Forest Service representative during the on-the-ground assessment of the timber sale. Consider the resulting Timber Harvest Limitation rating during the selection of logging and silvicultural methods and use it in determining acceptable intensity of and restrictions for land disturbance activities. Give interpretations of the considerations in the NEPA documentation. Provisions in the Timber Sale Contract specify the areas determined by the TES upon which tractors can operate.

Tractor logging is generally not permitted on slopes exceeding 40 percent. Exceptions may be made after a thorough investigation of on site conditions and inclusion of special specified mitigation prescriptions in the timber sale contract. Tight administrative control of such operations is also required.

24.18 - Tractor Skidding Location and Design

1. Objective. To minimize erosion and sedimentation by designing skidding patterns to best fit the terrain. To maintain the integrity of the streamside management zones, riparian areas, and other sensitive watershed areas.

2. Explanation. This is a preventative practice. The watershed factors that are considered include slope, soil stability, exposure, vegetative cover and any factor that may affect the peak flow and sediment yield potential of the land. The careful control of skidding patterns serves to minimize on site erosion and downstream channel damage by preventing the concentration of runoff in skid

trails. Proper skid pattern management involves such things as locating skid trails to avoid stream courses and restriction of skidders to designated trails.

Two complementary methods of complying with water quality standards when tractor skid trails are design:

a. End-Lining. This method involves winching the log directly out of the sensitive areas (streamside management zone, wet meadow, riparian area, and so forth) with a cable operated from outside the sensitive area.

b. Felling To The Lead. This method involves felling trees toward a predetermined skid pattern. Soil disturbance, compaction, and residual stand and site damage are minimized when this method is used.

3. Implementation. For skid trail design, identify and evaluate sensitive areas in the environmental assessment review during the IRM process. A special Timber Sale Contract provision can be included in the Timber Sale Contract for the location of skid trails. The Sale Administrator locates the skid trails with the timber Purchaser or by agreeing to the Purchaser's proposed locations prior to construction. Guidelines for skid trail locations are referenced in the sale plan, the Timber Sale Administration Handbook (FSH 2409.23), the Timber Sale Contract, and on the Presale Cutting Unit Summary card (R3-2400-50).

Mitigation measures were developed by the ID Team specifically for this project and were given identification numbers that precede each item (see Chapter 2, Table 2.1). They are as follows:

SOILS-M-4	Employ a “felling to lead” method to complement skidding practices. This practice involves felling trees toward a predetermined pattern. Allow operators to skid in random patterns to minimize soil compaction associated with single skid trails.
SOILS-M-5	Employ directional felling and end-lining to minimize damage to live vegetation and soils, especially in Streamside Management Zones.
SOILS-M-6	Design, locate, and use designated skid trails when skidding logs through areas not receiving treatment (such as unburned or low-severity burn areas).
SOILS-M-9	Fall dead trees away from the channel in bottom areas along 2nd order streams with defined bed and banks. Avoid felling into or across drainages.
SOILS-M-10	In channels, remove dead and down salvage generated debris that may become mobilized in flood events, deposited in debris jams, and lodged downstream in constricted channel reaches, culverts, bridges, and/or spillways.

24.2 - Log Landing Location

1. Objective. To locate landings so creation of unsatisfactory watershed conditions which lead to water quality degradation is avoided.

2. Explanation. This practice is both administrative and preventative. Location of all landings shall be agreed to by the Forest Service and Purchaser prior to construction. The following criteria are used in evaluating landings:

a. The cleared or excavated size of landings shall not exceed that needed for safe and efficient skidding and loading operations.

b. Landing locations are selected which minimize the amount of excavation and on-site soil loss.

c. Where possible, landings are located so that felled timber lying between drainages can be skidded to the landing without crossing channels.

d. Landings are located where the least number of skid roads are required, and side cast will neither enter drainages nor damage other sensitive areas.

e. Landings are positioned such that the skid road approach will be nearly level or less than 3 percent grade, far enough back to allow for good drainage.

f. Landings are located so a minimum number of tractor roads enter the landing.

g. Landings are not located in streamside management zones.

3. Implementation. Landing locations chosen by the contractor must be agreed to by the Timber Sale Administrator (SA). The SA can negotiate with the Purchasers' representative to select mutually acceptable landing locations. To be an acceptable landing, it must meet the above criteria. Should agreement not be reached, the decision of the Forest Service shall prevail within the limitations of law.

The following mitigation measure was developed by the ID Team specifically for this project:

SOILS-M-7	Select landing locations and sizes that minimize vegetation and soil loss. After harvest, close landings by scarifying them, placing slash and woody debris on disturbed areas, and seeding them.

24.21 - Erosion Prevention and Control Measures During Timber Sale Operations

1. Objective. To ensure that the Purchaser's operations shall be conducted reasonably to minimize soil erosion.

2. Explanation. Timber is purchased by individuals or companies who either harvest the timber themselves or contract harvest to other parties. Therefore, it is necessary to ensure that purchasers understand and adhere to water quality prescriptions arrived at in the timber sale planning process. This is accomplished by setting forth the Purchaser's and the Forest Service's responsibilities in the Timber Sale Contract.

3. Implementation. Equipment shall not be operated when soil conditions are such that accelerated soil erosion will result. The kinds and intensity of control work required of the Purchaser shall be adjusted to soil and weather conditions and the need for controlling runoff. Erosion control work shall be kept current immediately preceding expected seasonal periods of precipitation or runoff. If the Purchaser fails to do seasonal erosion control work prior to any seasonal period of precipitation or runoff, the Forest Service may temporarily assume responsibility for the work, and any unencumbered deposits may be used by the Forest Service to do the work.

24.22 - Special Erosion Prevention Measures on Disturbed Land

1. Objective. To prevent accelerated on-site soil loss and sedimentation of stream courses.

2. Explanation. This is an administrative and preventive treatment. When required by the contract, the Purchaser shall give adequate treatment by spreading slash or wood chips (or, by agreement, some other treatment) on portions of tractor roads, skid trails, landings, or temporary road fills. This provision is to be used only for sales that contain soil stabilization problems that are not expected to be taken care of by the normal methods prescribed under other contract provisions.

3. Implementation. The ID team shall identify the treatment areas in the IRM process and in the timber sale plan. The District Timber Sale Preparation Officer shall identify the acreage to be treated in the legend of the Sale Area Map (SAM) and prepare a special provision for the contract. The specific acreage to be treated shall be designated on the ground by the Forest Service.

24.23 – Revegetation of Areas Disturbed by Harvest Activities

1. Objective. Establish a vegetative cover on disturbed sites to prevent accelerated on-site soil loss and sedimentation of stream courses.

2. Explanation. Where soil has been severely disturbed by Purchaser's operations, and the establishment of vegetation is needed to minimize erosion, the Purchaser shall take appropriate measures normally used to establish an acceptable vegetative groundcover, or take other agreed stabilization measures. This measure is applied in contracts where it is expected that disturbed soils in parts of the sale area will require vegetative cover for stabilization and the problems will not be mitigated by other contract provisions. Apply this measure on soil with moderate and severe erosion hazard ratings.

3. Implementation. Through the IRM process, an estimate of the need for vegetative cover is determined and included in the sale plan, and in the timber sale appraisal. Where the establishment of vegetation is needed, use provision C6.6 in the Timber Sale Contract. The Forest Service shall designate on the ground the disturbed soils, such as skid trails, landings, and temporary roads, and so forth, that must be treated. The Forest Service shall provide instructions as to soil preparation and the application of suitable seed mixtures, mulch, fertilizer, and the timing of such work. It is the responsibility of the Sale Administrator to make sure that revegetation work is done correctly and in a timely manner.

24.24 - Log Landing Erosion Prevention and Control

1. Objective. To minimize on-site soil loss and subsequent sedimentation of stream courses, from log landings.

2. Explanation. This practice employs administrative, preventive, and corrective controls to meet the objective. After landings have served the Purchaser's purpose, the purchaser shall ditch or slope the landings to permit the drainage and dispersion of water. Landings will be properly drained when constructed before timber sale operations begin. Provisions are also made for revegetation. Other provisions may include ripping, scarifying, smoothing and sloping construction of drainage ditches, prevention of water draining off roads from reaching a landing, spreading slash, covering with wood chips, or applying straw mulch. Unless agreed otherwise, cut and fill banks around landings shall be sloped to remove overhangs and otherwise minimize erosion. The specific work needed on each landing will depend on the actual ground conditions. As part of the IRM process the interdisciplinary team assesses the need for stabilization.

3. Implementation. Timber Sale Contract requirements provide for erosion prevention and control measures on all landings. It is the responsibility of the Timber SA to ensure that this practice is properly implemented on-the-ground.

24.25 - Erosion Control on Skid Trails

1. Objective. To comply with Federal and state water quality standards by minimizing on-site soil loss and sedimentation of stream courses derived from skid trails.

2. Explanation. This practice employs preventive measures in order to meet the objective. The Timber Sale Contract requires the installation and maintenance of erosion control measures on skid trails, tractor roads, and temporary roads. Normally, the work involves constructing cross ditches and water spreading ditches. Grass seeding may also be required. This can be added to the Timber Sale Contract by use of contract clause C6.601. These areas are designated on-the-ground as logging and temporary access construction progresses.

3. Implementation. Location of all erosion control measures are designated and agreed to on-the-ground by the SA. The SA will identify site-specific preventive work to be required of the Purchaser. The Purchaser is obligated to maintain erosion control structures after construction, specified in contract provisions for one year unless maintenance need is caused by other National Forest users.

24.26 - Meadow Protection During Timber Harvesting

1. Objective. To avoid unacceptable groundcover, a reduction of soil productivity, soil compaction, severe soil erosion, and water not being in compliance with Federal and state water quality standards in meadows.

2. Explanation. This is an administrative and preventive action. Unauthorized operation of vehicular or skidding equipment in meadows that are designated on sale area maps and marked on the ground is prohibited. Vehicular or skidding equipment shall not be used on meadows except where roads, landings, and tractor roads are approved. Unless otherwise agreed, trees felled into meadows shall be removed by end lining. Logging slash shall be removed from the meadow.

3. Implementation. The concerns and constraints mentioned above are set forth in Timber Sale Contract requirements. It is the responsibility of the Timber Sale Administrator to ensure that this practice is properly implemented on the ground.

The following mitigation measures were developed by the ID Team specifically for this project:

The following guidelines apply to the protection of bottom areas, low points, swales, or depressions in headwater areas of ephemeral channels: (These areas may not have well-defined channel bottoms or banks).	
SOILS-M-19	Ensure that no skidding occurs up or down channel bottoms.
SOILS-M-20	Ensure that no temporary road construction occurs within 75 feet of ephemeral channels.
SOILS-M-21	Minimize the number of skid trails and road crossings over drainages and keep them perpendicular to the channel.
SOILS-M-22	Cut only dead trees within channels or swales. High stumping would be allowed to facilitate catching debris during floods.
SOILS-M-23	Ensure that logs are not decked within ephemeral streams or swales

24.27 – Stream Course Protection

1. Objective. To protect the natural flow of streams (including ephemeral and intermittent). To provide unobstructed passage of storm flows. To reduce sediment and other pollutants from entering streams. To restore the natural course of any stream as soon as practicable where diversion of the stream may occur as a result of timber management activities.

2. Explanation. This management practice employs administrative, preventive, and corrective measures to meet the objectives. The following points are fundamental to protecting streams and stream courses:

a. Location and method of stream course crossings must be agreed to prior to construction. This is done when locations of skid trails, tractor roads, and temporary roads are agreed on by the Forest Service and the Purchaser.

b. Purchaser shall repair damage to a stream course, including damage to banks and channel.

c. All timber sale debris shall be removed from stream courses within 48 hours, unless otherwise agreed, and in an agreed manner that will cause the least disturbance.

d. Equipment shall not operate within streamside management zones as determined in the IRM process. Streamside management zone boundaries may be modified by the Timber Sale Administrator to meet unforeseen operation conditions.

e. When ground skidding systems are employed, logs will be end-lined out of streamside management zones. Equipment is permitted to cross streamside management zones and stream courses only at locations agreed to by the Timber Sale Administrator and the Purchaser.

f. Lead-out ditches, water bars and other erosion control structures will be located so as not to channelize drainage water directly into stream courses. Energy dissipators will be located at the end of these structures to spread the water. This allows the sediments to drop out and the water to infiltrate.

g. Logs will be fully suspended in cable log harvesting operations within the streamside management zone when required.

h. All stream courses are to be protected with a streamside management zone.

3. Implementation. The Timber Sale Administrator works with the Purchaser's representative to ensure that the Timber Sale Contract clauses covering the above items are carried out on the ground. Specialists can be called upon to help the Timber Sale Administrator with decisions. In the event Purchaser causes debris to enter stream courses in amounts which adversely affect the natural flow of the stream, water purity, or fishery resources, Purchaser shall remove such debris as soon as practicable, but not to exceed 48 hours and in an agreed-upon manner that will cause the least disturbance to stream courses.

The following mitigation measures were developed by the ID Team specifically for this project:

Stream Channel Protection: The following guidelines apply to Streamside Management Zones (SMZs).	
SOILS-M-11	Minimum Filter Strip Widths in Streamside Management Zones: In areas with "Slight" erosion hazard: 100 feet (slope distance) on each side of the stream channel from the top of each bank. (TES Mapping Units 53, 178, 183, 186, 191, 193, 197, 198, and 5078).
SOILS-M-12	Minimum Filter Strip Widths in Streamside Management Zones: In areas with "Moderate" or "Severe" erosion hazard: 150 feet (slope distance) on each side of the stream channel from the top of bank. (TES Mapping Units 52, 54, 55, 181, 182, 187, 192, 189, 202, 5161, 5080, 5162, and 6405).
SOILS-M-13	Permitted activities within filter strips are limited to: Directional felling of trees away from the channel, and not across it, ground skidding or end-lining logs out of the area, skidding perpendicular across channels at designated crossings, and decking of logs and machine piling permitted only along existing roads that are already located within filter strips. However, logs must be decked at least 100 feet away from the channel and only on the uphill side of the road away from the channel.
SOILS-M-14	Activities not permitted within filter strips: Skidding up or down the filter strip or within the stream channel, new road construction, piling and burning of slash, and refueling or servicing of equipment.

The following guidelines apply to all stream channels:	
SOILS-M-15	Cross all drainages at designated crossings only. Roads and skid trails need to cross drainages perpendicular to the channel.
SOILS-M-16	Maintain leadout ditches and waterbars to divert runoff from the road directly away from stream channels. Runoff shall be discharged onto areas far enough away from streams so sediment can be deposited before reaching a watercourse.
SOILS-M-17	Remove debris generated from product harvest activities away from stream channels. Operating equipment within channels shall be avoided. Removal of material by hand or through end-lining is allowed. NOTE: Slash and debris can be left in first order headwater channels of ephemeral drainages designated by the District watershed representative, where slash can help retain runoff and sediment and provide headcut stabilization.
SOILS-M-18	If dead trees are harvested from channel banks, directionally fell trees away from the channel, rather than across it.

24.29 - Acceptance of Timber Sale Erosion Control Measures Before Sale Closure

1. Objective. To assure the adequacy of required erosion control work on timber sales.

2. Explanation. The effectiveness of soil erosion prevention and control measures is determined by the results found after sale areas have been exposed to the elements one or more years after a cutting unit or the entire timber sale has been closed. Although a careful check is required before a timber sale is closed to assure that planned erosion work has been completed to the standard prescribed, the erosion prevention work done in previous years should be periodically inspected during the life of the timber sale. These inspections will help determine whether the planned work was adequate, if maintenance work is needed, the practicability of the various treatments used, and the necessity for modifying present standards or procedures.

3. Implementation. "Acceptable" erosion control means that established standards have been met. Timber Sale Administrators shall not accept erosion control measures that fail to meet set standards.

24.3 - Slash Treatment in Sensitive Areas

1. Objective. To comply with Federal and state water quality standards by protecting sensitive areas (including streamside management zones, landslide areas, and so forth) from degradation that would result from using mechanized equipment for slash disposal.

2. Explanation. Special slash treatment may be prescribed in sensitive areas to facilitate slash disposal without use of mechanized equipment. Meadows, wetlands, streamside management zones, and landslide areas are typically sensitive areas where equipment use is normally prohibited. Slash treatment methods identified during the IRM process are indicated for each cut unit on the Sale Area Map.

3. Implementation. An assessment of the sale area shall be made in the timber sale planning process. Sensitive areas needing protection are identified. Results shall be documented in the sale plan and identified in the Timber Sale Contract and on the Sale Area Map. The Timber SA shall inspect the treatment for correct and satisfactory slash disposal accomplishment.

The following mitigation measure was developed by the ID Team specifically for this project:

SOILS-M-8	Lop all logging slash to a 2-foot height.

25 - WATERSHED MANAGEMENT

The objective of watershed management is to protect watersheds by implementing practices designed to retain soil stability, improve or maintain site productivity, secure favorable conditions of water flow, and preserve or enhance aquatic values. The watershed management program is oriented towards maintenance or improvement of watershed conditions, restoration of National Forests lands damaged by catastrophic events or degraded by past use, and monitoring of soil and water quality.

25.1 - Watershed Restoration

1. Objective. To reduce the potential for nonpoint source pollution by improving hydrologic function, soil stability, and soil productivity.

2. Explanation. Watershed restoration is a corrective measure to:

a. Increase ground cover (for example, vegetation and litter).

b. Increase infiltration.

c. Slow overland flow and conserve the soil resource.

d. Stabilize streambanks and stream channels.

e. Enhance soil productivity.

f. Reduce flood occurrence and flood damage.

g. Improve water quality to ensure compliance with state and Federal water quality standards.

h. Reduce on-site soil loss to within acceptable soil loss values.

i. Improve stream channel stability.

j. Protect watershed restoration projects until the areas have stabilized.

The following factors shall be considered during development of restoration projects; predicted changes in water quality, downstream values, site productivity, threats to life and property, any direct or indirect economic returns and social or scenic benefits.

3. Implementation. This management practice is implemented through the development of a watershed improvement needs inventory and integrated watershed improvement project plans. Planning and implementation will be done using the IRM Process. Pursue multifunctional funding of projects where improvement of watershed conditions will benefit multiple resource areas. The actual work may be done by Forest Service crews, through contract, or by volunteers.

25.11 - Conduct Floodplain and Wetland Hazard Analyses and Evaluations

1. Objective. To minimize the long- and short-term adverse impacts to hydrologic function associated with the occupancy and modification of floodplains.

2. Explanation. The condition of floodplains and wetlands plays an important role in the hydrologic functioning of a watershed. Development in the floodplain frequently has an adverse effect on hydrologic function. Forest Service policy is to recognize floodplains and wetlands as specific management areas, and to avoid adverse impacts that may be associated with the occupancy and modification of floodplains and with the destruction, loss, or degradation of wetlands.

3. Implementation. Floodplain analysis and evaluation are part of the environmental analysis process. Make flood hazard analysis and evaluation prior to acquisition or exchange of land within floodplains. A floodplain analysis and evaluation must be made when sites within floodplains are being considered for structures or developments. Include recommendations for alternative ways to achieve exchange, acquisition, or project goals, and protect hydrologic function in project designs and NEPA documents.

25.12 - Protection of Wetlands and Riparian Areas

1. Objective. To avoid adverse impacts, including impacts to water quality, associated with disturbance or modification of wetlands.

2. Explanation. The Forest Service recognizes the beneficial values of wetlands, and will, in accordance with Executive Order 11990 of May 24, 1977, take action to minimize destruction, loss, or degradation of wetlands.

3. Implementation. During project planning, all potentially impacted wetlands are mapped. Wetland values are considered and evaluated as an integral part of the project planning process. Mitigating measures are incorporated into project plans and designs to maintain the hydrologic and biologic function of the wetlands.

The following mitigation measure was developed by the ID Team specifically for this project:

ROADS-M-10	Discharge drainage from the road prism and associated ditches into buffer strips (or scattered slash piles) where its energy can be dispersed and sediment can drop out before reaching the natural drainage system. If this is not possible, relocate that portion of the road away from the channel or identify it as needing future relocation as part of the long-term rehabilitation of the burned area.

25.13 - Oil and Hazardous Substance Spill Contingency Plan and Spill Prevention Control and Countermeasure (SPCC) Plan

1. Objective. To prevent contamination of waters from accidental spills.

2. Explanation. A contingency plan is a predetermined organization and action plan to be implemented in the event of a hazardous substance spill. Factors considered for each spill are the specific substance spilled, the quantity, its toxicity, proximity of the spill to waters, and the hazard to life and property.

The SPCC Plan is a document that requires appropriate measures (40 CFR 112) to prevent oil products from entering the navigable waters of the United States. An SPCC Plan is needed if the total oil products on-site above ground storage exceeds 1,320 gallons or if a single container exceeds a capacity of 660 gallons.

3. Implementation. Each forest shall be responsible for designating emergency spill coordinators and documenting names and telephone numbers of agencies to call regarding cleanup of spills in the contingency plan. Individual Forests should maintain an inventory of materials to use during the cleanup of a spill. Disposal methods and sites must be coordinated with Environmental Protection Agency (EPA), state, and local officials responsible for safe disposal.

All Forests shall maintain a Spill Contingency Plan and SPCC Plans are required for Forest Service owned and special use permitted facilities, as well as by timber sale operators and other contractors who store petroleum products.

25.16 - Soil Moisture and Wetland Limitations for Equipment Operation Vehicle Use

1. Objective. The objective of this measure is to prevent compaction, rutting, and gullying which may result in site degradation, sediment production and turbidity.

2. Explanation. This is a preventative measure that reduces surface disturbance by equipment operating during wet soil conditions. Soil erodibility, climatic factors, soil/water relationships, and mass stability are factors used by soil scientists, and hydrologists during the environmental analysis process to make recommendations on equipment limitations during wet seasons.

3. Implementation. The COR is responsible for determining when the soil moisture is such that the soil surface is unstable and susceptible to damage. The COR is also responsible for suspending or terminating operations for contracted projects when soil moisture content warrants. The project supervisor is responsible for determining when the soil surface is susceptible to damage, and is then responsible for terminating operations when Forest Service personnel or volunteers are used to accomplish a project. Project planners are responsible for including appropriate contract provisions and management requirements in project work plans and environmental documents.

The following mitigation measures were developed by the ID Team specifically for this project:

SOILS-M-1	Limit ground disturbing activities (tractor skidding, decking, machine piling, etc.) to dry or frozen conditions especially on soil map units 183, 191, 192, 193, 197, 198, and 202. This would reduce compaction and soil displacement (rutting) associated with timber harvesting activities on sensitive soils when they are wet or saturated.
SOILS-M-2	At the discretion of the Sale Administrator, restrict hauling and skidding during wet periods to prevent damage to soils or road systems. See A-SNF Guidelines for Excessive Rutting, 6/10/92. These guidelines are applicable to any TES unit but particularly to units 53, 187, 198, and 202.

25.17 - Slope Limitations for Equipment Operation and Vehicle Use.

1. Objective. The objective is to reduce erosion and associated sediment production by limiting equipment and vehicle use on steep slopes.

2. Explanation. This is a preventative measure that limits excessive surface disturbance and surface erosion. This measure facilitates proper drainage of disturbed areas by limiting equipment and vehicle operation to slopes where corrective measures such as water bars can be installed.

3. Implementation. The need for slope limitation is determined in the IRM process. The COR is responsible for ensuring implementation of the contract provisions that pertain to equipment operation on steep slopes. The project planners have the responsibility to ensure that appropriate tractor operation provisions are included in the contract. This practice is implemented on all vegetative manipulation projects where appropriate. The project supervisor is responsible for identifying areas where operations should be limited on projects accomplished by Forest Service people or volunteers. The supervisor's direction is taken from the project work plan and environmental documentation.

The following mitigation measure was developed by the ID Team specifically for this project:

SOILS-M-3	Slope Limitations for Logging: Limit salvage and removal of trees to areas with slopes less than 40% for ground-based logging. Operating on or near the contour, where possible, allows for natural drainage of skid trails, minimizing gully formation within skid trails.

25.2 - Evaluation of Cumulative Watershed Condition Effects

1. Objective. To protect the beneficial uses of water from adverse effects of multiple land management activities.

2. Explanation. Watershed condition is a description of the health of a watershed in terms of water quality, quantity, and timing. Many management activities have an effect, either positive or negative, on watershed condition. Usually the effects of management activities are temporary, or declining in magnitude over time. Natural events may also have a positive or negative effect on watershed condition.

The ability and rate of a watershed to recover from negative effects is determined primarily by climate and soil. Each watershed has some tolerance for negative effects. When this tolerance is exceeded, permanent impairment to the watershed may result. Measures of groundcover, estimates of erosion, road density, water yield or macro-invertebrate diversity, can be used as

indicators of the management effects on watershed condition. These indicators can also be used to set watershed tolerances. When a watershed tolerance will be exceeded by a proposed activity, managers will consider changing the activity, changing the activity schedule, or employing mitigation measures to reduce the effects.

3. Implementation. Conduct the cumulative watershed condition effects evaluation as part of the IRM process.

25.21 - Soil Quality Monitoring

1. Objective. To assure that management practices do not allow significant or permanent impairment of the productivity of the land.

2. Explanation. Soil quality monitoring is used to evaluate the effects of management activities on soil productivity, and determine if soil management objectives have been achieved. Monitoring can be either implementation effectiveness or validation types of monitoring.

3. Implementation. Soil scientists and other trained personnel routinely conduct implementation monitoring. Additional effectiveness or validation monitoring may be identified through the IRM Process, in which case a complete Soil quality monitoring plan will be prepared by the soil scientist or other trained Forest personnel.

CHAPTER 40 – RESOURCE ACCESS AND FACILITIES

41.18 - Servicing and Refueling of Equipment

1. Objective. To prevent pollutants such as fuels, lubricants, bitumens, raw sewage, wash water, and other harmful materials from being discharged into or near rivers, streams, and impoundments, or into natural or man-made channels leading thereto.

2. Explanation. During servicing or refueling, pollutants from logging or road construction equipment may enter a watercourse. This threat is minimized by selecting service and refueling areas well away from wet areas and surface water, and by using berms around such sites to contain spills. Spill prevention, containment, and countermeasures (SPCC) plans are required if the volume of fuel exceeds 660 gallons in a single container or if total storage at a site exceeds 1,320 gallons.

3. Implementation. The COR/ER or SA will designate the location, size, and allowable uses of service and refueling areas. They will also be aware of actions to be taken in case of a hazardous substance spill, as outlined in the Forest Hazardous Waste Contingency Plan.

Any SPCC needs to be reviewed and certified by a registered professional engineer.

41.2 – Stream Crossings on Temporary Roads

1. Objective. To keep temporary roads from unduly degrading water quality, damaging streams, disturbing channels or impeding fish passage, so that state and Federal water quality standards are complied with.

2. Explanation. Culverts, coarse rock fills, hardened fords (using such features as rocked approaches), low water crossings, and temporary bridges shall be evaluated in the IRM process for each sensitive stream crossing. Such facilities shall be designed to provide for unobstructed flows and the passage of fish, and to minimize damages to stream courses. The number of crossings shall be kept to the minimum needed for access. Channel crossings shall be as

perpendicular to stream courses as possible. Stream bank excavation shall be kept to the minimum needed for use of the crossings, and entry and exit ramps may need to be rocked. Fords or turnpike crossings hardened with washed rock or landing mats are sometimes an acceptable alternative, depending on fishery and hydrological considerations.

Crossing facilities will be removed when the facility is no longer needed or, if the crossing obstructs high flows, prior to closing down operations for the season.

3. Implementation. Project location and mitigated measures are developed using an IRM process.

The following mitigation measures were developed by the ID Team specifically for this project:

ROADS-M-11	Improve or correct rolling dips, stream crossings, and culverts. Extend and enlarge, as needed, the raised portion of water-bars on the uphill side of the road to ensure all flow from ditches or drainages is diverted across the road.
ROADS-M-12	Install hardened drainage crossings at natural grade. Additional rolling dips or water-bars are preferred to culverts to divert water off roads and out of roadside ditches.

41.27 - Traffic Control During Wet Periods

1. Objective. To reduce road surface disturbance and rutting of roads. To lessen sediment washing from disturbed road surfaces.

2. Explanation. The unrestricted use of many National Forest roads during wet weather often results in rutting and churning of the road surfaces. Runoff from such disturbed road surfaces often carries a high sediment load. The damage/maintenance cycle for roads that are frequently used when wet can create a road surface that is a continuing sediment source.

Roads that must be used during wet periods should have a stable surface and sufficient drainage should be provided to allow such use with a minimum of resource impact. Rocking, oiling, paving, and armoring are measures that may be necessary to protect the road surface and reduce material loss. Roads that are not needed for public access or forest administrative use should be closed to use during the wet season. In many cases, use can be discouraged, but not prevented. Where rainy season field operations are planned, roads may need to be upgraded, use restricted to low ground pressure vehicles, or maintenance intensified to handle the traffic without creating excessive erosion and damage to the road surfaces.

3. Implementation. Road closures and traffic control measures should be used outside active timber sale areas. Project-associated implementation procedures can be enforced by District personnel. Hauling activity can be controlled by the sale administrator within active timber sales. The decision for closure is based on local soil moisture conditions and other criteria.

The following mitigation measures were developed by the ID Team specifically for this project:

SOILS-M-1	Limit ground disturbing activities (tractor skidding, decking, machine piling, etc.) to dry or frozen conditions especially on soil map units 183, 191, 192, 193, 197, 198, and 202. This would reduce compaction and soil displacement (rutting) associated with timber harvesting activities on sensitive soils when they are wet or saturated.
SOILS-M-2	At the discretion of the Sale Administrator, restrict hauling and skidding during wet periods to prevent damage to soils or road systems. See A-SNF Guidelines for Excessive Rutting, 6/10/92. These guidelines are applicable to any TES unit but particularly to units 53, 187, 198, and 202.
ROADS-M-5	Restrict hauling on un-surfaced roads to dry or frozen conditions.

41.3 - Obliteration of Roads

1. Objective. To reduce sediment generated from unneeded roads, roads that run in streambeds, and roads that are located in streamside management zones by closing them to vehicle use and restoring them to productivity.

2. Explanation. Roads that are no longer necessary for public access or management purposes need to be obliterated. Roads that were located in streambeds or streamside management zones need to be relocated and closed. Roads that are allowed to exist without proper maintenance are subject to continued, uncorrected damage and can become chronic sediment sources.

Effective obliteration is generally achieved through a combination of these measures:

a. Road effectively drained and blocked.

b. Temporary culverts and bridges removed and natural drainage configuration re-established.

c. Road returned to resource production through revegetation (including ripping, scarification, fertilizing, and seeding).

d. Sideslopes reshaped and stabilized.

e. Natural means.

3. Implementation. Identification of roads no longer necessary for public access or management purposes and roads that were located in streambeds or streamside management zones is accomplished using the IRM process and the Resource Access Travel Management assessment.

In timber sale areas, road closure, removal of culverts and bridges, and stabilization are accomplished by the timber purchaser or K-V funds. Compliance with plans and the Timber Sale Contract is assured by the sale administrator. Further revegetation needs are addressed in Sale Area Improvement Plans. The sale administrator may request the advice of a soil and water specialist in determining the most appropriate relocation and stabilization measures required.

Road obliteration is also accomplished through Forest Service funding provided for watershed, wildlife, and range improvement. In this case, Forest Service supervisors or contracting officers representations oversee restoration work and ensure road obliteration objectives are being met.

The following mitigation measure was developed by the ID Team specifically for this project:

ROADS-M-9	Obliterate temporary roads by scarifying road beds, reshaping the road prism to match the original contour, placing slash and woody debris on the disturbed area, and seeding the disturbed area.

Monitoring

A soil scientist and hydrologist will monitor implementation of BMPs during the life of the project to determine their effectiveness in protecting soil and water quality. Post project interdisciplinary reviews shall be conducted to determine if BMPs established were implemented as designed. Some pre- and post-fire baseline data for stream turbidity in Canyon Creek is available from the Arizona Game and Fish Department.

Appendix C – Wildlife Management Restrictions

The following management restriction apply to Mexican spotted owl protected activity centers and northern goshawk protected fledging areas during harvest activities to remove dead timber from the treatment areas displayed in the Rodeo-Chediski Salvage DEIS for action alternatives considered in detail, Alternatives 2, 3, 4 and 5.

Mexican spotted owl PAC's

There are eight guidelines given for PAC's (USDI, Fish and Wildlife Service, 1995. *Recovery plan for the Mexican spotted owl*). These are found on page VI Part III 86, but only numbers 5d and 8 would be specific to this project:

- **5d.** Treatments can occur only during the non-breeding season (1 September-28 February) to minimize any potential deleterious effects on breeding owls.
- **8.** If a stand replacing fire occurs within a PAC, timber salvage plans must be evaluated on a case-specific basis.

Further information indicates that salvage should only be considered in PACs when the fire is extensive in size and results in the mortality of substantial proportion of trees (page 89). Additionally, any such project should be designed to meet the intent of the Recovery Plan by protecting existing habitat and accelerating the development of replacement habitat.

These mitigations are based on the following assumptions:

- Salvage will occur in moderately and severely burned areas only, and will involve the removal of dead trees only.
- The Service will be provided with additional information, and changes may be required if this information generates additional concerns for the owl. The information needed includes transportation routes and estimated usage of certain roads, survey information as it becomes available.
- Salvage will not occur in existing PACs.
- Five snags per-acre will be left within ¼ mile of PACs. Snags will be recruited from the largest trees on site.
- The Forest Service will contact the Service when surveys locate owls.

The following table lists PACs by number and the management requirements and alternatives that the restrictions would apply to for protection of Mexican spotted owls. No treatments are proposed in PAC 201, 202, 203, 204, 205, 206, 208, 502, 508, 511, 512 and 513.

Table 67 - Mexican spotted owl mitigation measures for Protected Activity Centers (PACs) by alternative

PAC	Management Requirements	Alternative
PAC 201	No treatments proposed, No hauling through PACs.	2, 3, 4, 5
PAC 202	No restrictions, no treatments proposed.	2, 3, 4, 5
PAC 203	No restrictions, no treatments proposed	2, 3, 4, 5

PAC	Management Requirements	Alternative
PAC 204	No restrictions, no treatments proposed.	2, 3, 4, 5
PAC 205	No restrictions, no treatments proposed.	2, 3 ,4, 5
PAC 206	No restrictions, no treatments proposed.	2, 3, 4, 5
PAC 207	Do not use FR 87 through PAC for hauling	2, 3, 4, 5
PAC 208	No restrictions, no treatments proposed.	2, 3, 4, 5
PAC 209	25 mph speed limit on FS 86 in sections 19 &20	2, 3, 4, 5
PAC 210	25 mph speed limit on FS 86 from the Black Canyon Rim Campground to Black Canyon Lake.	2, 3, 4, 5
PAC 214	25 mph speeds limit on FS 300 from the Black Canyon Rim Campground to the intersection of FS 300 & FS 9564H.	2, 3, 4, 5
PAC 502	No restrictions, no treatments proposed.	2, 3, 4, 5
PAC 503	Timing on Harvest and Haul.	2
PAC 504	Timing on harvest and Haul.	2
PAC 508	No restrictions, no treatments proposed.	2, 3, 4, 5
PAC 509	Timing on Harvest and Haul.	2
PAC 510	Timing on Harvest and Haul.	2
PAC 511	No restrictions, no treatments proposed.	2, 3, 4, 5
PAC 512	No restrictions, no treatments proposed.	2, 3, 4, 5
PAC 513	No restrictions, no treatments proposed.	2, 3, 4, 5

The following table lists PFAs by number and the management requirements and alternatives that the restrictions would apply to for protection of northern goshawks. No treatments are proposed in the Outlaw, Willow Wash, Gourd Flat, Left Hand, Lons Canyon 2, Danish Hollow and Bear Canyon PFAs.

Table 68 - Northern goshawk mitigation measures for Post Fledgling Areas (PFAs) by alternative

PFA Name	Management Requirements	Alternative
Upper Canyon Creek	Breeding season restrictions on implementation of treatment activities to include road use within the PFA unless no birds found.	2, 3, 4, 5

PFA Name	Management Requirements	Alternative
Jersey Horse	Breeding season restrictions on implementation of treatment activities and road use on 9556E and 9556Q.	2, 3, 4, 5
Baca	Breeding season restrictions on implementation of treatment activities and road use	2, 3, 4, 5
Heber Hollow	Breeding season restrictions on implementation of treatment activities within the PFA. No restrictions on FR 50.	2, 3, 4, 5
Bunger	Breeding season restrictions on treatments including the use of FR 166 for that portion of the 166 which passes through sections 25 & 30 immediately west of FS 51 unless no birds found.	2, 3, 4, 5
Outlaw	No restrictions, no treatments proposed.	2, 3, 4, 5
Dead Horse	Breeding season restrictions on implementation of all treatment activities including hauling.	2, 3, 4, 5
Blevins	No restrictions, treatments proposed in SW corner of PFA. Area is severely burned.	2, 3, 5
Pig Pen	No restrictions, treatments proposed along the southern edge of PFA.	2, 3, 5
Bear Springs	Breeding season restrictions on treatments and hauling within the PFA.	2, 3, 4, 5
Willow Wash	No restrictions, no treatments proposed.	2, 3, 4, 5
Coal Canyon	No restrictions, no treatment proposed.	2, 3, 4, 5
Gourd Flat	No restrictions, no treatments proposed.	2, 3, 4, 5
Ashurst	No restrictions, totally burned, no nesting habitat remains.	2, 4, 5
South Cottonwood	Breeding season restrictions on treatments and the use of FR 9871T.	2, 3, 4, 5
Town Draw	No restrictions, totally burned, no nesting habitat remains.	2, 3, 4, 5
Left Hand	No restrictions, no treatments proposed.	2, 3, 4, 5

PFA Name	Management Requirements	Alternative
Lons Canyon	Breeding season restrictions on treatments and hauling within PFAs.	2, 3, 4, 5
Lons Canyon2	No restrictions, no treatments proposed	2, 3, 4, 5
Danish Hollow	No restrictions, no treatments proposed.	2, 3, 4, 5
Colbath	2003 surveys showed no nesting habitat remaining and no breeding birds. No restrictions	2, 3, 4, 5
Bear Canyon	No restrictions, no treatments proposed.	2, 3, 4, 5

Appendix D – Threatened, Endangered, Sensitive and Proposed Species List and Effects

Evaluation of endangered, threatened, proposed, and sensitive species that may be present in the action area of the proposed project. On February 23, 2003 the U.S. Fish and Wildlife Service concurred with a list of endangered (E), threatened (T), candidate (C), and proposed (P) species that may occur on the Apache - Sitgreaves National Forests. The Tonto National Forests last revised its list in July of 2000. These lists were developed to comply with 50 CFR 402.12(b)(2). On July 14, 2000, the Regional Forester issued a revised list of Sensitive Species (SEN) in compliance with FSM 2670. Species occurring on any of these lists, and that may occur on the Black Mesa and/or Lakeside Ranger Districts of the Apache-Sitgreaves National Forests, or on the Tonto National Forest are identified below. The following table documents the key habitat elements for each species, whether or not each species is likely to occur within the action area of the proposed project, potential effects to the species and its habitat, and provides a preliminary determination of effects. All "MAY EFFECT" determinations for TEP species are further discussed in the text of the biological assessment and evaluation.

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
MAMMALS					
Mustela nigripes **Black-footed ferret**	E/SEN 1967	N/A	Habitat is described as prairies, grassland plains, and surrounding mountain basins up to 10,500 ft. Depends almost exclusively on prairie dog colonies for food, shelter, and denning. Prairie dogs are the ferret's primary food source. LF-15	In Arizona, the range probably coincided with that of the Gunnison's prairie dog north of the Mogollon Rim, and possibly that of the black-tailed prairie dog below the rim in Graham and Cochise counties. There are no known current or historical prairie dog towns or complexes > 80 acres in extent within the action area	**NO EFFECT** (NOT PRESENT - all Alts)
Panthera onca **Jaguar**	E/SEN 1997	N/A	Shows a high affinity for lowland wet habitats; typically swampy savannas or tropical rain forests. Historically occurred in upland habitats in warmer regions of North and South America. In Arizona, jaguars have been sighted in a variety of ecological communities from Sonoran desert scrub through subalpine conifer forest. Most records are from Madrean evergreen-woodland, shrub-invaded semi-desert grassland, and along rivers.	Historic range includes the mountainous regions of eastern Arizona and southwestern New Mexico. May also have included on the Apache-Sitgreaves, Cibola, Coconino, Coronado, Gila, Lincoln, Prescott, and Tonto NFs. No State accepted sightings have occurred for this species within the analysis area since 1960. Wanderers from Mexico are possible.	**NO EFFECT** (NOT PRESENT - all Alts.)

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
Leptonycteris curasoae yerbabuenae **Lesser Long-nosed Bat**	E/SEN 1988	NO	Suitable day roosts and associated concentrations of food plants are crucial. Caves and mines are used as day roosts. Feeds on agave flowers and the nectar, pollen, and fruit produced by columnar cacti. The agaves include Palmer's agave (*Agave palmeri*), Parry's agave (*A. parryi*), desert agave (*A. deserti*), and amole (*A. schotti*). Amole is considered to be an incidental food source.	Flies long distances from roosts to forage, up to 30-40 miles nightly. No records exist on the Tonto NF, but recently observed in a mine in the McDowell Mountains a few miles west of the Tonto. Bats day-roosting in the McDowell Mountains could easily forage and night-roost on the Tonto NF. Foraging may occur on the Clifton RD, ASNF. No foraging or roosting habitat and no occurrence documented within analysis area.	**NO EFFECT** (NOT PRESENT – all alts.)
Canis lupus baileyi **Mexican Gray Wolf***	E/SEN 1976	N/A	Habitat types used are primarily Madrean evergreen forests and woodlands, including pine, oak woodlands, pinyon-juniper woodlands, riparian areas, and grasslands at elevations above 4,500 ft. Packs usually live within a specific territory. Territories range in size from 50 mi² to greater than 1,000 mi², depending on how much prey is available and their seasonal movements.	Historically occurred in the mountainous regions of the Southwest from throughout portions of southern Arizona, New Mexico, and Texas into central Mexico. Mexican gray wolves were extirpated in the United States by aggressive predator control programs. The reintroduced Mexican gray wolf population in Arizona has been designated as a non-essential experimental population. The analysis area is outside both the primary and secondary recovery zones.	**NOT LIKELY TO JEOPARDIZE** (NOT PRESENT- all alts)
Ovis canadensis mexicana **Desert Bighorn Sheep**	SEN	N/A	Best habitat can be found between 3,000 and 4,000 feet elevation in the jojoba communities where the dominant grass between shrubs is galleta. Known only to occur on the Mesa Ranger District.	Does not occur within nor does potential habitat exists within the analysis area.	No impact. (NOT PRESENT – all alts.)
Lontra canadensis sonora **Southwestern River Otter**	SEN	N/A	Requires permanent flowing water or ponds, overhanging bank vegetation, and haul-out sites suitable for leaving and entering water. Suggested that a minimum flow of 10 cfs is needed.	Historically occurred on both the TNF and ASNF. In 1971, a specimen was collected from Cherry Creek, 15 miles north of the confluence with the Salt River on the Pleasant Valley Ranger District. Reported for Canyon Creek in 1970s. Historically occurred in Chevelon Canyon, Willow Creek and a man-made stock tank near Heber.	No impact (NOT PRESENT – all alts.)
Perognathus flavus goodpasteri **Silky (Springerville) pocket mouse**	SEN	N/A	Ecotone between PJ or juniper woodlands and grasslands LF-15	Species known from northwest Lakeside RD and no potential habitat exists within analysis area.	No impact. (NOT PRESENT all alts.)

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
Zapus hudsonius luteus **New Mexican (Meadow) jumping mouse**	SEN	N/A	Lotic riparian, LF-3. Grass-forb-willow zones along permanent streams, large wet meadows within river floodplaines and narrow riparian zones along irrigation ditches.	Patches of suitable meadow habitats may occur within the analysis area.	No Impact (Treatments are not proposed in suitable habitat – all alts.)
BIRDS					
Empidonax traillii extimus **Southwestern Willow Flycatcher**	E/SEN 1995	NO	Found in riparian habitats along perennial drainages where dense growth of willows, tamarisk, and other shrubs and medium-sized trees are present with a scattered overstory of cottonwoods. Nests in thickets of trees and shrubs approximately 12-24 feet tall, with a high percentage of canopy cover and large volume of foliage.	This specie has not been found in mid-elevation riparian habitats from 3,400 to 7,960 feet. The analysis area is at the mid-elevation level and all riparian areas are of steep to moderate gradient. Species not known to occur in the analysis area and no suitable or occupied habitat occurs within 5 miles of the analysis area. Critical habitat is not present within the analysis area.	**NO EFFECT TO SPECIES OR CRITICAL HABITAT** (NOT PRESENT – all alts.)
Glaucidium brasilianum cactorum **Cactus Ferruginous Pygmy-owl**	E/SEN 1997	NO	Nests in cavities in trees or large columnar cacti. In central and southern Arizona, the pygmy owl's primary habitats historically were riparian cottonwood forests, mesquite-cottonwood woodlands and mesquite bosques.	The northernmost record was from New River, Arizona, approximately 34 miles north of Phoenix. Critical habitat has been designated for the pygmy owl, a portion of which overlaps the Tonto National Forest on the Mesa Ranger District. Neither the species nor its habitat occurs within the analysis area.	**NO EFFECT TO SPECIES OR CRITICAL HABITAT** (NOT PRESENT – all alts.)
Rallus longirostris yumanensis **Yuma Clapper Rail**	E/SEN	N/A	Preferred habitat is mature cattail-bulrush stands in shallow water near high ground. A mat of dead vegetation is an important habitat component. Relatively large areas of emergent vegetation are used more frequently than smaller areas.	The current range in Arizona is along the Colorado River from Topock Marsh to the Mexican border. Neither the species nor its habitat occurs within the analysis area.	**NO EFFECT** (NOT PRESENT – all alts.)
Haliaeetus leucocephalus **Bald Eagle**	T/SEN 1995	N/A	Occurs in Arizona as either breeding populations or winter migrants. Arizona bald eagles occur at elevations between 4600 and 7,390 feet. Nests occur in tall trees, cliff faces, ledges, and pinnacles near open water for foraging. Perches for shelter, roosting, foraging and guarding are important habitat components. LF-12	Non-breeding individuals may be present between November and March. Known day roost at OW Ranch within analysis area.	**NO EFFECT (Alt 1, 3, 4, 5) MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT (ALT. 2).**

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
Strix occidentalis lucida **Mexican Spotted Owl**	T/SEN 1993	N/A	Mixed conifer, pine-oak, mature trees. Owls nest and roost primarily in closed-canopy forests or rocky canyons. Forests used for roosting and nesting often contain mature or old growth stands with complex structure. LF-14	Known breeding areas within analysis area.	**NO EFFECT (ALT. 1) MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT (ALTS. 2,3,4,5)**
Charadrius montanus **Mountain plover**	PT/SEN	N/A	Short grass prairie/open plains habitats. LF-5	No suitable short grass prairie/open plains habitats occur or are impacted by the project within the analysis area.	**NO EFFECT** (NOT PRESENT-all alts.)
Falco peregrinus anatum **American Peregrine Falcon**	SEN delisted	N/A	General, riparian, tall cliffs for nesting habitat. LF-4	Suitable nesting cliffs and known eyries occur within the analysis area.	NO IMPACT (ALT. 1) **MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALTS. 2,3,4,5)**
Accipiter gentilis **Northern Goshawk**	SEN	N/A	Forest habitat generalist that uses a variety of forest types, forest ages, structural conditions and successional stages. It primarily occupies ponderosa pine, mixed-species, and spruce-fir habitats in the southwest and prefers mature conifer stands with dense canopies for nesting. LF-11	Breeding areas and foraging habitat occur within the analysis area.	NO IMPACT (ALT. 1) **MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALTS. 2,3,4,5)**

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
Buteogallus anthracinus **Common Black Hawk**	SEN	N/A	Associated with aquatic systems throughout its range. Year-round nesting and foraging habitat occurs in association with perennial systems characterized by mature riparian gallery forests, with cottonwoods and willows and/or sycamores dominating the overstory.	Known to occur within the analysis area. Habitat within analysis area was burned severely; specie not likely to return to area for nesting.	No Impact (Treatments are not proposed in suitable habitat –Alts. 1, 3, 4, 5) **MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALT. 2)**
Asturina nitida maxima **Northern Gray Hawk**	SEN	N/A	Gray hawks inhabit riparian areas in southern Arizona, typically where there is permanent running water. Primary riparian habitats consist of cottonwood, willow and sycamore groves in the San Pedro and Santa Cruz river drainages.	Has recently been found on the Tonto National Forest on Cherry Creek and nesting on Pinal Creek (T. Corman, pers. comm., 2/17/00).	No Impact (Treatments are not proposed in suitable habitat – all Alts.)
Vireo bellii **Arizona Bell's Vireo**	SEN	N/A	Dependent on riparian habitats and occupies watercourses and marshes where mesquite is mixed with cottonwoods, willows, saltcedar, elderberry and desert hackberry. It nests in dense riparian shrubs, usually near water.	Habitat occurs below the Mogollon rim. Neither specie nor its habitat is expected to occur within the analysis area.	No Impact (NOT PRESENT- all Alts.)
Charadrius alexandrinus nivosus **Western snowy plover**	SEN	N/A	Forages on wet sands of beaches, at the surf line, or along muddy or alkaline shores of ponds and lakes inland. It prefers open habitats and avoids thick vegetation	Confirmed migrant in Arizona (T. Corman pers. comm., 2/17/00), presumably at man-made reservoirs and possibly along large rivers. This specie nor its habitat is expected to occur within the analysis area.	No impact. (NOT PRESENT- all Alts.)
Euptilotis neoxenus **Eared Trogon**	SEN	N/A	Inhabits oak and pine-oak forests in mountain canyons and in sycamore, walnut, and cottonwood riparian habitats along streams. They build nests inside cavities of sycamores or cottonwoods, typically 12 – 40 feet above the ground.	Adults have also been documented in central Arizona in the Pinal Mountains, Chevelon Canyon on the Apache-Sitgreaves Forest, and at Christopher Creek on the Payson Ranger District of the Tonto. Neither specie nor its habitat is expected to occur within the analysis area.	No Impact (NOT PRESENT- all Alts.)

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
Coccyzus americanus occidentalis **Western Yellow-billed Cuckoo**	SEN	N/A	Uncommon to fairly common breeder in riparian habitats, below the Mogollon Rim in the Colorado and Gila River drainages. Requires a minimum of 25 acres of broadleaf forest at least 100 m wide.	Documented along the Verde River south of Bartlett Reservoir, Verde River near Horseshoe Reservoir, near Roosevelt Lake, Pinto Creek, Tonto Creek on the Tonto Basin Ranger District, and the Salt River near Blue Point on the Mesa Ranger District. Not documented as occurring within analysis area and habitat does not exist there.	No impact. (NOT PRESENT- all Alts.)
REPTILES					
Eumeces gilberti arizonensis **Arizona skink**	SEN	N/A	Occur in habitats where there is some moisture nearby – damp soil or a spring or stream. Seems to be more dependent on moisture than most lizards.	Known to occur in the Hassayampa watershed in Maricopa County.	No impact. (NOT PRESENT- all Alts.)
Thamnophis rufipunctatus **Narrowheaded garter snake**	SEN	N/A	Found in or next to quiet, well-lit sections of rocky streams in areas of pinyon-juniper or ponderosa pine. Seeks cover under rocks in water when disturbed.	Spotty distribution in three small disjunct areas in AZ, NM and Mexico. Found in Canyon Creek at 3 to 15 K above the Salt River. Not documented within the analysis area although habitat may exist.	No impact. (NOT PRESENT- all Alts.)
Thamnophis eques **Mexican garter snake**	SEN	N/A	Permanent water with lush vegetation. Lakes, large streams and rivers, and rich springs and headwaters. It is semi-aquatic and seldom seen more than 15 meters from permanent water.	Suitable habitat is found within the analysis area and the species is known to occur in Canyon Creek. Habitat burned; no longer expected to be found.	No impact. (NOT PRESENT- all Alts.)
Gopherus agassizii **Sonoran Desert Tortoise**	SEN	N/A	Land dwelling; ranging into some of the most arid parts of AZ. Requiring firm ground for construction of burrows in the banks of washes or compacted sand. Frequents desert oases, riverbanks, washes, dunes, and occasionally rocky slopes.	Creosote bush is often found in its habitat. Does not occur in the analysis area.	No impact. (NOT PRESENT- all Alts.)
Xantusia vigilis arizonae **Arizona Night Lizard**	SEN	N/A	Found under exfoliating rock in granite outcrops.	Does not occur in analysis area.	No impact. (NOT PRESENT- all Alts.)
Phyllorhynchus browni lucidus **Maricopa Leafnose Snake**	SEN	N/A	In northern part of range, inhabits desert scrub grown to mesquite, saltbush, creosote, paloverde and saguaro. A burrower in relatively coarse, rocky soils as well as in sand.	Closest known population is within the Lower Salt River watershed. Occurrence within the analysis area is highly unlikely.	No impact. (NOT PRESENT- all Alts.)

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
AMPHIBIANS					
Rana chiricahuensis **Chiricahua leopard frog**	T/SEN 2002	N/A	Occurs chiefly in the oak and mixed oak and pine woodlands. Highly aquatic and almost always associated with permanent water, preferably with emergent and submergent aquatic vegetation. Prefers rocky streams with deep rock bound pools. Species inhabits montane springs, streams, and tanks, it was historically found in numerous valley wetlands and cienegas. Fifty percent of the populations documented in Arizona were associated with natural lotic systems. The others were associated with stock tanks (39%) and natural or artificial lakes (11%).	Last recorded on Lakeside RD in 1970s. Known populations adjacent to analysis area. Un-surveyed potential habitat occurs within analysis area.	**NO EFFECT (Alt. 1) MAY AFFECT NOT LIKELY TO ADVERSELY AFFECT** (Treatments not proposed in habitat plus Mitigations in place to reduce effects – Alts. 2, 3, 4, 5).
Bufo microscaphus microscaphus **Southwestern toad**	SEN	N/A	Lotic and lentic riparian areas	Suitable habitat exists within the analysis area as well as records of occurrence.	No impact (ALT 1.) Alts. 2, 3, 4, 5: Treatments not proposed in habitat plus Mitigations in place to reduce impacts – **MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING**

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
Rana pipiens **Northern leopard frog**	SEN	N/A	Lotic and lentic riparian areas	Known to have occurred within the AA, most recent record in 2000	No impact (ALT 1.) Alts. 2, 3, 4, 5: Treatments not proposed in habitat plus mitigations in place. **MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING**
Rana yavapaiensis **Lowland Leopard Frog**	SEN	N/A	Restricted to permanent waters with aquatic and herbaceous vegetation. Found in desert scrub, grassland, and pine/oak woodland habitat types of central and extreme northwestern Arizona below 4800 feet.	In AZ occurs below around 4800' south of the Mogollon Rim. In pinyon-juniper woodlands.	No impact (ALT 1.) Alts. 2, 3, 4, 5: Treatments not proposed in habitat plus Mitigations in place to reduce impacts – **MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING**
FISHES					
Gila elegans **Bonytail Chub**	E/SEN	NO	Considered a main stream river fish, but live much of their time in backwaters and eddies rather than fight the strong current. They are able to survive in lakes and ponds, including lakes Mohave and Havasu. They apparently prefer waters with high levels of total dissolved solids (TDS), avoiding less than 560 and more than 6,600 ppm TDS.	Originally found in the main stem of the Colorado River and some of its tributaries as far north as Wyoming, bonytail now persists in unknown numbers in some mainstem reservoirs (Mohave and Havasu) of the Colorado River, and maintains an apparently declining population in the Colorado River upstream from the Grand Canyon. Locally, the species was collected from the Gila River near San Carlos, and in the Salt River at Tempe and at the confluence of the Verde River. It does not currently occur on Tonto NF and no connectivity	**NO EFFECT TO SPECIES OR CRITICAL HABITAT** (NOT PRESENT- all Alts.)

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
				between extant populations and habitat within the analysis area exists. Critical habitat does not occur on the Tonto.	
Cyprinodon macularius macularius **Desert Pupfish**	E/SEN	NO	Desert pupfish occupied a diversity of habitats ranging from cienegas and springs to small streams and margins of larger bodies of water. Most habitats were shallow and had soft substrates and clear water. Abundance of aquatic vegetation and invertebrates probably varied seasonally, with lowest levels associated with harshest conditions. Pupfish can survive in water temperatures to 112º F, dissolved oxygen concentrations as low as 0.1 milligrams per liter, and salinities twice that of sea water. Pupfish typically occupy water shallower than that inhabited by adults of most other species.	Nearly all of the original range of desert pupfish has been irretrievably lost due to channelizing, damming, and diversion of water. Currently no natural populations of desert pupfish occur in Arizona. Does not occur within the analysis area and no connectivity between extant populations and habitat within the analysis area exists. Critical habitat does not occur within the analysis area.	**NO EFFECT TO SPECIES OR CRITICAL HABITAT** (NOT PRESENT- all Alts.)
Ptychocheilus lucius **Colorado Pikeminnow (squawfish)**	E/SEN	N/A	Characterized as a "big river" generalist species, occurring in turbid, deep, and strongly flowing water. However, small individuals occupy shallow backwater areas with little or no current and silt/sand substrates. During flood periods, adults move out of the river channels and occupy flooded bottom lands where they may feed on terrestrial animals.	Since 1985, extensive reintroductions of hatchery-raised Colorado pikeminnow have been made into the Salt and Verde River systems. Reintroduction sites on the Tonto and Prescott NF's include the Salt River from Roosevelt Dam to Hiway 60 bridge, and from Horseshoe Reservoir to Perkinsville on the Verde River. Pikeminnow populations in these areas are designated "experimental-nonessential."	**NO EFFECT (no Treatments within habitat ALTS. 1,3,4,5) NOT LIKELY TO JEOPARDIZE (ALT. 2)**
Plagopterus argentissimus **Woundfin**	E/SEN	N/A	A riverine species most often found adjacent to riffles in runs and quiet waters over sand or sand/gravel substrates; they cannot tolerate reservoir conditions. They apparently prefer areas of shifting sand substrates that are mobilized by almost laminar currents. Preferred depths range from 2 to 14 inches, but disturbed fish move rapidly to deeper areas. They apparently are mainstream dwellers, seldom ascending creeks much beyond the floodplain of the larger river. They tolerate higher salinities than most fishes in their native habitat.	Restricted to the Virgin River in Arizona, Nevada, and Utah. Attempts to increase its range have included transplanting into the Hassayampa, Pariah, and Salt Rivers, and Sycamore Creek in the Agua Fria drainage. None have been successful. All habitats formerly available in the mainstem Colorado, Gila, Salt, and Verde Rivers are now unavailable for woundfin. It does not currently occur on Tonto NF. Does not occur within the analysis area and no connectivity between extant populations and habitat within the analysis area exists.	**NO EFFECT** (NOT PRESENT- all Alts.)

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
Xyrauchen texanus **Razorback Sucker**	E/SEN	NO	Poorly known. Fairly sedentary, moving relatively few miles over several months. They tend to occupy strong, uniform currents over sandy bottoms, eddies and backwaters lateral to river channels, and sometimes concentrating in deep places near cut banks or fallen trees.	On Tonto NF, razorback sucker have been stocked into the Verde and Salt Rivers, and several of their larger tributaries. Critical habitat includes all of the Verde River north of Horseshoe Dam. Critical habitat does not occur within the analysis area; however occurrence records exist for Canyon Creek within the analysis area. These were stocked fish and considered "experimental-nonessential populations."	**NO EFFECT (ALT. 1,3,4,5) NOT LIKELY TO JEOPARDIZE (Alts 2)**
Poeciliposis occidentalis occidentalis **Gila Topminnow**	E/SEN 1984	N/A	Prefers shallow, warm and fairly quiet waters, but can adjust to a rather wide range, living in quiet to moderate currents, depths to three feet, and water temperatures from constant 80° F springs to streams fluctuating from 43-99º F. The species lives in a wide variety of water types; springs, cienegas, marshes, permanent or interrupted streams, and formerly along the edges of large rivers. Preferred habitat contains dense mats of algae and debris, usually along stream margins or below riffles, with sandy substrates sometimes covered with organic mud and debris.	Historically widespread and abundant in the Gila River drainage. It was described as "one of the commonest fish in the southern part of the Colorado River drainage" in the early 1940s, and was found throughout the Gila River system up to about 4,500 feet elevation. Today, Gila topminnow is eliminated from all riverine habitats and remains in only eight natural sites (two on public lands) and in a varying number of transplanted sites. Does not occur within the analysis area and no connectivity between extant populations and habitat within the analysis area exists.	**NO EFFECT** (NOT PRESENT- all Alts.)
Oncorhynchus gilae gilae **Gila Trout**	E/SEN 1967	N/A	Occurs in small headwater streams where water temperatures seldom exceed 70° F. Stream gradients are often 2% or greater, and stream morphology is a consequence of valley topography. Pools are usually formed by boulders, rootwads, or large, down trees. Riffles are gravel-dominated and generally free from sand or finer particles. Stream banks are stable and usually vegetated with a diverse array of riparian grasses, shrubs and trees. Hiding and resting cover for Gila trout is provided by boulders, deep pools, and large rootwads and trees.	Native to the tributaries and main stem of the upper Gila River and a portion of the San Francisco River in New Mexico, and tributaries to the Verde River in Arizona. Their present distribution is restricted to relic and reestablished populations in the Gila, San Francisco, and Mimbres River drainages in New Mexico, and Dude Creek in the Verde River drainage in Arizona. Does not occur within the AA and no connectivity between extant populations and habitat within the AA exists.	**NO EFFECT** (NOT PRESENT- all Alts.)

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
Lepidomeda vittata **Little Colorado spinedace**	T/SEN 1987	NO	Found in water 0.5-4.3 ft deep, but appear most abundant in depths of about 1.9 ft. Spinedace are most common in slow-to-moderate water currents that flow over fine gravel bottoms. They avoid deep, heavily shaded pools and shallow, open areas, preferring unshaded pools with rocks or undercut banks for cover. Temperatures where populations exist generally range from 58-79° F. Spinedace appear quite capable of tolerating relatively harsh environments that undergo dramatic fluctuations in pH, dissolved gases, and water temperatures.	Habitat is not present, may have to look at downstream effects within the watershed. Spinedace were taken from 11 localities in the Little Colorado River mainstem, East Clear Creek and associated tributaries, Chevelon Creek, and Nutrioso Creek. Additional sites have included Silver Creek, Show Low Creek, Leonard Canyon and tributaries, and Rudd Creek. Surveys in the late 1990s in Silver Creek and Show Low Creek documented spinedace in Silver Creek just upstream of its confluence with the Little Colorado River. Spinedace were not collected in Show Low Creek.	**NO EFFECT** (NOT PRESENT- all Alts.)
Tiaroga cobitis **Loach minnow**	T/SEN 1986	NO	Inhabits turbulent, rocky riffles of mainstream rivers and tributaries up to about 7,200 feet elevation. It is restricted almost exclusively to a bottom dwelling habit, swimming above the substrate for only brief moments as it darts from place to place. Adult loach minnows are typically found in water flowing 2 to 2.5 feet per second and 6 to 7 inches deep where they occupy the interstices of cobble-size substrate (these habitats occasionally have dense growths of filamentous algae).	Once locally common throughout much of the Gila River system, including mainstem and tributaries of the Verde, Salt, San Pedro, San Francisco and Gila rivers, and the East, Middle and West forks of the upper Gila River. On Tonto NF there are no historical records of occurrence. Rare to uncommon where it is found in the following areas: Aravaipa Creek (Pinal and Graham Counties); limited reaches of the White River (Gila County) and the North and East forks of the White River (Navajo County); Three Forks area of the Black River; throughout the Blue River; Campbell Blue Creek; sporadic in Eagle Creek; and in the San Francisco River between Clifton and the New Mexico border (Greenlee County). On Tonto National Forest, critical habitat includes 65 miles of stream in Verde River, and Fossil, Tonto, Rye, and Greenback Creeks. Analysis area does not contain nor does it drain into occupied habitat or critical habitat.	**NO EFFECT TO SPECIES OR CRITICAL HABITAT** (NOT PRESENT- all Alts.)
Meda fulgida **Spikedace**	T/SEN 1986	NO	Occupies midwater habitats of runs, pools, and swirling eddies that are typically less than one foot deep with velocities of 1 to 2 feet per second. Adults often aggregate in shear zones along gravel-sand bars, quiet eddies on the downstream edge of riffles, and broad, shallow areas above gravel-sand bars.	Salt and Verde Rivers and Tonto Creek are historical collection sites, however the spikedace currently persists only in the upper Verde River and Aravaipa Creek in Arizona. On Tonto National Forest, critical habitat includes 51 miles of stream in Verde River, Fossil, Tonto, Rye, and Greenback Creeks. Analysis area does not contain nor does it drain into occupied habitat or critical habitat.	**NO EFFECT TO SPECIES OR CRITICAL HABITAT** (NOT PRESENT- all Alts.)

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
Gila intermedia **Gila Chub**	PT/SEN	N/A	Typically occupies pools in small streams, marshes, cienegas, and other quiet waters, although it may have occurred in larger, more complex habitats. It is highly secretive, remaining in deeper waters near cover.	This specie was widely distributed in isolated habitats, occurring in the headwaters of essentially all the major tributaries to the Gila River, including the Verde, Agua Fria, Aravaipa, San Pedro, and Santa Cruz drainages. A 1999 record exits for the Verde. Species did not historically occur in analysis area	**NO EFFECT** (NOT PRESENT- all Alts.)
Gila robusta **Roundtail chub**	SEN	N/A	Found in lotic riparian systems. Occupies cool to warm water, mid-elevation streams and rivers where typical adult microhabitat consists of pools to eight feet deep adjacent to swifter riffles and runs. Cover is usually present and consists of large boulders, tree rootwads, submerged large trees and branches, undercut cliff walls, or deep water.	This specie occurs in the mainstem and tributaries to the Verde and Salt rivers, although populations have declined considerably during the past few decades.	No impact – All ALTs. (Treatments not proposed in habitat nor are they expected to impact their habitat)
Catostomus sp. 3 **Little Colorado sucker**	SEN		Lotic riparian systems	Habitat not present; may have to look at downstream effects within the watershed.	No impact – ALL ALTs. (Treatments not proposed in habitat nor are they expected to impact their habitat)
Catostomus latipinnis **Flannelmouth Sucker**	SEN		Common in the upper Colorado River basin; has disappeared entirely from the lower basin including the Gila River Drainage. Remain in deeper water except when feeding; then move onto moderate rapids and riffles. Found in lotic systems.	Habitat not present; may have to look at downstream effects within the watershed.	No impact – ALL ALTs. (Treatments not proposed in habitat nor are they expected to impact their habitat)
CLAMS					
Anodonta californiensis **California floater**	SEN		Found in streams or rivers; needs native host fish to survive.	Historically probably occurred but almost certainly no longer exists in the analysis area. No surveys completed.	No Impact (NOT PRESENT- all Alts.)
SNAILS					
Pyrgulopsis simplex **Fossil springsnail**	SEN		Found in freshwater, spring/spring brook habitats. Special habitat factors being benthic systems	Found in the Verde river watershed in Gila and Yavapai Counties. Species is not known to occur in the analysis area.	No Impact (NOT PRESENT- all Alts.)

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
INSECTS					
Cicindela oregona maricopa **Maricopa tiger beetle**	SEN		Species found in stream drainages of juniper-chaparral to grassland and Upper Sonoran desert scrub. Habitats are always sandy, rip arian situations.	Historical data place it in the Salt River in Phoenix, Prescott, Camp Verde, and Southeastern AZ. Habitat does not occur in the analysis area. Species is not known to occur in the analysis area.	No Impact (NOT PRESENT- all Alts.)
Cicindela purpurea cimarrona **Cow Path Tiger Beetle**	SEN		Is a dispersed high elevation grassland and prairie species in AZ. Prefers clay soils or areas with volcanic dust and cinders.	Can be found in the Coronado NF on Mt. Graham. Not likely to be found in the analysis area.	No impact (NOT PRESENT- all Alts.)
Cicindela hirticollis corpuscula **Hairy-Necked Tiger Beetle**	SEN		Found in open sandy areas, on sandy beaches, and on open paths or lanes. Also may be found in sand dunes and sand pits away from water.	Areas within the analysis area could provide suitable habitat, information is lacking. This is a wide spread specie. No surveys have been completed; however it is not expected to be found within the analysis area.	No impact (Alt. 1) **MAY IMPACT INDIVIDUALS OR HAB ITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALTS. 2,3,4,5)**
Cicindela praetextata pallidofemora **Tiger Beetle**	SEN		Found in open sandy areas, on sandy beaches, and on open paths or lanes.	Areas could provide suitable habitat, but information is lacking. No surveys have been completed in analysis area. Presence is not expected.	No impact (Alt. 1) **MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALTS. 2,3,4,5)**
Cylloepus parkeri **Parker's Riffle Beetle**	SEN		Riverine Habitat such as; creeks, springs/brooks. Is found in small rocky streams, probably hides under rocks. Known to occur in the Lower Verde watershed in Yavapai county.	Occurs in the Lower Verde watershed in Yavapai County, Arizona.	No Impact (NOT PRESENT- all Alts.)
Agathon arizonicus **Netwing Midge**	SEN		Occur along swift -moving streams, in which the larvae live.	Potential habitat along Canyon Creek. Treatments not proposed in habitat or likely to affect habitat.	No Impact (NOT PRESENT – Alts. 1, 3, 4, 5) **MAY**

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
Netwing Midge					**IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALT. 2)**
Dragonflies					
Libelula nodisticta **Hoary Skimmer**	SEN		Fast fliers found around large streams and lakes.	Potential habitat along Canyon Creek and Black Canyon Lake. Treatments not proposed in habitat or likely to affect habitat.	No impact (Alts. 1, 3, 4, 5) **MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALT. 2)**
Ophiogomphus arizonicus **Arizona Snaketail**	SEN		Found in fairly swift rocky mountain streams in pine woodland with silt for larval habitat. Female adults forage and the males perch on rocks near pools of stream to wait for females. Threats include lumbering, overgrazing, and fires that destabilize stream flow.	Is described from the Huachuca Mountains, though not recently found there. Not likely to occur within the analysis area.	No impact (NOT PRESENT- all Alts.)

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
Butterflies					
Callophrys Comstock **Comstock's Hairstreak**	SEN		Feeds principally on nectar and other liquid food, and many are common on flowers.	Potential habitat in the analysis area. Treatments not likely to affect habitat.	No impact (Alt. 1) **MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALT. 2,3,4,5)**
Agathymus neumoegeni **Neumogen's Giant Skipper**	SEN		Fast-flying insects that hold their wings vertical at rest. Larvae bore into stems and roots of yucca and related plants	Occurs in dry mountains with Agave food plants.	No impact (Alt. 1) **MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALT. 2,3,4,5)**
Limenitis archippus **Obsolete Viceroy Butterfly**	SEN		Found in riparian and scrub-shrub wetlands. Probably could turn up in any reasonably open habitat with willows or poplars. Can breed only on willows and poplars.	Known to occur in Southeastern Arizona.	No impact (habitat is not proposed for treatment - all Alts.)
Agathymus evansi **Evansi Brigadier**	SEN		Habitat: upper Sonoran open woodland with *Agave parryi var. huachucensis*.	Restricted to the Huachuca Mountains and Cochise County in southern Arizona. Not likely to occur within the analysis area.	No impact (NOT PRESENT - all Alts.)

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
Lycaena ferrisi **Arizona copper**	SEN		Utilizes open meadows that have sufficient moisture to support populations of dock (*Rumex sp.*), which serves as the caterpillar host.	Areas occur within the analysis area that could provide suitable habitat for this specie.	No impact (Alt. 1) **MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALT. 2,3,4,5)**
Piruna polingi **Spotted skipperling**	SEN		Moist woodland openings with lush vegetation, meadows or narrow ravines.	Species not documented on district, but suitable habitat may exist.	No impact- ALL ALTs. (Treatments not planned in suitable habitat)
Speyeria nokomis nitocris **Mountain silverspot butterfly**	SEN		Found in riparian areas, moist woodland openings. Utilizes meadows with sufficient permanent moisture to sustain healthy violet populations on which larvae feed. Adults feed on nectar of red thistles.	Known to occur on Lakeside RD but may not be within analysis area. Species /habitat not expected to occur within the analysis area.	No impact (NOT PRESENT- all Alts.)
PLANTS					
Agave arizonica **Arizona Agave**	E/SEN 1984	N/A	Occupies mesas and slopes, in isolated clusters of plants (usually clones) or as isolated plants. This species is found in Interio r Chaparral, Desert Grassland and transition between grassland and pinyon-juniper zone on shallow, rocky soils derived from granite, schist, gneiss, quartzite, tuff and limestone. Elevations range from 3,000 to 6,000 feet and occurrence coincides with the range of its putative parents (*A. chrysantha*, *A. toumeyana* var. *toumeyana* and *A. toumeyana* var. *bella*).	Most plants are on the Tonto National Forest in the New River Mountains. One isolated individual occurs southeast of Payson and another near Parker Creek at the south end of Sierra Ancha Mountains. Found on the A Cross, Bronco, Cartwright, New River and Star Valley Allotments. Does not occur within or adjacent to the analysis area.	**NO EFFECT** (NOT PRESENT- all Alts.)

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
Echinocereus triglochidiatus var. arizonicus **Arizona Hedgehog Cactus**	E/SEN 1979	N/A	Occurs within Interior Chaparral and Madrean Evergreen Woodland communities at elevations ranging from 3,300 to 5,700 feet. Preferred habitat is found on parent materials of igneous origin, primarily Schultze Granite and Apache Leap Tuff (Dacite). Plants occurring on the Pinal schist and Pioneer formations are found only in proximity to the preferred parent materials and where the formations are expressed as exposed bedrock.	Occurs on both the Apache-Sitgreaves and Tonto National Forests. Arizona Hedgehog Cactus is found on the following allotments on the Tonto: Bohme/Sleeping Beauty, Devil's Canyon, Millsite, Pinto Creek, and Bellevue. Does not occur within the analysis area.	**NO EFFECT** (NOT PRESENT- all Alts.)
Purshia subintegra **Arizona Cliffrose**	E/SEN 1984	N/A	Restricted to nutrient-deficient, calcareous limy-tuff soils derived from Tertiary lacustrine deposits. Crucifixion thorn is the most common plant associate. Subpopulations at the Horseshoe Lake site occur at elevations between 2,100 and 2,700 feet	Although it occurs on the Tonto National Forest, it does not occur on either Payson or Pleasant Valley Ranger Districts. Does not occur within the analysis area.	**NO EFFECT** (NOT PRESENT- all Alts.)
Agave delamateri **Tonto Basin Agave**	SEN		No fertile seed is produced. Very limited range.	Known only from 70 plants in Tonto Basin in Gila County. Does not occur in the analysis area.	No impact (NOT PRESENT- all Alts.)
Agave murpheyi **Hohokam Agave**	SEN		Mountainous slopes at elevations of 460-930m in dry chaparral and desert areas. The propagules are easily transported and transplanted and some occurrences appear to be associated with old Indian sites.	Known to occur in Gila, Maricopa, Pinal and Yavapai Counrties. Known only from very restricted geographic areas, populations are very small.	No impact (NOT PRESENT- all Alts.)

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
Carex chihuahuaensis **Chihuahua Sedge**	SEN		Found in saturated soils.	Known from Tonto NF. Not expected in analysis area.	No impact – ALL Alts (No treatments proposed in suitable habitat)
Carex ultra **Arizona Giant Sedge**	SEN		Found in saturated soil near or in perennial seeps, streams and springs at 2,500-6,000 ft elevation	Occurs in the Santa Catalinas, Atascosas, Huachuca, Dragoon, Chiricahua mountain ranges. Does not occur in the analysis area.	No impact (NOT PRESENT- all Alts.)
Cimicifuga arizonica **Arizona Bugbane**	SEN		A robust perennial herb that produces a spike of white, petal-less flowers. Is found in wooded ravines with rich soil 1675-2130 m elevations.	Limited distribution occurs within the following watersheds: Havasu Canyon, Upper Salt, Upper Verde, Lower Verde in Coconino and Gila County. Is not known to occur within the analysis area though habitat may exist	No impact (NOT PRESENT- all Alts.)
Rumex orthoneurus **Blumer's dock**	SEN		Occurs in meadows or stream sides where there is sufficient permanent moisture to sustain populations. Most often found above 6,500 feet in wetland habitats or springs.	Species not known to occur, but habitat occurs within the analysis area. May be found along ephemeral drainages.	No impact (Alt. 1) **MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALT. 2,3,4,5)**
Erigeron anchana **Mogollon Fleabane**	SEN		A perennial herb, usually less than 1.5 dm tall, with old leaf bases persisting on the branches. Found in rock crevices and ledges on boulders or on vertical cliff faces, usually in canyons.	Known only in the Sierra Ancha Mountains. Is not known to occur within the analysis area.	No impact (NOT PRESENT- all Alts.)
Erigeron piscaticus **Fish Creek Fleabane**	SEN		A multi-branched annual, about 4 dm tall. Flower heads have white ray flowers and blooms in summer. Found in terraces in moist, sandy canyon bottoms associated with perennial streams.	A recently described species known from three canyons in Maricopa and Graham Counties in central Arizona. About 80 plants were found during surveys in 1993 and 1994.	No impact (NOT PRESENT- all Alts.)
Cirsium parryi ssp. Mogollonicum **Mogollon Thistle**	SEN		Restricted to less than one square mile of habitat on the Mogollon Rim.	Endemic to Arizona, it is restricted to less than one square mile of equally rare habitat on the Mogollon Rim in Coconino County.	No impact – ALL Alts. (Treatments are not proposed in habitat)

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
Eriogonum ripleyi **Ripley Wild Buckwheat**	SEN		A tuft or mound forming perennial herb, on calcareous ridge tops or chalky carbonate Verde formations at 1045m and among pinyon-juniper at 1830 m.	Known from five widely separated localities in AZ. Seems to be restricted to white, calcareous substrates. Closest population occurs on the Lower Verde River watershed.	No impact (NOT PRESENT- all Alts.)
Heuchera eastwoodiae **Eastwood Alum Root**	SEN		Known only from central Arizona and is found on moist slopes in ponderosa pine forests and canyons.	Species/habitat occurs within the analysis area and has a wide range in central Arizona.	No impact (Alt. 1) **MAY IMPACT INDIVIDUALS OR HABITAT, BUT WILL NOT AFFECT VIABILITY OR LEAD TO TREND TOWARDS FED. LISTING (ALT. 2,3,4,5)**
Heuchera glomerulata **Arizona Alum Root**	SEN		Occupies moist slopes in the ponderosa pine forest of southeast Arizona.	Is known from the mountains of southeastern AZ and from Animas Peak, NM. No habitat or occurrences in analysis area.	No impact (NOT PRESENT- all Alts.)
Lotus alamosanus **Alamos Deer Vetch**	SEN		A semi-aquatic perennial raging from southern Arizona through Sonora, Chihuahua, Sinaloa and Durango, Mexico, occurring in wet soil or sand in springs and streams of canyons or meadows. It can be abundant locally.	No habitat or known occurrences in analysis area.	No impact (NOT PRESENT- all Alts.)
Mabrya acerifolia **Mapleleaf False Snapdragon**	SEN		Occurs on rock overhangs.	Endemic to a narrow range in Maricopa and Pinal Counties, along the Middle Gila and Lower Salt watersheds. Treatments not proposed in habitat.	No impact (NOT PRESENT- all Alts.)
Osmorhiza brachypoda **Sweet Cicely**	SEN		Stout perennial with white, purplish, or greenish flowers. Shaded woods below 8,500 ft, in oak woodlands, mixed forests.	Believed to be common in California. No surveys have been completed but not expected to be found in analysis area.	No impact (NOT PRESENT- all Alts.)
Penstemon nudiflorus **Flagstaff Beardtongue**	SEN		A perennial herb with blue-whitish leaves and stems. Found in dry ponderosa pine forests in mountainous regions south of the Grand Canyon.	Endemic to a narrow range in AZ. Not abundant in any known occurrence.	No impact (NOT PRESENT- all Alts.)
Perityle gilensis var. gilensis **Gila Rock Daisy**	SEN		Perennial herb.	Has been reported to occur in south-central AZ. in the Middle Gila watershed.	No impact (NOT PRESENT- all Alts.)

Species	FWS/FS Status and Year	Critical Habitat Present	Key Habitat Elements and Life Form- LF*	Status within Action Area of Project	Determination of Effect by Alternative
Perityle saxicola **Fish Creek Rock Daisy**	SEN		A perennial herb, 2-4 dm tall that produces yellow ray and disk flowers. Found in cracks and crevices in cliff faces, in large boulders and rocky outcrops in canyons. Rock surfaces are composed of Barnes Conglomerate and Mescal Limestone. Habitat is very dry. Threats include aphids and mining activities requiring blasting.	A narrow endemic with very specific habitat requirements.	No impact (NOT PRESENT- all Alts.)
Phlox amabilis **Arizona Phlox**	SEN		A low perennial herb that produces pink, tubular flowers with deep-notched petals. Found on open, exposed limestone-rocky slopes within pinyon-juniper woodlands and pine-oak communities.	An Arizona endemic, known from 12 collections. The closest being the Tonto watershed.	No impact (NOT PRESENT- all Alts.)
Salvia amissa **Aravaipa Sage**	SEN		A perennial herb, up to 1 m tall. Leaves are covered with fine, pale hairs, giving them a grayish appearance. Stream banks and moist meadows in full sun or light shade.	Endemic to southern Arizona and known from riparian and other moist areas in Pinal, Graham, and Pima Counties. Abundance is unknown.	No impact (NOT PRESENT- all Alts.)
Eriogonum ericifolium var. ercifolium **Heathleaf wild buckwheat**	SEN		White powdery gypseous limestone of Tertiary lakebed deposits in open creosote bush desert scrub 3,000-3,500 ft elevation.	Endemic in a small area of central Arizona in the upper and lower Verde watershed in Coconino and Yavapai Counties.	No impact (NOT PRESENT- all Alts.)
Helenium arizonicum **Arizona sneezeweed**	SEN		Endemic to north central AZ, it is almost exclusively found in Coconino County. The plant is found in regions of ponderosa forests, around wet places such as bogs, ponds, lakes and roadside ditches.	Found in regions of ponderosa forests, around wet places such as bogs, ponds, lakes, and roadside ditches. Is probably found within the analysis area.	No impact- all Alts. (No Treatments proposed in habitat)

Appendix E – Management Indicator Species

Evaluation of Management Indicator Species that may be present in the action area of the proposed project. The Apache-Sitgreaves National Forests (ASNF) and the Tonto National Forest (TNF) Land Management Plans (LMP) were prepared under planning regulations issued in 1982. The Forest Service is required to address MIS in compliance with various regulations and agency policy (e.g. 36 CFR 219, Forest Service Manual (FSM) 2621, FSM 1920), which are, themselves, tiered to the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA), as amended by the National Forest Management Act of 1976 (NFMA). Appendix G of the Tonto National Forest Plan (page 249-250) describes the MIS species selected for each forest cover type and specifically what attribute of this cover type they represent. The Apache-Sitgreaves National Forests Plan (page 74) lists the species to be considered MIS and directs managers to maintain or achieve within each diversity unit at least 40% of the potential habitat capability for each species. The MIS to be addressed are identified for each Management Area defined in the LMP. The following table documents the key habitat elements for each species, whether or not each species is likely to occur within the action area, potential effects to the species and its habitat, and provides a preliminary determination of whether the current habitat and population trend is likely to change given the implementation of any alternative. All "MAY CHANGE TREND" determinations are further discussed in the text of the EIS under Snags and Logs or the TES Section.

Species	Forest and Management Area	Cover Type	Key Habitat Elements (Affected Environment)	Status within Action Area of Project and Environmental Consequences	Change/No Change in Habitat/Population Trend by Alternative
MAMMALS					
Rocky Mountain Elk (*Cervus elaphus*)	TNF – 5D ASNF – 1	PP, PJ, Oak, Grass	The ASNF LMP (page 124) and TNF LMP (page 156) indicate that management should strive for a forage-to-cover ratio of between 60:40 and 70:30. Optimum forest cover for elk is 40-80 BA, (60 in smaller size classes and 70 in the 12-22 inch dbh class). Total road densities should average 3.5 mi/sq.mile or less and open road densities should average 2.0 mi/sq.mile or less.	High densities throughout Analysis Area. Post-Fire Habitat at 64:36 forage to cover ratio. Salvage will not change ratio of forage to cover; animals will avoid during harvest and for about 1-2 years post-harvest until vegetation recovers.	**ALTS 1,2,3,4,5: NO CHANGE IN HABITAT OR POPULATION TREND**

Species	Forest and Management Area	Cover Type	Key Habitat Elements (Affected Environment)	Status within Action Area of Project and Environmental Consequences	Change/No Change in Habitat/Population Trend by Alternative
Pronghorn Antelope (*Antilocapra americana*)	ASNF - 2	PP, PJ, Oak, Grass	Habitats in Analysis Area encompass a variety of grassland ranging from high desert grasslands to forest and mountain meadow. Prefer flat, open grassland areas, but also use rolling or broken hills and mesa tops of less than 20 percent slope. Will also use sparse woodlands and open forests.	Occurs on northern edge of Analysis Area, in more open grassland habitats. Openings created may create more forage and help increase populations.	**ALTS. 1: NO CHANGE – TREATMENTS NOT PLANNED IN PREFERRED HABITAT.** **ALTS. 2,3,4,5: SMALL SALES WOULD IMPROVE FORAGING HABITAT AFTER 1-3 YEARS**
Rocky Mountain Mule Deer (*Odocoileus hemionus hemionus)*	ASNF - 1	PP, PJ, Oak, Grass	In those habitats where elk and mule deer both exist, most studies indicate that the patterns of habitat use by elk are quite similar to those of mule deer. Therefore habitat management for mule deer should focus on the same factors mentioned under elk: vegetative cover, structure, diversity, available forage and adequate free water. Most authors indicate that by meeting the needs of elk the needs of mule deer will be met.	Within the fire's perimeter mule deer are found in the northern portion of Arizona Game and Fish's Game Management Unit 23 and 3C. Post-Fire Habitat at 64:36 forage to cover ratio. Salvage will not change ratio of forage to cover; animals may avoid during harvest and for about 1-2 years post-harvest until vegetation recovers.	**ALTS 1,2,3,4,5: NO CHANGE** **IN HABITAT OR POPULATION TREND FROM POST-FIRE CONDITIONS.**
Abert's Squirrel (*Sciurus aberti*)	TNF - 5D ASNF - 1	PP	The best squirrel habitat has some mature ponderosa pine trees with canopy covers exceeding 60%. Squirrels will forage or nest in unburned or under-burned stands of VSS 3 and greater. In Arizona up to 98% of the summer/fall diet comprises hypogenous fungi (truffles), associated with mid-aged forest with relatively high canopy covers. Apical buds, staminate cones, and seeds of ponderosa pine are also important food items, especially in winter.	Known to occur within the analysis area. Will not use open spaces created by burn whether or not salvage takes place. Large openings can create movement barriers.	**ALTS 1,2,3,4,5: NO CHANGE** **IN HABITAT OR POPULATION TREND**

Species	Forest and Management Area	Cover Type	Key Habitat Elements (Affected Environment)	Status within Action Area of Project and Environmental Consequences	Change/No Change in Habitat/Population Trend by Alternative
Red squirrel (*Tamiasciurus hudsonicus mogollonensis*)	ASNF - 1	MC	Key habitat elements in clude density of cone bearing trees, canopy cover, shading, insulation, and suitable cache sites. Other habitat requirements for middens and home range areas are large trees (usually greater than 16-18" DBH), interlocking canopies that provide arboreal escape routes, and an abundance of dead and down woody material that provide substrates for fungi, another important food source, as well as provide under-the-snow runways during deep snow	Known from Analysis area only within mixed conifer stands, approx. 3,490 acres. Red squirrels will avoid burned areas after caches removed or dried out. Will avoid burned areas and openings whether or not salvage occurs.	**ALTS 1,2,3,4,5: NO CHANGE IN HABITAT OR POPULATION TREND**
Arizona Gray Squirrel (*Sciurus arizonensis*)	TNF - 5D	Riparian	Limited to deciduous riparian forest below about 7,000 ft elevation. Preferred habitat includes walnuts, sycamores, and cottonwoods, but can be found up into riparian habitats surrounded by ponderosa pine and occasional mixed conifer sp ecies. Preferred foods include walnuts, acorns, and conifer seeds.	Known from analysis area. Post -fire habitat not suitable for foraging or nesting.	**ALTS 1,2,3,4,5: NO CHANGE IN HABITAT OR POPULATION TREND FROM POST-FIRE CONDITIONS.**
BIRDS					
Cinnamon Teal (*Anas cyanoptera septentrionalium*)	ASNF - 11	Water	One of the most common nesting ducks in Arizona, concentrated in wetland habitats above the Mogollon Rim on the San Francisco Plateau and in the White Mountains. Prefers small, shallow wetlands typically surrounded by grasses and herbaceous vegetation 1 to 2 feet in height.	Not known to nest within the action area due to lack of suitable habitat.	**ALTs. 1,2,3,4,5: NO CHANGE IN HABITAT/POPULATION TREND**
Northern Goshawk (*Accipiter gentiles*)	TNF – 5D ASNF - 1	PP, MC	forest habitat generalist that uses a variety of forest types, forest ages, structural conditions and successional stages. It primarily occupies ponderosa pine, mixed-species, and spruce-fir habitats in the southwest and prefers matur e conifer stands with dense canopies for nesting. LF-11	Breeding areas within action area. AA also provides foraging habitat.	**ALT. 1: NO CHANGE** **ALTS. 2, 3, 4, 5: NO CHANGE TO CURRENT LIVE HABITAT; COULD**

Species	Forest and Management Area	Cover Type	Key Habitat Elements (Affected Environment)	Status within Action Area of Project and Environmental Consequences	Change/No Change in Habitat/Population Trend by Alternative
					IMPACT POPULATION TREND BY DISTURBING NESTING PAIRS – MITIGATION IN PLACE TO MINIMIZE WHERE NESTS LOCATED.
Common Black Hawk (*Buteogallus anthracinus*)	TNF - 5D	Riparian	Associated with aquatic systems throughout its range. Year-round nesting and foraging habitat occurs in association with perennial systems characterized by mature riparian gallery forests, with cottonwoods and willows and/or sycamores dominating the overstory. Feed predominately on fish and frogs	Known to occur within AA; probably nested just downstream on flatter benches with cottonwood gallery forest. Habitat within AA burned severely; species not likely to return to area for nesting after initial forays into area.	**Alt. 1,3,4,5: No Impact** **ALT. 2: NO IMPACT – SPECIES MOST LIKELY NO LONGER IN AREA – NO SUITABLE HABITAT REMAINS.**
Merriam's Turkey (*Meleagris gallopavo merriami*)	ASNF - 1	MC, PP, PJ, Oak	Turkeys inhabit any vegetation type as long as an adequate food base and habitat structure is present. Importance of pine habitats increase with increased canopy cover and increased structural stage. Ponderosa pine with high canopy covers is important as winter habitat because pine seed is a preferred winter food. Because turkey diets in the summer are mostly seeds and leaves and an inverse relationship occurs between canopy cover and understory production, higher turkey use in summer is associated with canopy covers less than 40%	Known to be very common in AA before fire. Likely some poults died in fire because they were too young to fly. The action alternatives would not impact the remaining live habitat for this species. The largest impact from all the action alternatives on turkeys will be the openings created. Because turkey prefer small openings and are more susceptible to predation in large openings, fire had more impact than salvage will.	**ALT. 1: NO IMPACT TO CURRENT HABITAT** **ALTS. 2,3,4,5: WILL CREATE LARGE OPENINGS SOONER, BUT WILL NOT IMPACT CURRENT HABITAT/ POPULATION BECAUSE ACTIONS IN HIGH/MODERATE SEVERITY BURNS.**

Species	Forest and Management Area	Cover Type	Key Habitat Elements (Affected Environment)	Status within Action Area of Project and Environmental Consequences	Change/No Change in Habitat/Population Trend by Alternative
Mexican Spotted Owl *(Strix occidentalis lucida)*	ASNF - 1	MC, PP, PP/ Oak	Mixed conifer, pine-oak, mature trees. Owls nest and roost primarily in closed-canopy forests or rocky canyons. Forests used for roosting and nesting often contain mature or old growth stands with complex structure. LF-14	Known breeding areas within AA. Treatments proposed in PACs in Alt. 2 only	**ALT. 1: NO CHANGE** **ALTS. 2: HABITAT DISTURBANCE IN BURNED OVER PACS. POTENTIAL DECREASE IN NUMBERS ATTEMPTING TO NEST IN BURNED PACS.** **ALTS. 3, 4, 5: NO CHANGE TO HABITAT OR POPULATION TREND. SOME DISTURBANCE FROM VEHICULAR TRAFFIC COULD OCCUR NEAR PACS.**

Species	Forest and Management Area	Cover Type	Key Habitat Elements (Affected Environment)	Status within Action Area of Project and Environmental Consequences	Change/No Change in Habitat/Population Trend by Alternative
Red-naped sapsucker (*Sphyrapicus nuchalis*)	ASNF - 1	MC, AS, PP	Associated with deciduous and deciduous/coniferous forests, especially aspen and riparian woodlands. Commonly associated with aspen, cottonwood, willow, alder, sycamore, ponderosa pine, spruce, white fir and Douglas-fir. While observed in old-growth forests, species found in greater abundance in harvested areas. In the Southwest, red-naped sapsuckers more abundant in partially cut ponderosa pine forests than in uncut forests.	Suitable habitat and some records from AA. Fairly common in pinyon-juniper, ponderosa pine, and mixed conifer habitats across the forest. Nest success did not differ significantly between unharvested and harvested forest plots (including patch cuts and clear cuts)	**ALT. 1: NO CHANGE IN HABITAT OR POPULATION TREND** **ALTS. 2, 3, 4, 5: LACK OF DATA ON SALVAGE AND THIS SPECIES. LOGGED FORESTS WERE BENEFICIAL; DO NOT ANTICIPATE CHANGE FROM POST-BURN TREND GIVEN SNAG DENSITIES TO REMAIN.**
Hairy Woodpecker (*Picoides villosus*)	TNF – 5D ASNF - 1	MC, PP, PJ	Year round residents of nearly all forest types found in Arizona; not closely associated with any single tree species or species group. Usually found in forests containing some element of coniferous trees and in open rather than dense timber. Often found in abundance in burns and stands of dead trees.	The species is fairly common throughout the Analysis Area. More frequently found in cut than in uncut forests; detected most frequently in early Post-Fire forests. Less abundant and lower nesting success in salvage-logged stands relative to unlogged post-fire forests.	**Alt 1: NO CHANGE** **Alts. 2,3,4,5: DECREASE IN MAXIMUM POPULATIONS**
Western Wood-Pewee *(Contopus sordidulus)*	TNF - 5D	Riparian	Prefers riparian areas and open ponderosa pine habitats with grassy understories. Found frequently in relative abundance in post-Fire cover types.	Common nesters in PJ/pine, pine, and mixed conifer in Analysis Area. Their dependence on standing dead trees in post-fire habitats makes it likely a potential negative effect could occur from post-fire salvage logging on this species.	**ALT. 1: NO CHANGE IN HABITAT OR POPULATION TREND** **ALTS. 2, 3, 4, 5: LIKELY DECREASE FROM MAXIMUM POPULATIONS DUE TO SALVAGE. ALTS. 3, 4 LESS IMPACT THAN ALTS. 2,5.**

Species	Forest and Management Area	Cover Type	Key Habitat Elements (Affected Environment)	Status within Action Area of Project and Environmental Consequences	Change/No Change in Habitat/Population Trend by Alternative
Violet Green Swallow (*Tachycineta bicolor*)	TNF - 5D	PP, Riparian	Prefers riparian areas and open ponderosa pine habitats with grassy understories near water. Found frequently in relative abundance in post-Fire cover types.	Species nor its habitat is expected to occur within the AA.	No impact. (NOT PRESENT-all Alts.)
Juniper Titmouse (*Baeolophus griseus*)	ASNF - 2 TNF - 5D	PJ	An obligate inhabitant of pinyon-juniper woodlands. Occurs in mixed-species flocks or as singles/pairs. Feeds on juniper seeds, and consumes large amounts of ponderosa pine seeds. In Arizona, a fairly common to common resident in the northeastern, portion of the state. An obligate secondary cavity nester, mostly in juniper 6-15 inches. Tree densities of 60-155 and canopy closures 11% to 26% best. Density of population and percent of species composition tends to drop with increasing tree density and canopy cover, increasing total bird density, increasing proportion of junipers.	Fairly common nester in PJ across analysis area, and uses mixed pine/PJ transition stands of Analysis Area. Most (77%) stands burned were dense habitat that does not provide good nesting sites.	**ALT. 1: NO CHANGE IN HABITAT TREND** **ALTS. 2, 3, 4, 5: NO CHANGE IN TREND BECAUSE NEEDS LIVE STANDS THAT PROVIDE BOTH NESTS AND FOOD.**
Pygmy Nuthatch	ASNF - 1 TNF - 5D	PJ, PP, MC	Found primarily in mature and old growth ponderosa pine forest, pinyon/juniper woodlands, aspen, cottonwoods, and lightly disturbed areas. Prefers open, park like forests, structural stages of 4A or greater. Considered a secondary cavity nester. Large Snags in the ponderosa pine type preferred nest and winter roost habitat.	Common nester and winter resident in Analysis Area. Their dependence on standing dead trees in post-fire habitats makes it likely a potential negative effect could occur from post-fire salvage logging on this species.	**ALT. 1: NO CHANGE IN HABITAT OR POPULATION TREND** **ALTS. 2, 3, 4, 5: LIKELY DECREASE FROM MAXIMUM POPULATIONS DUE TO SALVAGE. ALTS. 3, 4 LESS IMPACT THAN ALTS. 2,5.**

Species	Forest and Management Area	Cover Type	Key Habitat Elements (Affected Environment)	Status within Action Area of Project and Environmental Consequences	Change/No Change in Habitat/Population Trend by Alternative
Western Bluebird (*Sialia mexicana*)	TNF - 5D	PP	Prefers mixed coniferous-deciduous forests. Prefers lightly or moderately disturbed areas in northern Arizona ponderosa pine communities. Secondary cavity-nester, preferring cavities abandoned by woodpeckers in dead or dying trees. In Arizona, western bluebirds are less sensitive to low snag densities than other cavity nesters, using oaks more often in areas with few ponderosa pine snags. Five studies reported increased numbers in partially cut forests. The abundance of newly killed trees in burned areas and concomitant woodpecker activity is valuable to western bluebirds for nest cavities. If salvage logging is unavoidable (for sanitary or firebreak reasons) then some areas should be left untouched rather than thinning the entire unit.	Common nester in Analysis Area. Snag availability in postfire communities is a substantial positive influence on western bluebird activity. Can use lower snag densities than primary cavity nesters. Snags should be greater than 20 inches d.b.h.	**ALT. 1: NO CHANGE** **ALTS. 2, 5: CHANGE TO CURRENT SNAG HABITAT COULD DECREASE HABITAT/POPULATION TREND OVER ALT.1, BUT NO CHANGE DETECTED IN HQI ANALYSIS.** **ALTS. 3, 4: INCREASED SNAG DENSITIES AND LARGER SNAGS COMBINED WITH MORE UNTREATED STANDS SHOULD MAINTAIN POPULATIONS AT OR ABOVE CURRENT LEVELS.**
Warbling Vireo (*Vireo gilvus)*	TNF - 5D	PP, Riparian	Open deciduous and mixed deciduous-coniferous woodland, riparian forest and thickets, pine-oak association, orchards, and parks. In migration and winter use a wide variety of forest, woodland and scrub habitats. In winter seems to prefer light woodland and savanna groves. Usually nests at end of branch in a deciduous tree, 9-18 m above ground, or 1-3.5 m above ground, in shrub or orchard tree.	Uncommon in ponderosa pine forests of Analysis Area. Fairly common in Canyon Creek area prior to fire.	**ALTS: 1, 3, 4, 5: NO CHANGE IN HABITAT OR POPULATION TREND.** **ALT. 2: SUITABLE HABITAT NO LONGER PRESENT.**

Species	Forest and Management Area	Cover Type	Key Habitat Elements (Affected Environment)	Status within Action Area of Project and Environmental Consequences	Change/No Change in Habitat/Population Trend by Alternative
Lucy's Warbler (*Vermivora luciae*)	ASNF - 3	Riparian (low elev.)	dependent on riparian habitats and occupies watercourses and marshes where mesquite is mixed with cottonwoods, willows, saltcedar, elderberry and desert hackberry. Breeds primarily along lower Colorado River, though locally to central and southeastern Arizona. Nests in mesquite thickets, usually near water. Winters in Mexico.	Habitat occurs below the Mogollon rim. Neither species nor its habitat expected to occur within the AA.	No Impact (NOT PRESENT - all Alts.)
Yellow Breasted Chat (*Icteria virens*)	ASNF MA3 (riparian)	Riparian (low)	Found in riparian habitats along perennial drainages where dense growth of willows, tamarisk, and other shrubs and medium-sized trees are present with a scattered overstory of cottonwoods.	AA is at the mid-elevation level and all riparian areas are of steep to moderate gradient. Species not known to occur in the AA.	No Impact (Treatments are not proposed in suitable habitat – all alts.)
Lincoln's Sparrow *(Melospiza lincolnii)*	ASNF MA3 (riparian)	Riparian (low)	Found in riparian habitats along perennial drainages where dense growth of willows, tamarisk, and other shrubs and medium-sized trees are present with a scattered overstory of cottonwoods.	Found in riparian habitats along perennial drainages where dense growth of willows, tamarisk, and other shrubs and medium-sized trees are present with a scattered overstory of cottonwoods.	No Impact (Treatments are not proposed in suitable habitat – all alts.)

Appendix F – Monitoring Plan

Resource Area/	Factors to Measure	Sampling Methods	Timing and Frequency	Indication of Need to Change	Funding Source	Annual Cost Estimate	Baseline Data Source
Watershed Effectiveness Monitoring: (1) Are treatments resulting in beneficial increases in water yield or unacceptable peak flow events that may alter stream channel morphology? (2) Does implementing BMPs result in protecting water quality for this project? (3) Are standards for protecting water quality adequate and being properly implemented on the ground? (4) Is long-term soil productivity being maintained and enhanced?							
1, 2, 3, 4	Water quality, stream bed morphology, soil quality	Ocular evlauatio n by a soil scientist and hydrologist; Post project interdisciplinary reviews to determine if BMPs established were implemented as designed	Once per project lifespan	BMPs are not effective in protecting water quality	KV Plan for Project	$5,200	Serveys conducted by AGFD pre- and post-fire
Wildlife Implementation Monitoring: (1) What are current and projected Habitat Quality Indices (HQIs) and forage/cover ratios for Management Indicator Species (MIS)? Effectiveness Monitoring: (2) Are treatments resulting in a loss of key habitat features such as snags, dead and down logs, and vegetative cover? (3) Is TE&S suitable habitat being affected? (4) What are the cumulative effects of management activities and natural events on habitat capability? (5) Are Threatened, Endangered and Sensitive (TE&S) species with "May Affect" determinations impacted during their breeding seasons by harvest activities, equipment noise, or other disturbance factors? (6) Are Management Indicator Species for each vegetation type affected by management activities?							

Resource Area/	Factors to Measure	Sampling Methods	Timing and Frequency	Indication of Need to Change	Funding Source	Annual Cost Estimate	Baseline Data Source
1, 4	HQIs	Run HQI models using stand exam data to determine VSSs and HQIs	Once per project lifespan	Non-compliance with management area plans; non-complaince with utilization standards; comprehensive plan goals are not met.	KV Plan for Project	$3,000	Apache-Sitgreaves and Tonto NF Annual Monitoring Reports.
2	Large snags and down logs, Canopy cover	Stand exam plots, and stratified random samples. Timber stands would be monitored before and after treatment to determine changes and trajectories in snag basal areas, number of down logs over 12 inches in diameter per acre, and basal area of hardwood trees over 10 inches DRC	Immediately following harvest activities	Numbers of snags per acre and down logs over 12 inches in diameter per acre do not meet averages specified in alternative selected for implementing project	KV Plan for Project	$5,200	MSN analysis as described in Vegetation Section

Resource Area/	Factors to Measure	Sampling Methods	Timing and Frequency	Indication of Need to Change	Funding Source	Annual Cost Estimate	Baseline Data Source
3	Threatened, Endangered, and Sensitive habitat	Run HQI models using stand exam data to determine VSSs and HQIs	Once per project lifespan	Any identified species with a may affect determination;: when any potential impact is identified on occupied or potential habitat; other TE&S species: when any potential impact may move a sensitive species toward Category 1 listing	KV Plan for Project	$1,200	Apache-Sitgreaves and Tonto NF Annual Monitoring Reports.
5	Threatened, Endangered and Sensitive Species (TE&S)	Conduct surveys for species with "may affect" determinations on all three Ranger Districts according to current monitoring protocol	Four surveys per site during breeding season for life of project	When population trends move a sensitive species toward Category 1 listing	District wildlife funds and KV Plan for Project	$80,000	US F&WS baseline data

Resource Area/	Factors to Measure	Sampling Methods	Timing and Frequency	Indication of Need to Change	Funding Source	Annual Cost Estimate	Baseline Data Source
6	Management Indicator Species (MIS)	Conduct surveys on all three Ranger Districts according to current monitoring protocol using existing survey and monitoring data	Number and frequency of surveys will vary according to monitoring protocol for each species	When potential habitat capability for MIS selected for each vegetation type falls below 40% within the analysis area.	District wildlife funds and KV Plan for Project	$40,000	Data from the Forest Service, other Government agencies, and and non-government organizations .
Vegetation Implementation Monitoring: (1) What is the harvest method for the project area? (2) Do silvicultural prescriptions precede vegetative treatments? (3) Are silvicultural prescriptions practical, will they meet the desired condition specified by the project ID team, and do they meet Forest Plan standards? What is the range and average size of created openings?							
1	Harvest methods	Annually review project stand file information and compare with harvest method schedule specified in the project plan	Once per project lifespan	Planned treatment varies + or – 25% from scheduled intervals	KV Plan for Project	$500	Apache-Sitgreaves and Tonto NF Annual Monitoring Reports

Resource Area/	Factors to Measure	Sampling Methods	Timing and Frequency	Indication of Need to Change	Funding Source	Annual Cost Estimate	Baseline Data Source
2, 3	Harvest method effectiveness	Review project implementation plans (one proposed and one post-harvest)	Once per project lifespan	(2) When any treatment has been accomplished which was not preceded by a silvicultural prescription; (3) 15% or more of stands fail to meet LRMP standards	KV Plan for Project	$500	Apache-Sitgreaves and Tonto NF Annual Monitoring Reports
4	Range and size of openings	Review of unit size in Stand Database	Once after project completion	If any of the units exceed size standards, without following proper procedures {36 CFR 219.12 (K)(5)}	KV Plan for Project	$500	Apache-Sitgreaves and Tonto NF Annual Monitoring Reports

Resource Area/	Factors to Measure	Sampling Methods	Timing and Frequency	Indication of Need to Change	Funding Source	Annual Cost Estimate	Baseline Data Source
Heritage Implementation Monitoring: (1) Are surveys being accomplished and are they completed to Regional standards? Effectiveness Monitoring: (2) Are all sites marked for avoidance before ground disturbing activities? (3) Are marked sites being avoided during ground disturbing activities? (4) Is post-project monitoring of heritage sites being accomplished in accordance with the Rodeo-Chediski Fire Programmatic Agreement between the Forest Service and SHPO?							
1.	Heritage surveys	Heritage surveys will be monitored by Supervisory Archeologists	Once per project lifespan	When any required survey is not accomplished according to Regional standards	KV Plan for Project	$500	Survey data & re-quirements of NHPA and NHRP
2	Site marking	Field visit by Forest or District archeologist after field layout is complete and prior to ground disturbing activity.	Once before project implement ation	New sites are discovered within the Area of Potential Effect	KV Plan for Project	$500	Determn. of No Adverse Effect and concurnce from AZ Hist. Pres. Officer

Resource Area/	Factors to Measure	Sampling Methods	Timing and Frequency	Indication of Need to Change	Funding Source	Annual Cost Estimate	Baseline Data Source
3	Site marking	Field visit by Forest or District archeologist.	Once per project lifespan	Sites are being disturbed by harvest activities.	KV Plan for Project	$500	Review of recorded sites on the ground
4	Post-project site monitoring	Field visit by Forest or District archeologist after harvest activities to 20 percent of sites within harvest units.	Once after project completion	Sites are being disturbed by harvest activities.	KV Plan for Project	$500	Review of recorded sites on the ground
Visual Resources Implementation Monitoring: (1) Are visual quality objectives being met?							
1	Visual quality	Review of project work plans and post-accomplishment that involve vegetative treatment, trail and road construction, or other major developments.	Once per project lifespan	A project reduces visual quality levels below Forest objectives and tolerance levels in Forest Plan, deviation from the desired future condition	KV Plan for Project	$500	Apache-Sitgreaves and Tonto NF Annual Monitoring Reports

Resource Area/	Factors to Measure	Sampling Methods	Timing and Frequency	Indication of Need to Change	Funding Source	Annual Cost Estimate	Baseline Data Source
Roads and Infrastructure Implementation Monitoring: (1) How many miles of roads are being built and obliterated for the life of the project? (2) How many miles of Forest roads are maintained by maintenance level? Effectiveness Monitoring: (3) Is the road maintenance level adequate for the normal use that the roads receive? (4) Are road closure and obliteration techniques effective?							
1	Miles of roads built and closed	Review road closures to evaluate effectiveness and techniques	Immediately after implementa-tion	When road closures are less than 75% effective	KV Plan for Project	$500	Roads Analysis Process for Project
2	Miles of road maintained by maintenance level	Annual accomplishment report, TIS	Once per project lifespan	20% deviation of planned accomplishment	KV Plan for Project	$500	Deferred Maintenance Summary, Table RTEWK05L

Resource Area/	Factors to Measure	Sampling Methods	Timing and Frequency	Indication of Need to Change	Funding Source	Annual Cost Estimate	Baseline Data Source
3	Road maintenance effectiveness	Field check representative roads	Daily during wet weather events in con-junction with TSO inspection duties	Maintenance level is above/below resoruce and/or use, needs	KV Plan for Project	$500	Transportation Section for Project and Deferred Maint. Sum.
4	Road closure effectiveness	Review road closures to evaluate effectiveness and techniques	Once per project lifespan	When road closures are less than 75% effective	KV Plan for Project	$500	Roads Analysis Process for Project

Appendix G - Maps

Map 1: Vicinity Map

Map 2 (East): Burn Severity

Map 2 (West): Burn Severity

Map 3 (East): Soil Types

Map 3: (West): Soil Types

Map 4: Affected 5th and 6th Code Watersheds Overview

Map 5 (East): Affected 5th and 6th Code Watersheds

Map 5 (West): Affected 5th and 6th Code Watersheds

Map 6 (East): Streamside Management Zones (SMZs)

Map 6 (West): Streamside Management Zones (SMZs)

Map 7 (East): Salvage Treatment Areas – Alternative 2

Map 7 (West): Salvage Treatment Areas – Alternative 2

Map 8 (East): Salvage Treatment Areas – Alternative 3

Map 8 (West): Salvage Treatment Areas – Alternative 3

Map 9 (East): Salvage Treatment Areas – Alternative 4

Map 9 (West): Salvage Treatment Areas – Alternative 4

Map 10 (East): Salvage Treatment Areas – Alternative 5

Map 10 (West): Salvage Treatment Areas – Alternative 5

Map 11: Analysis Zones

References

Air Quality

A Desk Reference for NEPA Air Quality Analyses, CHM Hill, 1995. Prepared for the USDA Forest Service, with oversight from Forest Service Air Resource Managers.

Laws and Regulations, U. S. Environmental Protection Agency, Clean Air Act, Air Quality Where You Live. http://www.epa.gov/oar/

Prescribed Fire Smoke Management Guide, February 1985. National Wildfire Coordinating Group, PMS 420-1, BIFC-BLM Warehouse, Boise, ID.

Smoke Management – A Workbook for Balancing Air Quality and Land Management Goals, 1982. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, EPA-450/2-82-001.

The Clean Air Act, 1970. 42 U.S.C. s/s 7401et. Seq., Congressional Law, U. S. Environmental Protection Agency.

Aquatic Resources

AGFD, 2002. A briefing of the effects of the Rodeo-Chediski Fire on wildlife and wildlife habitats. Unpubl. Rep., Pinetop, Ariz. 14 pp.

Allen, C. D., tech. Ed., 1996. Fire effects in southwestern forests: Proceedings of the second La Mesa Fire symposium; 1994 March 29-31; Los Alamos, New Mexico. Gen. Tech. Rep. RM-GTR-286. Fort Collins, CO: U.S. Dept. of Agriculture, Rocky Mountain Forest and Range Experiment Station. 216 pp.

Baker, M. B., Jr., 1990. Hydrologic and water quality effects of fire. Pages 31-42 in J. S. Krammes, tech. Coord. Effects of fire management of southwestern natural resources. Gen. Tech. Rep. RM-191. Fort Collins, CO: U.S. Dept. Agr., Forest Service, Rocky Mountain Forest and Range Experiment Station.

Chandler, C., P. Cheney, P. Thomas, L. Trabaud, and D. Williams, 1991. Fire in Forestry, Forest Fire Behavior and Effects, Vol. I. Krieger Publishing Co., Malabar, Florida. 450 pp.

Danzer, S. R., C. H. Baisan, and T. W. Swetnam. 1996. The influence of fire and land-use history on stand dynamics in the Huachuca Mountains of southwestern Arizona. Pages 265-270 in The Effects of Fire on Madrean Province Ecosystems. USDA USFS Gen. Tech. Rep. RM GTR-289. Rocky Mountain Range and Exp. Station, Fort Collins, CO.

Debano, L. F., D. G. Neary, and P. F. Folliott, 1998. Fire Effects on Ecosystems. John Wiley and Sons, Inc., New York, NY.

Gottfried, G. J. and L. F. Debano, 1990. Streamflow and water quality responses to preharvest prescribed burning in an undisturbed ponderosa pine watershed. Pages 222-228 in J.S. Krammes, tech. Coord. Effects of fire management of southwestern natural resources. Gen. Tech. Rep. RM-191. Fort Collins, CO: U.S. Dept. Agr., Forest Service, Rocky Mountain Forest and Range Experiment Station.

Kramp, B. A., D. R. Patton, and W. W. Brady, 1986. The effects of fire on wildlife habitat and species. RUN WILD Wildlife Habitat relationships Tech. Rep.. USDA Forest Service, Southwestern Region, Albq., NM.

Minckley, W. L., 1973. Fishes of Arizona. Arizona Game and Fish Department, Phoenix, AZ.

Rinne, J. N. and W. L. Minckley, 1991. Native fishes of arid lands: A dwindling resource of the desert southwest. USDA Forest Service General Technical Report RM-206: 1-45.

USFWS. 1999. Biological opinion for the Coronado National Forest's ongoing and long-term grazing program. USFWS, Phoenix, AZ.

Fire and Fuels

Agee, James K., 1993. Fire Ecology of Pacific Northwest Forests, Washington, DC: Island Press, 493p.

Agee, J. K., Bahro, B., Finney, M., Omi, P. N., Sapsis, D. B., Skinner, C. N., van Wagtendonk, J. W., Weatherspoon, C. P., 1999. The Use of Fuelbreaks in Landscape Fire Management.

Agee, J. K., 1996. The Influence Of Forest Structure On Fire Behavior, pp. 52-68, in proceedings of the 17th Forest Vegetation Management Conference, Redding, California.

Amman, Gene D.; Ryan, Kevin C., 1991. Insect Infestation Of Fire-injured Trees in the Greater Yellowstone Area. Res. Note INT-398. U. S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, UT, 9 p.

Anderson, Hal E., 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. General Technical Report INT, 122 p.

Andrews, Patricia L., 1986. BEHAVE: fire behavior prediction and fuel modeling system-BURN subsystem, Part1. USDA Forest Service gen. Tech. Rep.INT-196, 130 p.

Arno, Stephen F.; Scott, Joe H.; Hartwell, Michael G., 1995. Age-class structure of old growth ponderosa pine/Douglas-fir stands and its relationship to fire history. Res. Paper INT-481. USDA Forest Service, Intermountain Research Station, Ogden, UT, 25 p.

Arno, Stephen F.; Smith, Helen Y.; Krebs, Michael A., 1997. Old growth ponderosa pine and western larch stand structures; influences of pre-1900 fires and fire exclusion. Res. Paper INT-495. USDA Forest Service, Intermountain Research Station, Ogden, UT, 20 p.

BAER, 2002. Burned Area Emergency Rehab report on file at Black Mesa Ranger District, Apache-Sitgreaves National Forests, Overgaard, AZ.

Beschta, R. L. et al., 1995. Wildfire and Salvage Logging: Recommendations for Ecologically Sound Post-Fire Salvage Management and Other Post-Fire Treatments on Federal Lands in the West, Water Resources Research, 14:1011-1016.

Biswell, Harold H., et al, 1973. Ponderosa pine fire management: a task force evaluation of controlled burning in ponderosa pine forests of central Arizona. Tall Timbers Research Station, Tallahassee, FL, 49 p.

Brown, James K.; Reinhardt, Elizabeth D.; Kramer, Kylie A., 2001. Coarse Woody Debris and Succession in the Recovering Forest.

Brown, James K., 1985 Intermountain Forest and Range Experiment Station, General Technical Report INT-182, pp 127-128.

Brown, James K., Overheau, Rick D., Johnson, Cameron M. 1982 "Handbook for Inventorying Surface Fuels and Biomass in the Interior West". USDA Forest Service General Technical Report INT, 129 p.

Brown, James K., 1978. Weight and density of crowns of Rocky Mountain Conifers, USDA Forest Service Research Paper INT-197. 56 p.

Brown, James K., 1974. "Handbook for Inventorying Downed Woody Material", USDA Forest Service, General technical Report INT – 16.

Burns, R. M. and Honkala, B. H., 1990. Silvics of North America, Volume 1, Conifers. Agriculture Handbook 654, USDA Forest Service, Washington D. C. 673 p.

Byram, G. M., 1959. Combustion of forest fuels. In Brown K. P. Forest Fire: Control and Use, McGraw and Hill, New York, New York.

Cooper, C. F., 1960. Changes in vegetation, structure and growth of Southwestern pine forests since white settlement. Ecol. Monographs 30, pp. 129-164.

Covington, W. W. and M. M. Moore, 1994. Southwestern ponderosa pine forest structure: changes since Euro-American settlement, Journal of Forestry, 95:23-29.

DeBano, Leonard F. 1969. Water Repellent Soils, A worldwide concern in management of soil and vegetation. Reprinted from Agricultural Science Review, Vol. 7, No. 2, Second Quarter 1969. Published quarterly by Cooperative State Research Service, USDA.

DeBano, Leonard F., 1989. Effects of fire on chaparral soils in Arizona and California and postfire management implications. Proceedings of the Symposium on Fire and Watershed Management, October 26-28, 1988 in Sacramento, CA., Gen. Tech. Rep. PSW-109, Berkeley, CA; USDA, Forest Service, PSW; 55-62. Available from: National Technical Information Service, Springfield, VA 22161; PB89-228639.

Dieterich, John H., 1980. Chimney Spring fire history. Res. Paper RM-220. Ft. Collins CO. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, 8p.

Graumlich, L. J., April 1993. Holocene variation in spatial scale of vegetation patterns. Plant Ecology, Vol.74, No. 3. Held by Rocky Mountain Research Station, Ogden, Utah.

Harrington, M. G., 1996. Fall rates of prescribed fire-killed ponderosa pine. INT-RP-489, U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah, 7 p.

Hadfield, J. S.; Magelssen, R. W., 1998. Wood changes in fire-killed eastern Washington tree species – third year progress report. U. S. Department of Agriculture, Forest Service, Wenatchee National Forest, Wenatchee Service Center, Wenatchee, WA. 37 p.

Ice, G. G.; Megahan, W. F.; McGreer, D. J.; Belt, G. H., 1995. A Review of the Report, "Wildfire and Salvage Logging: Recommendations for Ecologically Sound Post-Fire Salvage Logging and Other Post-fire Treatments on Federal Lands in the West," 10 p., on file at

the National Council of the Paper Industry for Air and Stream Improvement, Inc., P.O. Box 458, Corvallis, OR 97339.

Keen, F. P., 1955. The rate of natural falling of beetle-killed ponderosa pine snags. Journal of Forestry, 53: 720-724.

Kimmey, J. W., 1955. Rate of deterioration of fire-killed timber in California. Circular No. 962, Washington, DC. U. S. Department of Agriculture. 22 p.

Lucia, E., 1983. Tillamook Burn Country: A Pictorial History. Caxton Printers, Caldwell, ID.

Machlis, G. E., et al., 2001. Burning Questions: A Social Science Research Plan for Federal Wildland Fire Management. Report to the National Wildfire Coordinating Group, University of Idaho, Moscow, Idaho.

Omi, Philip N.; Martinson, Erik J., March 25, 2002. Final Report: Effects of Fuels Treatment on Wildfire Severity, Western Forest Fire Research Center, Colorado State University. Submitted to the Joint Fire Science Program Governing Board.

Penningto, Roy, June, 2000. Paper on file at Santa Fe National Forest, Fire Management Office.

Pyne, S., 1999. Fire in America, University of Washington, Seattle, WA.

Rothermel, Richard C., 1991. Predicting behavior and size of crown fires in the Rocky Mountains. USDA Forest Service, Res. Paper, RP-INT-438. 46 p.

Rothermel, Richard C., 1983. How to Predict the Spread and Intensity of Forest and Range Fires. USDA Forest Service, GTR INT-143. 161 pp.

Rothermel, Richard C., and Deeming, John E., 1980. Measuring and interpreting fire behavior for correlation with fire effects. USDA Forest Service General Technical Report, INT-GTR-93.

Simard, A. J., 1991. Forecasting fire severity. Proceedings of the 11th Conference on Fire and Meteorology, Society of American Foresters, SAF Pub. 91-04, pp. 119-130.

Southwestern Region, 1996. Photo Series for Quantifying Forest Residues in the Southwestern Region. Data compiled from; Black Hills Ponderosa Pine and Spruce type 1990; GTR-PNW – 105, 1980; GTR–PNW-52, 1976; GTR-PNW-56, 1981.

Swetnam, T. W., 1999. Historical fire regime patterns in the Southwestern United States since AD 1700. Fire Effects in Southwestern Forests, RM-GTR-286. p. 12.

Weatherspoon, C. P. and Skinner, C. N, 1995. An assessment of factors associated with damage to tree crowns from the 1987 wildfires in northern California. Forest Science, 41:430-451.

Geology and Minerals

Arizona Department of Transportation (ADOT), Materials Division, Arizona Materials Inventory, Aggregate Sources and Geology of Gila County (1961), 49 pages, maps and text.

Arizona Department of Transportation (ADOT), Materials Services, Highway Division, A Materials Inventory of Navajo County (1978), 86 pages, maps and text.

Chronic, Halka, 1983. Roadside Geology of Arizona, Mountain Press Publishing. ISBN 0-87842-147-5, 314 pages.

Green, F., 2003. Assistant District Ranger, Black Mesa Ranger District, Apache-Sitgreaves National Forests, personal communication.

Hendricks, David M., 1985. Arizona Soils, College of Agriculture, University of Arizona, Tucson, ISBN 0-932913-02-4, 244 pages.

Kamilli, R.J. and S.M. Richard, 1998. Geologic Highway map of Arizona: Tucson, Arizona, Geological Society and Arizona Geological Survey, 1 sheet containing text and figures, scale 1:1,000,000.

Lang, Larry; Ambos, Norman; Subirge, Tom; McDonald, Christina; Nelson, Chris; Robbie, 1989. Terrestrial Ecosystems Survey of the Apache-Sitgreaves National Forests, USDA Forest Service.

Skotnicki, Steven J., 2002. Geologic Map of the Sierra Ancha, Central Arizona, Arizona Geological Survey, Digital Geological Map 24, 29 pages text, maps at 1:100,000 scale.

Smiley, Terah L., J. Dale Nations, Troy L. Pewe, and Schafer, John P., 1984. Landscapes of Arizona, The Geological Story, University Press of America, Lanham, MD., ISBN 0-8191-4178-X, 506 pages.

Subirge, Thomas, 2003. U.S. Forest Service soil scientist, riparian and watershed specialist, Apache-Sitgreaves National Forests, Springerville, AZ. Personal communication.

Wilson, Eldred D., Richard T. Moore, and Robert T. O'Haire, 1960. Geologic Map of Navajo and Apache Counties, Arizona, Arizona Bureau of Mines, University of Arizona, Tucson.

NOTE: *All above references are available in Supervisor's Office of the Apache-Sitgreaves National Forests, Springerville, AZ. Some references are Forest Service property, while some are privately owned by employees.*

Heritage Resources

North, Chris, Michael S. Foster, and Louise Senior, 2003. Archaeology at the Edge of the Rim; An Area Heritage Resource Survey of Portions of the Rodeo-Chediski Burn Area, Black Mesa and Lakeside Ranger Districts, Apache-Sitgreaves National Forests, Navajo County, Arizona. Manuscript on file at the Forest Supervisor's Office, Apache-Sitgreaves National Forests.

Ryan, Denise, 2002. Rodeo-Chediski Fire Archaeological Damage Assessment: OW Ranch Vicinity. Report 2002-12-082 on file at the Supervisor's Office, Tonto National Forest.

Traylor, Diane, Lyndi Hubbell, Nancy Wood and Barbara Fiedler, 1990. The 1977 La Mesa Fire: An Investigation of Fire and Fire Suppression Impact on Cultural Resources in Bandelier National Monument. Southwest Cultural Resources Center, Professional Paper Number 28. Branch of Cultural Resources Management, Division of Anthropology, National Park Service, Santa Fe, New Mexico.

Socio-economics

Alward, G., 1995. IMPLAN folder/Economic Diversity index. USDA Forest Service, Fort Collins, CO.

Behavior Research Center, 2002. Public Opinion on Forest Management in Arizona. Prepared for Southwest Forest Alliance, Sierra Club – Grand Canyon Chapter, and Center for Biological Diversity, unpublished.

Bengston, David N., 1993. Changing Forest Values and Ecosystem Management, Society of Natural Resources, Volume 7, pp. 515-533.

Brandenburg, Andrea M., and Carroll, Matthew S., 1995. Your Place or Mine?: The Effect of Place Creation on Environmental Values and Landscape Meanings. Society and Natural Resources, Volume 8, pp. 381-398. Sept-Oct 1995.

Bright, Alan D.; Cordell, Ken H.; and Hoover, Anne P., 1999. Guidelines for Conducting Social Assessments within a Human Dimensions Framework, in press.

Carroll, Matthew S.; Findley, Angela J.; Blatner, Keith A.; Mendez, Sandra Rodriguez; Daniels, Steven E.; Walker, Gregg B., 2000. Social assessment for the Wenatchee National Forest wildfires of 1994: targeted analysis for the Leavenworth, Entiat, and Chelan Ranger Districts. Gen. Tech. Rep. PNW-GTR-479. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR. 114 p.

CEEM, 1999. Heber-Overgaard Interface Analysis; Apache-Sitgreaves National Forests Landscape Assessment. Completed by continuing education in Ecosystem Management Team.

Cosgrove, Catherine R., 1998. Public land use in Apache, Greenlee and Navajo Counties. Results of a survey of community interests and values. 20pp. Unpub. Partial funding by Apache County Economic Security Corporation, Greenlee County and Navajo County.

Hunt, B. S., 1993. It is not often: Early day logging between Heber and Overgaard. Pine Graphics, Overgaard, AZ.

Lane, J., May 11, 1999. Rural, Rustic Heber-Overgaard. White Mountain Independent.

Merrill, Bruce D., Ph.D., 1998. Attitudes Toward Rural Communities and Environmental Values. Prepared for The Eastern Arizona Counties Organization. July 5, 1998. Unpublished.

Mitchell, M. Y.; J. E. Force, M. S. Carroll; and W. J. McLaughlin, 1993. Forest Places of the Heart, Journal of Forestry, 91(4): pp. 32-37.

Navajo County, 1997. General Plan Heber/Overgaard. Unpublished.

Niemi, Ernie; Whitelaw, Ed, 1999. Assessing economic tradeoffs in forest management. Revised. Gen. Tech. Rep. PNW-GTR-403. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 78 p.

Peterson, G. L. and C. F. Sorg. 1987. Towards the Measurement of Total Economic Value. Gen. Tech. Report. RM-148. USDA, Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Raish, Carol, 1995. Historic land use and grazing patterns in northern New Mexico. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Experiment Station. RM-GTR-272, pp. 189-197.

Randall, A., 1992. A Total Value Framework for Benefit Estimation. Pages 87-111 in Peterson, G. L., and others, Editors. Valuing Wildlife Resources in Alaska. Boulder, Westview Press.

Rollins, Kimberly, 2001. Measuring Ecosystem Values; as published in Jensen and Bourgeron, A Guidebook for Integrated Ecological Assessments, Springer Press

Simmons, M., 1979. History of the Pueblos since 1821. Handbook of North American Indians, Volume 9, Smithsonian Institution, Washington, D. C., pp. 206-223.

Steel, B. S.; P. List; and B. Shindler, 1994. Conflicting values about federal forests: a comparison of national and Oregon publics. Society and Natural Resources, 7:137-153.

U. S. Bureau of Economic Analysis. Regional Economic Information System, 1969-1997 data, available via internet.

U. S. Census Bureau, 2000. U. S. Census Data, Housing and Population Divisions, available via internet.

U. S. Census Bureau, 1992. U. S. Census Data, Economics and Agriculture Census, available via internet.

U. S. Department of Commerce, 1996. American Indian Reservations and Trust Areas, Economic Development Administration.

USDA Forest Service, 1996. Status of the Interior Columbia Basin - Summary of Scientific Findings. General Technical Report, PNW-GTR-385, U. S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

USDA Forest Service, 1997. An Assessment of Forest Ecosystem Health in the Southwest. General Technical Report, RM-GTR-295, U. S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experimental Station, Southwestern Region.

USDA Forest Service, 2000. Forest Service Roadless Area Conservation. Draft Environmental Impact Assessment, Volume 1, U. S. Department of Agriculture, Forest Service, Washington Office.

Xu, Zhi; and Bengston, David N., 1997. Trends in National Forest Values among Forestry Professionals, Environmentalists and the News Media, 1982-1993. Society and Natural Resources, 10:43-59.

Soils and Hydrologic Resources

BAER Handbook, 2002. Interagency Burned Area Emergency Stabilization and Rehabilitation Handbook, Version 2.0, CD date, 03/01/02.

Beschta, Dr. Robert L.; Christopher L. Frissell; Robert Gresswell; Richard Hauer; James R. Karr; G. Wayne Minshall; David A. Perry; Jonathan J. Rhodes; 1995. Wildfire and Salvage Logging: Recommendations for Ecologically Sound Post-Fire Salvage Logging and

other Post-Fire Treatments on Federal Lands in the West. Unpublished white paper, 13 pages.

Butler, Gary. White Mountain Independent. Friday August 23, 2002. Fire Testimony. Page 6A.

Debano, Leonard F., 1991. The Effect of Fire on Soil Properties. Proceedings: Management and Productivity of Western Montane Forest Soils, USDA Forest Service, Intermountain Research Station, General Technical Report INT-280.

FEMA (Federal Emergency Management Agency), June 1997. FIRM (Flood Insurance Rate Map) Flood insurance study for Navajo County, Arizona.

Larson, Noel, October 27, 1989. Correspondence: Region to Forests, Effect of Fire on Soil. Director of Watershed and Air Management, USDA Forest Service, Southwestern Region.

MacCarthy, P.; C.E. Clapp; R.L. Malcolm; and P.R. Bloom eds., 1990. Humic Substances in Soil and Crop Sciences: Selected Readings. American Society of Agronomy, Inc. and Soil Science Society of America, Inc., Madison, WI., ISBN 0-89118-104-0, 281 pages.

National Weather Service, Flagstaff, Az. Radar. Doppler Radar Output for Rain Event 9/11/2002 showing Storm Precipitation Totals. Web site accessed 9/12/2002. Source: www.wrh.noaa.gov/radar//latest/DS.80stp/si.kfsx.shtml.

Renard, K. G.; G. R. Foster; G. A. Weesies; D. K. McCool; and D. C. Yoder, 1997. Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE). USDA Agricultural Research Service, Agricultural Handbook Number 703, ISBN 0-16-048938-5.

Stevenson, F. J., Second Edition, 1994. Humus Chemistry: Genesis, Composition, Reactions, John Wiley & Sons, ISBN 0-471-59474-1, 496 pages.

USDA Forest Service. Forest Service Manual FSH 2554, Region 3 Supplement, Soil Quality Monitoring, approximately 12 pages.

Van Lear, David H. and Peter R. Kapeluck, 1989. Fell and Burn to Regenerate Mixed Pine-Hardwood Stands: an Overview of Effects to Soil. Proceedings: Pine-Hardwood Mixtures: A Symposium of Management and Ecology of the Type. Thomas Waldrop ed. Atlanta, Georgia, Southeastern Forest and Range Experiment Station.

Transportation

Bolander, Peter, 1999. Dust Palliative Selection and Application Guide, Pacific Northwest Region, 20 pp.

Castro, Janine, 2002. Geomorphologic Impacts of Culvert Replacement and Removal, U. S. Fish and Wildlife Service, Portland, Oregon. 19 pp.

Vegetation

Beschta, R. L., et al., 1995. Wildfire and Salvage Logging: Recommendations for Ecologically Sound Post-fire Salvage Logging and Other Post-fire Treatments in the Oregon Coast Range, Water Resources Research, 14:1011-1016.

Cooper, Charles F., 1960. Changes in Vegetation, Structure, and Growth of Southwestern Pine Forests Since White Settlement, Ecological Monographs, Vol. 30, No. 2, pp. 129-164.

Covington, W. Wallace, 1994. Implications for Ponderosa Pine/Bunchgrass Ecological Systems, pp. 92-97 in W.W. Covington and L.F. Debano, technical editors. Sustainable Ecological Systems: Implementing an Ecological Approach to Land Management, U. S. Forest Service General Technical Report RM-247.

Covington, W. W. and Moore, M. M., 1994. Southwestern Ponderosa Pine Forest Structure: Changes Since Euro-American Settlement, Journal of Forestry, 92(1):39-47.

Everett, Richard, 1995. Forest Service Review of Wildfire and Salvage Logging by Beschta, et al., USDA, Washington DC August 21, 1995.

Fiedler, C. E., Arno, S. F., Harrington, M. G., 1996. Flexible Silvicultural and Prescribed Burning Approaches for Improving Health of Ponderosa Pine Forests, pp. 69-74 in Conference on Adaptive Ecosystem Restoration and Management, USDA, Rocky Mountain Forest and Range Experiment Station, RM-GTR-278.

Ganey, Joseph L., 1999. Snag Density and Composition of Snag Populations on Two National Forests in Northern Arizona, Forest Ecology and Management, 117:169-178.

GAO, 1999. Western National Forests: A Cohesive Strategy is Needed to Address Catastrophic Wildfire Threats, GAO/RCED-99-65.

Hallet, James G., et al., 2001. Decay Dynamics and Avian Use of Artificially Created Snags, Northwest Science, Vol. 75, No. 4, pp. 378-386.

McIver, James D. and Lynn Starr, 2000. Environmental Effects of Postfire Logging: Literature Review and Annotated Bibliography". USDA Forest Service General Technical Report PNW-GTR-486.

Moir, William H., et al., 1997. Ecology of Southwestern Ponderosa Pine Forests, pp. 3-27, USDA Forest Service General Technical Report RM-GTR-292.

Moore, Margaret M., W.W. Covington, and P. Z. Fule, 1999. Reference Conditions and Ecological Restoration: A Southwestern Ponderosa Pine Perspective. Ecological Applications, Vol. 9, No. 4, pp. 1266-1277.

Morgan, Penelope, 1994. Dynamics of Ponderosa and Jeffrey Pine Forests, pp. 47-73 in G.D. Hayward and J. Verner, technical editors. Flammulated, Boreal, and Great Gray Owls in the United States: A Technical Conservation Assessment, U. S. Forest Service General Technical Report RM-253.

Reynolds, Richard T., et al., 1992. Management Recommendations for the Northern Goshawk in the Southwestern United States, USDA Forest Service General Technical Report RM-217.

Sackett, S. S., et al., 1996. Lessons Learned from Fire Use for Restoring Southwestern Ponderosa Pine Ecosystems, pp. 54-61, Covington and Wagner, tech coordinators. Conference on Adaptive Ecosystem Restoration and Management: Restoration of Cordilleran Conifer Landscapes of North America, USDA Forest Service General Technical Report RM-GTR-278.

Sampson, R. Neil, et al., 1995. Forest Ecosystem Health in the Inland West, pp. 53-62, L.G. Eskew, compiler. Forest Health Through Silviculture, Proceedings of the 1995 National Silviculture Workshop, USDA Forest Service General Technical Report RM-GTR-267.

Schubert, Gilbert H., 1974. Silviculture of Southwestern Ponderosa Pine: The Status of Our Knowledge, USDA Forest Service, Research Paper RM-123.

USDA, 1985. Tonto National Forest Land and Resource Management Plan, USDA Forest Service, Southwestern Region.

USDA, 1987. Apache-Sitgreaves National Forests Land and Resource Management Plan, USDA Forest Service, Southwestern Region.

USDA, 1996. Record of Decision for Amendment of Forest Plans, USDA Forest Service, Southwestern Region.

USDA, 2002a. 2002 Aerial Detection Survey Apache-Sitgreaves NF, (two 36” x 40” color maps plus attached table).

USDA, 2002b. 2002 Forest Insect and Disease Aerial Detection Survey Results. Letter to Arizona Forest Supervisors from Southwestern Region Forest Health, Arizona Field Office, dated October 29, 2002 with attachments, File code 3410.

USDI, 1995. Recovery Plan for the Mexican Spotted Owl, USDI Fish and Wildlife Service, Southwestern Region.

Visual Quality

USDA, Forest Service. Landscape Aesthetics: A Handbook for Scenery Management, Forest Service Handbook 701.

USDA, Forest Service. Landscape Character Types of the National Forests in Arizona and New Mexico, Forest Service, Southwestern Region.

USDA, Forest Service. Visual Vulnerability of the Landscape: Control of Visual Quality, Forest Service Research Paper WO-39.

Wildlife

AGFD, 2002. A briefing of the effects of the Rodeo-Chediski Fire on wildlife and wildlife habitats. Unpubl. Rep., Pinetop, Ariz. 14 pp.

Balda, R. P., 1975. Relationship of secondary cavity nesters to snag densities in western coniferous forests. Widlife Habitat Tech. Bull. No. 1. USDA Forest Serv., Region 3. 37 pp.

Beschta, R. L., C. A. Frissell, R. Gresswell, R. Hauer, J. R. Karr, G. W. Minshall, D. A. Perry, and J. J. Rhodes, 1995. Wildfire and salvage logging. Unpubl. Rep., Corvallis, OR. 16 pp.

Bull, E. L., C. G. Parks, and T. R. Torgersen, 1997. Trees and logs important to wildlife in the interior Columbia River Basin. USDA For. Serv., Pacific NW Research St. Gen. Tech. Rep. PNW-GTR-391, 55p.

Carey, A. B. and M. L. Johnson, 1995. Small mammals in managed, naturally young, and old-growth forests. Ecological Applications 5(2), 336-352.

Daubenmire, R., 1968. Ecology of fire in grasslands. In: Cragg, J. B., ed. Advances in ecological research: Vol. 5. New York: Academic Press: 209-266.

Dieterich, J.H. 1983. Fire history of southwestern mixed conifer: a case study. Forest Ecology and Management 6:13-31.

Evers, Louisa, 2003. Addressing the issues raised in the 1995 Beschta report on post fire salvage logging. Unpubl. Rep. (draft), 25 pp.

Grifantini, M. C., 1991. Early-seral changes following wildfire, salvage-logging, and reforestation, Klamath Mountains, CA. Final Rep. Humboldt State Univ., Arcata, 47 p.

Grissino-Mayer, H. D., C. H. Baisan, and T. W. Swetnam, 1994. Fire history and age structure analyses in the mixed conifer and spruce-fir forests of Mount Graham. Unpubl. Rep., 72 pp.

Harrington, M. G., 1996. Fall rates of prescribed fire-killed ponderosa pine. INT-RP-489. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Missoula, MT, 7 p.

Higgins, Kenneth F.; Kruse, Arnold D.; Piehl, James L., 1989. Effects of fire in the Northern Great Plains. Ext. Circ. EC-761. Brookings, SD: South Dakota State University, Cooperative Extension Service, South Dakota Cooperative Fish and Wildlife Research Unit, 47 p.

Ingraldi, M., 1995. Memo and table summarizing Arizona Game and Fish Department's 1995 ranid frog surveys on the Sitgreaves National Forest.

Kindschy, Robert; Sundstrom, Charles; Yoakum, James., 1978. Range/wildlife interrelationships--pronghorn antelope. In: Proceedings, 8th biennial pronghorn antelope workshop; 1978 May 2-4; Jasper, AB. Edmonton, AB: Albertal Recreation, Parks, and Wildlife, Fish and Wildlife Division: 216-262.

Klein, E., M. Gilbert, S. Lisius, R. Richards, M. Ross, C. Woods, B. Calamusso, D. Pollock and J. Spencer, 2002. Tonto National Forest Land and Resource Management Plan Management Indicator Species Status Report Version 1.0. Unpbl. Report, Tonto National Forest, Supervisors Office, Phoenix, AZ.

Myers, T., editor, 2002. Apache-Sitgreaves forest wide MIS evaluation. Draft Upubl. Report, Apache-Sitgreaves National Forests, Supervisors Office, Springerville, Arizona.

Platz, J. E. and J. S. Mecham, 1979. *Rana chricahuensis*, a new species of leopard frog (*Rana pipiens* complex) from Arizona. Copeia 3:383-390.

Platz, J. E. and A. L. Platz, 1973. *Rana pipiens* complex: hemoglobin phenotypes of sympatric and allopatric populations in Arizona. Sci. 179:1334-1336.

Raphael, M. G., 1983. Cavity nesting bird response to declining snags on a burned forest: a simulation model. Pages 211-215 in Davis, J. W., G. A. Goodwin, and R. A. Ockenfels, Tech eds. Snag Habitat Management Proceedings of the Symposium. USDA Forest Serv. Gen. Tech. Rept. RM-99. Ft. Collins, CO.

Raphael, M. G. and M. White, 1984. Use of snags by cavity nesting birds in Sierra Nevada. Wildl. Monogr. 86, The Wildlife Society, Bethesda, MD.

Reynolds, R. T., R. T. Graham, H. M. Reiser and others, 1992. Management recommendations for the northern goshawk in the southwestern United States. Gen. Tech. Rep. RM-217. Ft. Collins, CO, USDA For. Serv., Rocky Mount. For. Range Exp. Sta. 90 pp.

Schwalbe, C. R., 1988. Lowland leopard frog. Wildlife Views, page 15.

Seim, S., 1994. Memo and table summarizing Arizona Game and Fish Department's 1994 riparian herpetofauna survey results on the Lakeside Ranger District.

Sredl, M., 1992. Relicit leopard frog. Wildlife Views, page 15.

Smith, Jane K, ed. 2000. Wildland fire in ecosystems: effects of fire on fauna. Gen. Tech. Rep. RMRS-GTR-42, Vol. 1. U. S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Ogden, UT. 83 pp.

Stebbins, R. C., 1985. A field guide to western reptiles and amphibians. Houghton Mifflin Co., Boston. MA. 336 pp.

Taylor, D. L. and W. J. Barmore, 1980. Post-fire succession of avifauna in coniferous forest of Yellowstone and Grand Teton National Parks, Wyoming. In R. M. DeGraff, Tech Coord. Management of western forests and grasslands for non-game birds. USDA Forest Serv. Gen. Tech. Rept. INT-86. Ogden, UT.

Thomas, J. W., H. Black, Jr., R. J. Scherzinger, and R. J. Pedersen, 1979. Deer and elk. *In* Thomas, J.W., ed. Wildlife habitats in managed forests—the Blue Mountains of Oregon and Washington, pages 104-127. USDA, Washington, D.C., Agric. Handb. 553.

USDA Forest Service. 2002. Wildlife Report, Rodeo-Chediski Fire. Unpubl. Rep., 84 pp. plus appendices.

USDA Forest Service. 1992. Oak Regeneration: Serious problems practical recommendations, pages 79-95, in Symposium Proceedings, Knoxville, TN. Southeastern Forest Experiment Station, Gen. Tech. Rep. SE-84.

USDA Forest Service, 1987. Apache-Sitgreaves National Land and Resource Management Plan, Springerville, AZ. 295 pp.

USDI, Fish and Wildlife Service, 1984. American Peregrine Falcon Recovery Plan: Rocky Mountain Southwest Populations. Prepared in cooperation with the American Peregrine Falcon Recovery Team, Denver, CO. 105 pp.

USDI, National Park Service, Wind Cave National Park. 1966. Conservation Plan: Wind Cave National Park, Custer County Conservation District. Wind Cave National Park, SD: U.S. Department of the Interior, National Park Service, 46 p.

USDI, Fish and Wildlife Service, 2002. Birds of conservation concern 2002. Div. Migratory Bird Management, Arlington, VA. 99 pp.

USDI, Fish and Wildlife Service, 1998. Proposed rule to remove the peregrine falcon in North America from the list of endangered and threatened wildlife. Federal Register 63:45446-45463.

USDI, Fish and Wildlife Service, 1998. Status review of the northern goshawk in the forested west. Off. Tech. Sup. – Forest Resources, Portland, OR. Unpubl. Rep. 250 pp.

USDI, Fish and Wildlife Service, 1995. Recovery plan for the Mexican spotted owl, Vol. I. Albuquerque, NM. 172 pp.