

Chapter 2 • Alternatives

Introduction

This chapter describes and compares the alternatives considered by the Forest Service for the Kachina Village Forest Health Project. It includes a discussion of how alternatives were developed; an overview of mitigation measures, monitoring and other features common to all alternatives, a description, visual simulations, and map of each alternative considered in detail; and a comparison of these alternatives focusing on the significant issues. Alternative A is identified as the preferred alternative. Chapter 2 is intended to present the alternatives in comparative form, sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public (40 CFR 1502.14).

Some of the information used to compare alternatives at the end of Chapter 2 is summarized from Chapter 3, “Affected Environment and Environmental Consequences.” Chapter 3 contains the scientific basis for establishing baselines and measuring the potential environmental consequences of each of the alternatives. For a full understanding of the effects of the alternatives, readers will need to consult Chapter 3.

Alternative A Development Process

The development of alternatives for the Kachina Village Forest Health Project began with the development of the Proposed Action (Alternative A). This alternative was crafted by the Forest Service Interdisciplinary Team (IDT) after several months of collaboration and work with members of the public and the Greater Flagstaff Forests Partnership. The project focus is to improve forest health conditions focusing on the Flagstaff Wildland-Urban Interface (WUI). For the City of Flagstaff and the surrounding satellite communities, the Forest Service has had a definition of the WUI in the Coconino National Forest Plan and a map of the interface that has been in use for years. The Fire Management Area Zone (FMAZ) Map shows that all but a small area south of James Canyon are within the WUI. In the Forest Plan, there is guidance on the size and scale of the WUI. On page 93, the Plan states, “The urban interface is defined as an area up to 10 miles long in a southwesterly direction from urban areas.”

Wildland-Urban Interface Areas— Background Information

The Council of Western State Foresters and the Forest Service have adopted the following definition of wildland-urban interface. A “Wildland-Urban Interface is where humans and their development meet or are intermixed with wildland fuels” (Teie and Weatherford, 1998: 11-12).

There are four different wildland-urban conditions:

- An **Interface Condition** is a situation where structures abut wildland fuels. There is a clear line of demarcation between the structures and the wildland fuels along roads or back fences. Wildland fuels do not continue into the developed area.
- An **Intermix Condition** is a condition in which structures are scattered throughout a wildland area. There is no clear line of demarcation. The wildland fuels are continuous outside of and within the developed area.
- An **Occluded Condition** is a situation normally within a city in which structures abut an island of wildland fuels. There is a clear line of demarcation between the structures and the wildland fuels along roads or back fences.
- A **Rural Condition** is a situation in which scattered small clusters of structures are exposed to wildland fuels. There may be miles between these clusters.

The prioritization of the Flagstaff Urban Interface has relied on the Forest Service and local fire department personnel to describe areas that should be treated to improve forest health, leading to decreased wildfire potential. In the Cohesive Strategy, Lavery et al. (2000:17) states, “The first priority for restoration will be the millions of acres already roaded and managed landscapes that are in close proximity to communities.” Lavery (2000: 14) also sets the following three priorities:

- **Wildland-Urban Interface.** The WUI areas include those areas where flammable wildland fuels are adjacent to homes and communities.

- **Readily Accessible Municipal Watersheds.** Water is the most critical resource in many western states. Watersheds impacted by uncharacteristic wildfire effects are less resilient to disturbance and unable to recover as quickly as those that remain within the range of ecological conditions characteristic of the fire regime under which they developed.
- **Threatened and Endangered Species Habitat.** The extent of recent fires demonstrates that, in fire-adapted ecosystems, few areas are isolated from wildfire. Dwindling habitat for many threatened and endangered species will eventually be impacted by wildland fire. The severity and extent of fire could eventually push declining populations beyond recovery.

Development of Alternatives

The IDT used information from public scoping, including the significant issues identified for the project (see Chapter 1), in conjunction with the field-related resource information, to formulate different alternative themes. Based on these themes, the IDT then assigned different potential treatment prescriptions to land units to create the various alternatives. **The alternatives for the Kachina Village Forest Health Project are differentiated primarily by a limit on the size of tree to be thinned, the intensity of the treatments proposed in thinning units, and the miles of temporary road.** The Proposed Action (Alternative A) and each action alternative presented in this EIS provide a different response to the significant issues. One alternative may respond to more than one issue. Each action alternative is also designed to meet the stated purpose and need for the Kachina Village Forest Health Project and the project-specific desired future conditions.

Each action alternative represents a site-specific proposal developed through intensive interdisciplinary evaluation of current and desired conditions based on field verification. Unit identification and design also made use of high-resolution topographic maps, aerial photos, and a large quantity of resource data available in geographic information system (GIS) format.

Items Common to All Action Alternatives

Many items in the Proposed Action (Alternative A) also occur in all action alternatives. The **action alternatives are differentiated by the size of the trees to be thinned, changes in intensity of thinning prescriptions, and the use of temporary roads.** The following items from the Proposed Action (Alternative A) are common to Alternatives A, C, D, and E and would not occur under Alternative B (No Action). Refer to the Purpose and Need section of Chapter 1 to see the reasons why these items are proposed.

Administrative and Strategic Direction for the Project Area

1. Follow all Coconino National Forest Plan Standards and Guidelines and Apply Mitigation Measures

This is the application of the Coconino National Forest Plan and subsequent amendments, including all guidelines for Mexican spotted owl, northern goshawk, Management Indicator Species, Best Management Practices for water and soil, and archeological site protection. Refer to “Forest Plan Consistency” and “Monitoring” found later in this chapter for more detail.

2. Retain all existing mature ponderosa pine trees or old “yellow-barked” trees.

Temporary road or landing locations to achieve removal objectives will avoid large diameter trees, where possible.

3. Prioritize Project Implementation

Project implementation will treat stands adjacent to communities first, then progressing south thereafter.

4. Involve the Public

Involve individual property owners, fire protection districts, and communities in the proposed treatments. Currently, Highlands Fire Department is actively working in the communities of Kachina Village and Forest Highlands, conducting thinning projects and increasing public awareness of fire prevention techniques.

5. Encourage Research and Monitoring

The Arizona Game and Fish Department, Northern Arizona University, and the USDA Forest Service Rocky Mountain Research Station have expressed interest and discussed preliminary actions for research in the project area. Possible research studies may include Mexican spotted owl studies to examine the effects of fuel reduction treatments, black bear, turkey, antelope, Abert squirrel, and songbird studies to evaluate the effects of the project, and further studies by Northern Arizona University to evaluate and compare the ongoing research and monitoring of adaptive management strategies for the Greater Flagstaff Forests Partnership Projects. See "Monitoring" later in this chapter for more details.

6. Apply thinning systems to sites as appropriate

Thinning systems will include mechanized equipment resulting in the commercial removal of trees. Hand felling will also be used for commercial thinning, as well as public firewood use. Some trees will be piled and burned on site.

Reducing Fire Potential – Improving Forest Ecosystem Health – Fuels and Vegetation Management

(See Figure 2, "Fuels Treatment Alternatives A, C, D and E" and Figure 3, "Thinning Treatments Common to All Action Alternatives A, C, D and E" for maps related to the following items)

7. Broadcast Burning and Slash Treatment

Activity-generated slash resulting from thinning will be treated through machine piling or by hand. Existing large logs and logs created will be retained. The majority of slash from thinning will be piled in a manner that minimizes soil disturbance. Some small coarse woody debris will be retained on the ground to meet Best Management Practices for soil and watershed health. Nearly 80 percent of the slash created will be treated. The slash piles will be burned approximately 1 to 2 years following thinning. Public firewood will be made available from slash piles, where feasible. Broadcast burning will occur after thinning is completed. Best Management Practices for soil and watershed manage-

ment will be employed to minimize soil disturbance and the spread of invasive and noxious weeds. Broadcast burning will begin adjacent to the communities and progress south thereafter. Burns will occur over a number of years with different portions of the project area burned in a given year. All national forest lands within the project area, excluding the canyons, are proposed for broadcast burning in the following priority:

- First priority is the area north of Kelly Canyon and along the Highway 89A Corridor;
- Second priority is the area between Kelly and James Canyons; and
- Third priority is the area south of James Canyon.

8. Thinning from Below: Mexican Spotted Owl (MSO) Protected Activity Centers (PAC's)

Four hundred fifty-six acres of thinning from below is proposed for habitat within Mexican spotted owl PAC's. A special team, including U.S. Fish and Wildlife Service (USFWS) personnel, Arizona Game and Fish Department (AGFD) habitat specialists, U.S. Forest Service (USFS) wildlife biologist, and fire management practitioners, are visiting all stands within MSO PAC's and recommending site-specific treatments to lessen fire potential and risk. Specifics for treatments are located in the Project Record File. All stands are located on slopes less than 30 percent. Proposed management includes thinning trees less than 9-inches dbh, broadcast burning, and road access management to reduce fire risk. The key to implementation of site-specific thinning includes layout and assistance during thinning by the USFWS, USFS, and AGFD personnel.

9. Wildlife Movement Corridor

The AGFD and USFS wildlife biologists identified the location of this wildlife movement corridor (143 acres) based on historical knowledge of the area. The treatment within the corridor will include light thinning within the drainage and the area 200 yards on either side of the drainage located in these two stands. The remainder of the stand will be treated with

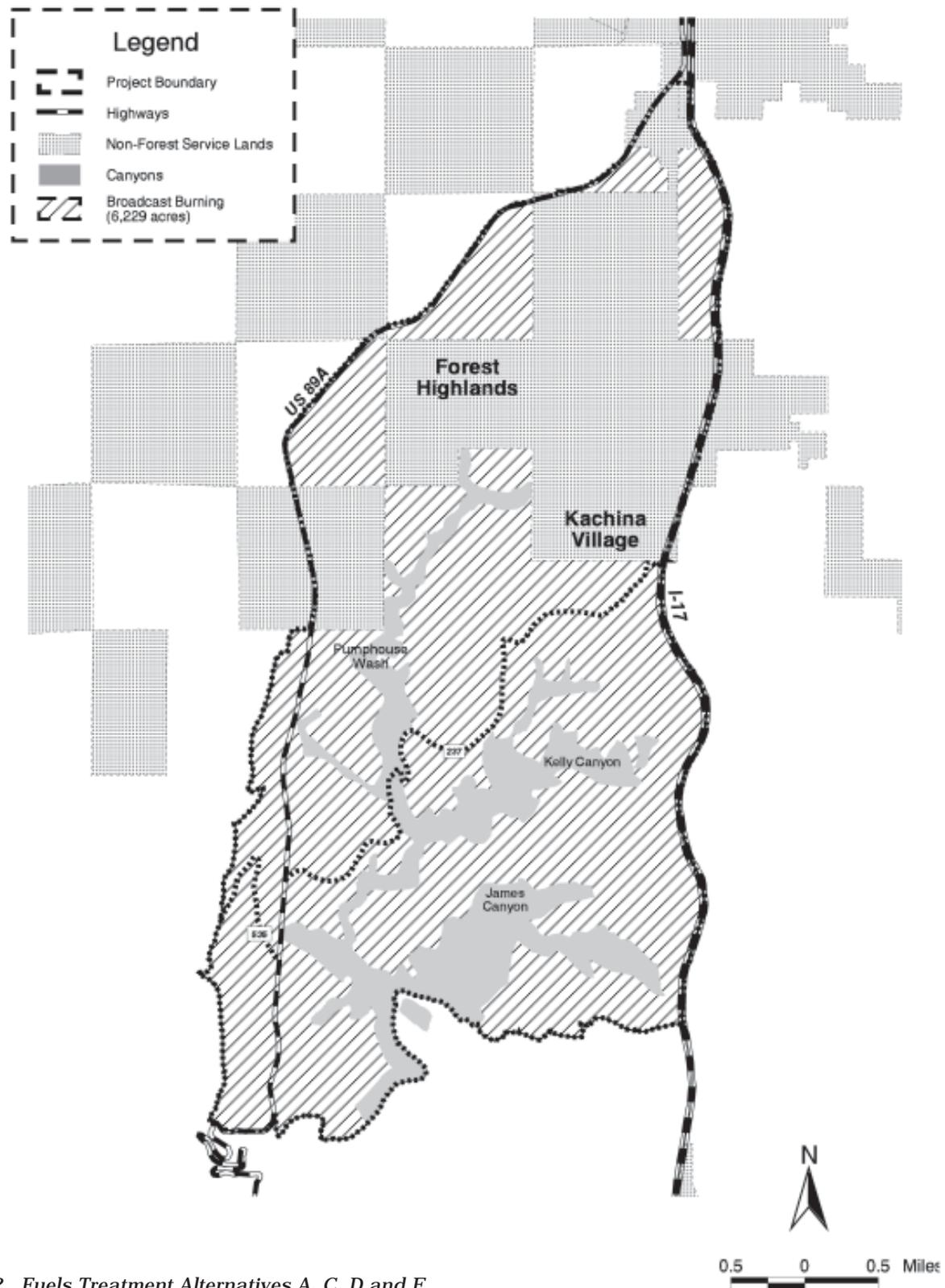


Figure 2. Fuels Treatment Alternatives A, C, D and E

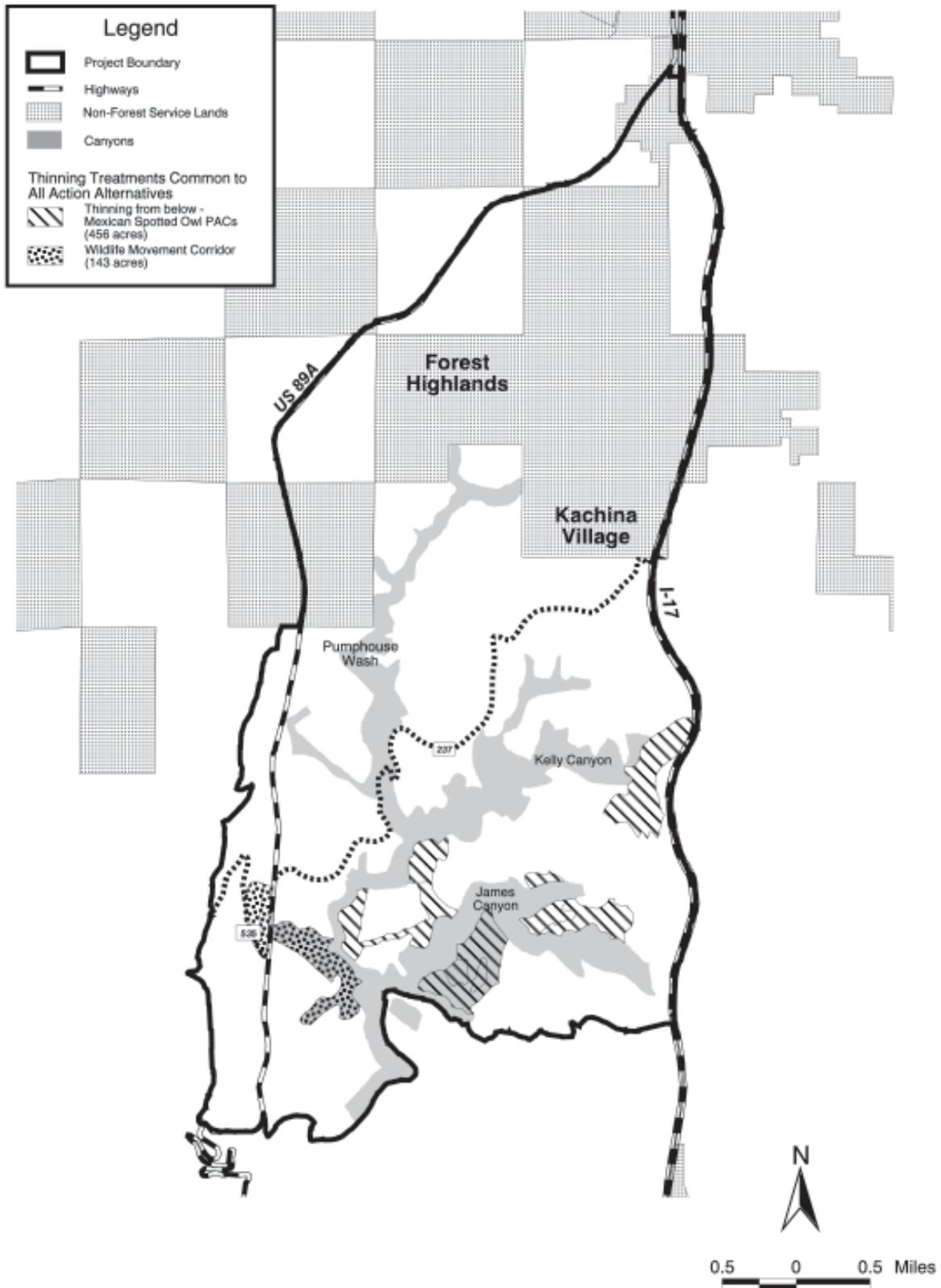


Figure 3. Thinning Treatments Common to All Action Alternatives A, C, D and E

a variable thinning. The site-specific layout will include assistance from the AGFD and USFS wildlife biologists.

Reducing Fire Risk – Balancing Human Influences, Fire Occurrence, Wildlife Habitat, and Watershed Health Through Management of Recreational Uses and Access

(See Figure 4, “Management of Recreational Uses Alternatives A, C, D and E” and Figure 5, “Open Forest Roads” for maps related to the following items)

10. Camping and Campfires

Camping and campfires will be prohibited in the area north of Kelly Canyon and west of Pumphouse Wash to one half mile on the west side of Highway 89A, except in designated areas. Camping and campfires will be prohibited in areas of close proximity to Kachina Village and Forest Highlands. Camping and campfires will also be prohibited on the first one half mile of the FR 535 as it departs Highway 89A.

Designated camping is proposed along the FR 237. Camping will be limited to camping in designated campsites only. Designated camping sites will not be located closer than 1/2 mile from residential areas. Selection of designated campsite locations will be determined from site-specific inventory and be incorporated into the layout of proposed thinning treatments. Camping in the designated sites will be allowed within a 50 to 100-foot radius of a marked post.

11. Trails

Forest Service system non-motorized trails are proposed south of Forest Highlands and Kachina Village. Approximately 7 miles of trails are proposed south of Kachina Village to replace a social trail system in the area. Any newly designated trail access from Kachina Village and Forest Highlands will be determined with the layout and design of a non-motorized trail system for the area. One new trailhead is proposed near the existing ADOT yard on Highway 89A. An existing social trail from Forest Highlands into the Griffith Spring area will be converted to a Forest Service system trail. Trails will

have additional visual and Recreation Opportunity Spectrum (ROS) objectives that will be included in thinning prescriptions and overall project design.

12. Mexican Pocket Management

Mexican Pocket will be designated for day-use only, with no camping or campfires. To continue to provide access to a popular area, a 2-mile loop trail is proposed to provide hiking to the edge of Pumphouse Canyon and to connect the Oak Creek Vista Overlook with a small trailhead constructed near the ADOT yard.

13. Passenger Car Roads (Level 3 Roads)

Forest Roads 237 and 535 will be maintained as Level 3 roads, thereby providing approximately 7 miles of passenger car roads. FR 237 will continue to be the primary access road to the Kachina Village Forest Health Project Area, in addition to important area access for wildfire fighting efforts.

14. High-Clearance Vehicle Roads (Level 2 Roads)

Approximately 8.5 miles of road will be maintained as Level 2 roads in the project area (See Figure 5). The proposed road access plan provides good administrative access for firefighting and provides for the best arrangement and location of roads to balance wildfire risk (human access) and recreation experience. Roads not shown on the open-road system will be converted to trails, obliterated, or gated for administrative use. Primary administrative use is fire access.

15. Riparian Restoration Project at Kelly Seep (Located Near Kelly Canyon)

The area around Kelly Seep will be fenced and structures removed to improve riparian habitat conditions.

Forest Plan Consistency

All alternatives, including the Proposed Action, are consistent with the Coconino National Forest Plan. All applicable forest-wide and land use designation standards and guidelines have been incorporated. The Forest Service uses many mitigation and preventive measures in the planning and implementation of land management activities. The application of these measures begins during the

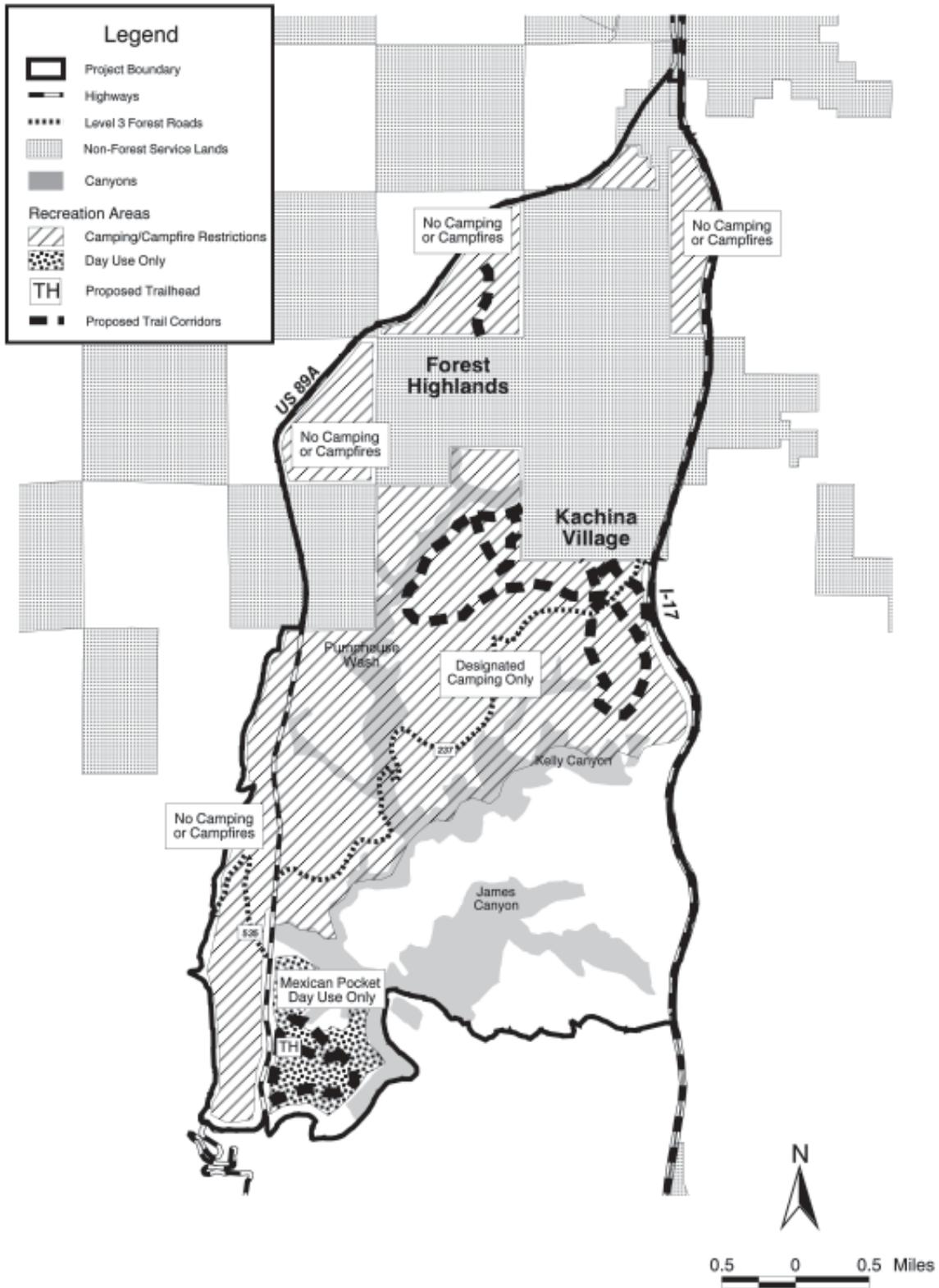


Figure 4. Management of Recreational Uses Alternatives A, C, D, and E

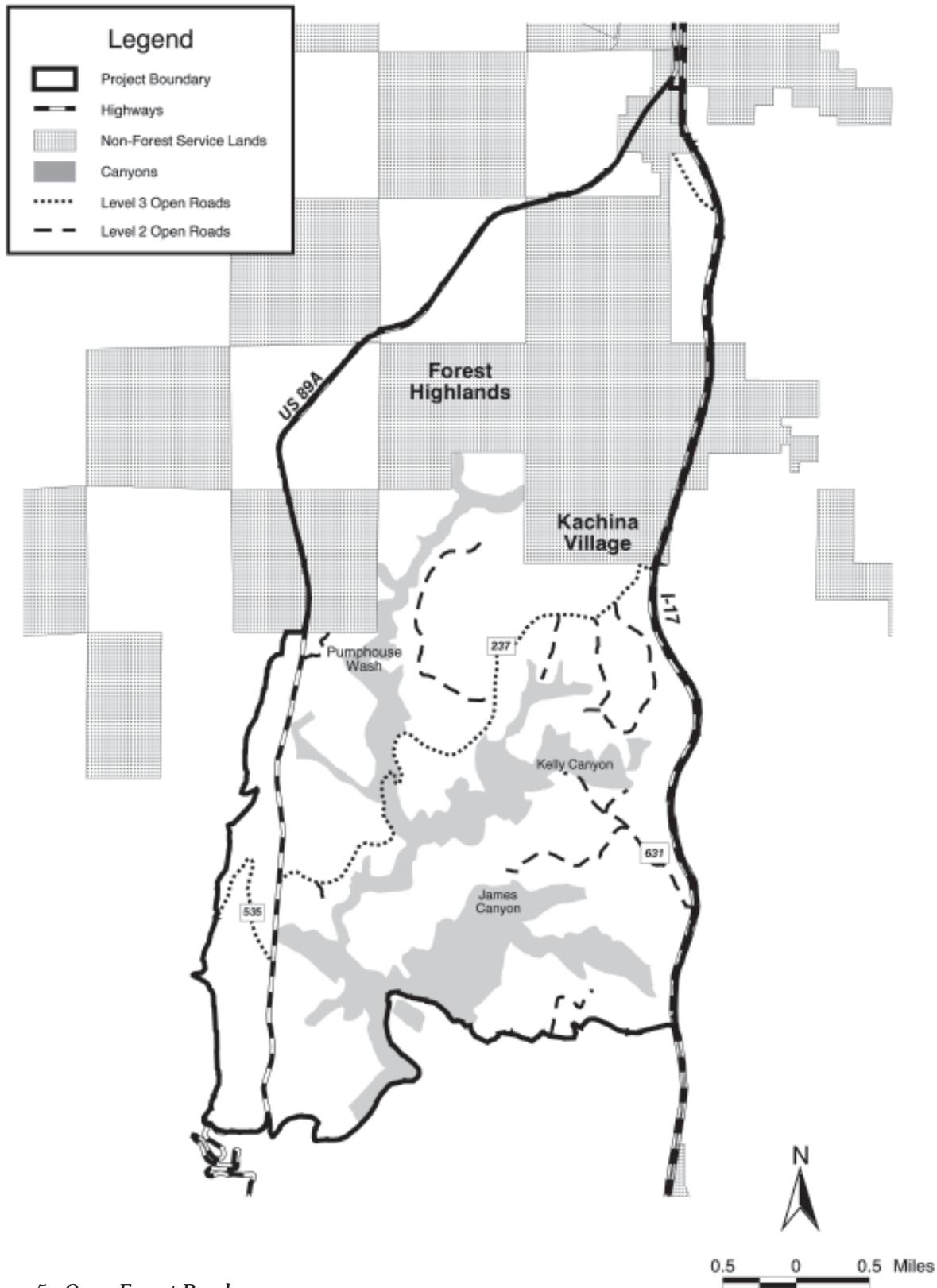


Figure 5. Open Forest Roads.

planning and design phases of a project. Additional direction comes from the Regional Guide and applicable Forest Service manuals and handbooks. Not all desired conditions in the Forest Plan can be achieved with a single, on-the-ground action. Often many actions are necessary in order to meet desired conditions identified by management direction. For example, this project has alternatives that make progress toward the desired distribution of tree sizes and ages described for northern goshawk habitat. We do not plan to change the structure of the forest stands in one single treatment in order to meet those guidelines in this area.

Appendix E highlights some of the key directions from the Forest Plan (primarily from Chapter 4, “Forest-wide Standards and Guidelines”). Further direction is located in Forest Plan as changed by Amendment 11. (Also see, “Project-Specific Mitigation” that follows.)

Project-Specific Mitigation

The analysis documented in this EIS discloses the possible environmental consequences that may occur from implementing the actions proposed under each alternative. Measures have been formulated to mitigate or reduce these impacts. These measures were guided by the direction from the Forest Plan and the interdisciplinary team (IDT) as they developed the project.

IDT specialists use on-the-ground inventories, computer (GIS) data, and aerial photographs to prepare reports. Resource specialists include their concerns in their reports and then describe how the concerns can be mitigated, if not completely avoided, in the design of each treatment unit or road segment. These reports may be found in the planning record. Resource concerns and mitigation measures may be further refined during the final design work, when specialists have one more opportunity to revise their recommendations.

Applicable Forest Plan standards and guidelines and Best Management Practices (BMP's) used to meet the requirements of the Clean Water Act and project-specific mitigation measures are identified in these reports. The following items are mitigation measures that will be employed for the Kachina Village Forest Health Project. Though most of the following mitigation items are common to all action alternatives, there are a few associated with Alternative E that are different. These exceptions are noted in the text.

Soil and Watershed Protection

A Best Management Practice (BMP) is “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 and 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 (“Guidelines for Using Best Management Practices” (FSH 2509.22)).” Authority and guidance to prescribe and implement BMP's is defined in FSM 2501, 2530, FSH 2509.22, and the Forest Plan.

BMP's with numbers (e.g., 24.1 Timber Harvest Unit Design) are from the Soil and Water Conservation Practices Handbook. BMP's without numbers (e.g., Mechanical Harvesting Restriction) are site and activity-specific BMP's designed to minimize nonpoint source pollutants.

BMP's are located in the project record file (PRD137c) and will be reviewed by project implementation personnel.

Wildlife and Sensitive Species Habitat Protection

Bald Eagle

- In the potential winter roost area, snags and large yellow pine trees will have the duff raked away from the tree bases.
- Implement a 300-foot radius buffer around known bald eagle winter roosts (Coconino National Forest Plan, 1987, p. 123), or as amended.
- Mandatory Impact Minimization Measures will be used to protect bald eagles (USDI Fish and Wildlife Service 2001) if it is later determined that the potential winter roost site, or any other area within the project boundary, is used for roosting by bald eagles.
- There will be no project activities within 1/4 mile of known bald eagle winter roost areas between October 15 and April 15.

Mexican Spotted Owl (MSO)

- No treatment activities will occur within PAC's during the breeding season (March 1 to August 31).
- Microhabitat monitoring will be conducted per protocol.
- Additional mitigation for MSO is in the project record file (PRD151).

Peregrine Falcon

- Activities, including public use, are prohibited in the vicinity of occupied peregrine falcon nesting habitats between March 1 and August 15 (Forest Plan page 64-1). No treatments will occur on location/sites 354/29 and 31 and the southern half of location/sites 354/23 and 24 from March 1 to August 15. This seasonal restriction applies unless falcon habitat is determined to be unoccupied. Trails will be designed to avoid nesting areas.

Northern Goshawk

- Thinning treatments will not occur within or near nesting areas during the breeding season (March 1 through September 30).
- The Coconino National Forest Plan (1987 as amended) standards and guidelines will be followed regarding broadcast burning.
- As the trail system is implemented, recreational trails that traverse nesting areas will be closed. Access that will allow people to travel into nesting areas will be discouraged.

Other Raptors

- Buffers for nest and roost sites will be implemented according to the Coconino National Forest Plan (1987 as amended, p. 123-124) standards and guidelines.

Turkey Nesting

- Thinning and broadcast burning will not occur from April 15 through June 30 within turkey nesting and brood sites within location 368/sites 7, 9, 10, 32, 33, 36, 37, and 38. Duff and debris will be raked away from the base of roost trees prior to broadcast burning. Also within these stands, the wildlife biologist and

burn boss will coordinate, in the field, whether or not to conduct spring burning in these sensitive areas.

Plants

- To reduce the impacts on rare and sensitive plants, thinning slash and burn lines will not be placed within plant populations. Appropriate firing techniques will be used to minimize the effect of burning on known populations.
- Prescribed fire control lines and temporary roads will avoid known populations of sensitive plant species.
- Surveys for rare plant species will be conducted prior to trail construction. If sensitive plant species are found, trail layout will avoid plants.⁴
- Native perennial species or annual rye grass seeds will be used where re-seeding of grasses and herbaceous vegetation is needed after ground disturbing activities. Sterile non-native species or non-seeding methods, such as weed-free straw, may be necessary for sites where annual rye grass persists. Seed mixes containing seeds of non-native *Penstemon spp.* will be avoided.
- Equipment will be cleaned prior to entering the project area to avoid introduction or transfer of invasive and noxious weeds. Within the project area, equipment will be cleaned prior to leaving areas infested with invasive and noxious weeds. Equipment entrance and exit routes from Interstate 17 and Highway 89A will include hand tool treatment of noxious weeds. Known populations of knapweed and bull thistle will be marked for avoidance.

Yellow Pines and Other Mature Trees

- Slash piles will not be placed near large yellow pines to avoid damage during burning. This would be especially important in bald eagle winter roost areas, turkey summer and winter ranges, and protected or restricted MSO habitat.
- Burn damage to large mature trees will be avoided. Burning techniques will protect mast-producing trees (i.e. large alligator juniper, large pine, and oak), and turkey

⁴ Rare plant populations are relatively small in this area, so trails can be designed to avoid impacts.

roost trees throughout the project area. Burning techniques will minimize heat effects to the feeder roots and cambiums of mature trees.

- Old trees will have duff raked away from the bases where high litter depth layers (greater than 6 inches) may result in girdling and mortality. The Prescribed Burn Monitoring Report and Information (Randall-Parker and Miller 1999) will guide our actions.

Gambel Oak

- Large Gambel oak will be retained. Burn plans will mitigate oak loss through the removal of large material, raking duff from the base of oaks, and avoidance of slash piles near oaks.

Snags and Logs

- Snags will be lined prior to broadcast burning. Slash piles will be placed away from snags.
- Loss of large logs will be minimized through ignition techniques and possibly fire-lining. The timing of prescribed burning (spring burning) may also reduce the loss of logs.
- Trees that are converted to snags or logs will be monitored.

Recreation

- No slash piling in dispersed camping sites.
- No log landings in dispersed camping sites.
- No disruptive restoration activities on heavily-used holiday weekends such as Memorial Day, Fourth of July, or Labor Day.

Visual Management – Coordination with Layout and Design of stands prior to marking

- Adjust unit boundaries to avoid straight edges around units. Develop marking prescriptions, which “feather” the edges of units. Look for opportunities to define unit boundaries with natural features such as canyon edges or drainages and avoid using roads or fence lines as unit boundaries when those features are straight. Refer to visual simulations for reference.

Apply above mitigation especially to units at the upper elevations of the project, and to

units whose boundaries are visible from areas of concern such as from Highway 89A and Interstate 17.

Monitoring

Monitoring activities can be divided into forest plan monitoring and project-specific monitoring. The National Forest Management Act requires that national forests monitor and evaluate their forest plans (36 CFR 219.11). Chapter 6 of the Forest Plan includes the monitoring and evaluation activities to be conducted as part of forest plan implementation. There are three categories of forest plan monitoring:

- **Implementation monitoring** is used to determine if the goals, objectives, standards, guidelines, and practices of the forest plan are implemented in accordance with the forest plan.
- **Effectiveness monitoring** is used to determine if the forest plan standards, guidelines, and practices, as designed and implemented, are effective in accomplishing the desired result.
- **Validation monitoring** is used to determine whether the data, assumptions, and estimated effects used in developing the forest plan are correct.

Effectiveness and validation monitoring are not typically done as a part of the project implementation. Implementation monitoring and any additional project-specific monitoring are, however, important aspects of the project. Though most of the following mitigation items are common to all action alternatives, there are a few associated with Alternative E that are different. These exceptions are noted in the text.

Routine Implementation Monitoring

Routine implementation monitoring assesses if the project was implemented as designed and if it complies with the Forest Plan. Planning for routine implementation monitoring began with the preliminary design of the Kachina Village Forest Health Project.

Routine implementation monitoring is a part of the administration of all project contracts. They monitor performance relative to contract requirements. Input by resource staff specialists, such as wildlife biologists, soil scientists, hydrologists, and engineers, is regularly requested during this

implementation monitoring process. These specialists provide technical advice when questions arise during project implementation.

The Coconino National Forest staff conducts an annual review of BMP implementation and effectiveness. The results of this and other monitoring are summarized in the Coconino National Forest Annual Monitoring and Evaluation Report. This report provides information about how well the management direction of the forest is being carried out. It also measures the accomplishment of anticipated outputs, activities, and effects.

The Kachina Village Forest Health Project will include the following implementation monitoring:

- **Alternatives A, C, and D: Thinning from Below, South of Kelly Canyon.**

Site-specific implementation, such as the layout of cover, marking, and thinning, will include assistance from the Arizona Game and Fish Department and the USFS wildlife biologists. The monitoring objective will be to assure the sites include cover patches. The sites will include 25 percent cover patches in patches no larger than 1 acre. The district wildlife biologist along with timber staff will assume responsibility for the completion of the task. Alternative E does not include cover clumps.

- **All Action Alternatives: Thinning from Below, MSO PAC's**

The key to implementation of site-specific thinning includes layout and assistance during thinning by U.S. Fish and Wildlife Service, USFS, and Arizona Game and Fish Department personnel. Recommendations for thinning and prescribed burning are located in the Project Record File (PRD 117). The objective of the monitoring is to reduce fire potential within MSO PAC's, following recovery guidelines. Fuels specialists and the district wildlife biologist will be responsible for completing the task.

- **All Action Alternatives: Wildlife Movement Corridor**

The site-specific layout will include assistance from the Arizona Game and Fish Department and USFS wildlife biologists. The monitoring objective is to assure the site includes adequate cover within the movement corridor. The district wildlife

biologist along with the timber staff will assume responsibility for completion of the task.

- **All Action Alternatives: Herbaceous Understory Recovery**

The Annual Operating Instructions (AOI) for grazing allotments will be adjusted as needed to allow for recovery of naturally occurring herbaceous communities. Range conservationists will conduct monitoring following both thinning and burning treatments. Monitoring will be conducted via observations to determine readiness for livestock use. These observations will include species maturity (seed heads) and abundance. Grass species, including Arizona fescue (*Festuca arizonica*), mountain muhly (*Muhlenbergia montana*), and squirrel tail (*Sitanion hystrix*) will be the key species used in these observations. Invasive and noxious weed monitoring will occur during these observations to detect changes in distribution and/or abundance.

Project-Specific Effectiveness Monitoring

The purpose of effectiveness monitoring is to determine the efficacy and usefulness of specific design features or mitigation measures in protecting natural resources.

Administrative and Strategic Direction for the Project Area

The Arizona Game and Fish Department, Northern Arizona University (NAU), and the USDA Forest Service Rocky Mountain Research Station have expressed interest and discussed preliminary actions for research within the project area. This research and monitoring is encouraged. Possible research studies may include MSO studies to examine the effects of fuel reduction treatments, black bear, turkey, antelope, Abert squirrel, and songbird studies to evaluate the effects of the project, and further studies by NAU to evaluate and compare the ongoing research and monitoring of adaptive management strategies for the Greater Flagstaff Forests Partnership projects.

At the time the Draft EIS was prepared, three monitoring proposals were submitted to the Coconino National Forest for consideration. The proposals are from the Arizona Game and Fish Department to examine songbirds, Abert squirrel, and mule deer. The proposals are supported by the

Forest Service and are included as part of the project proposal. The Forest Service and the Arizona Game and Fish Department are actively searching for funding to support these wildlife monitoring efforts. Proposals are located in Appendix B.

At the time the Draft EIS was prepared, an additional proposal from the Ecological Restoration Institute (ERI) at NAU was discussed. The proposal was to examine songbirds, using a community collaborative approach. Members of NAU, the Grand Canyon Trust, Arizona Game and Fish Department, USFS, and Northern Arizona Audubon Society are working to develop a proposal that would support and enhance the monitoring efforts suggested by the Arizona Game and Fish Department. Although no formal proposal has yet been submitted, the Forest Service encourages and is actively searching for funding to support this effort.

Microhabitat Monitoring for Mexican Spotted Owls

Microhabitat monitoring will be conducted according to standard protocol as identified by Forest Service Region 3 direction.

Implementation of NEPA Decisions

Implementation will occur over many years. Prior to each year's implementation or at approximately every 3 to 5-year interval, the documentation will be reviewed to see if any new information or changed circumstances exist relating to the environmental impacts of the project. If no new findings are made, the project will continue. New findings may lead to correction, supplementation, or revision of environmental documents.

Findings and Disclosures

Several of the laws and executive orders listed in Chapter 1 require project-specific findings or other disclosures, which are included in this DEIS.

Alternatives Considered but Eliminated from Detailed Study

Several alternatives were considered during the planning process but have not been included in the DEIS for detailed study. These are described briefly below, along with the rationale for not considering them further.

McKinnon (Comment to DEIS September 2002) – Alternative Suggested

The comment requests that an analysis seeking to maximize the extent to which project objectives south of Kelly Canyon can be met without the use of new temporary roads would be very valuable. The commenter adds that an appropriate GIS assessment would buffer existing roads with the distance in which heavy machinery can operate without needing to construct new temporary roads. The forest within this buffer would qualify for heavy machinery use, that outside the buffer would be relegated to less intrusive methods such as hand crews and ATV or bobcat skidding.

The comment states that one area to consider may be south of Kelly Canyon the relatively remote land peninsula in sections 11 and 12 (along roads 09426U, 09420L, and sections of the 00631 slated for closure in the project). This would require using hand crews and atv's or bobcats'- methods similar to those employed at Elden - in the patch of forest slated for fire potential reduction/forest health improvement/cover management along these roads. However, given that thinning from below for MSO surrounds this patch, necessary crews and equipment would already be in place. This would further prevent repeated heavy machine travel through or near the PAC removing logs from this area, and lack of machinery impacts would contribute to retaining the remote character of the area. For the same reasons, similar opportunities should be explored of this same land peninsula in Section 1 west of road 00631D, and in currently unroaded areas south of James Canyon and in the Mexican Pocket area adjacent to MSO thinning.

As noted in the DEIS on page 44 Table 4 there were only 5.75 miles of temporary road needed to implement Alternatives A, C, and D. Nearly all the temporary roads needed are in areas north of Kelly Canyon and along the highway 89 corridor. If we did not build the 5.75 miles of temporary road approximately 1,500 acres of treatment would be done by hand under this scenario or to 12 inches diameter as was done at the Elden Project. The 1,500 acres of lighter thinning would occur predominately North of Kelly Canyon, and would place an additional 1,500 acres of dense stand conditions near the communities of Forest Highlands, Kachina Village and along the Highway 89 corridor. This alternative would not meet project objectives, because we would not reduce wildfire threat adjacent to the communities at risk.

No new temporary road construction is necessary to access Section 12, and approximately 0.2 mile of temporary road is needed to access a small portion of Section 11. The temporary road needed in Section 11 will access areas adjacent to Highway 89A, that are included in areas that need to be thinned because of high risk from a fire starting along the 89A corridor. Lighter thinning in this high fire risk area using either a 9 inch or 12 inch diameter limit would not meet the purpose and need and place this area at high fire potential. No new temporary road construction is needed to access Section 1, and there are no new temporary roads needed south of James Canyon or in Mexican Pocket.

In summary, the alternative suggested that Alternatives A, C, D should be evaluated without the use of building temporary roads and that areas south of Kelly Canyon were unroaded and that is not the case. There are very few temporary roads needed south of Kelly Canyon, with most all temporary road needs tied to the North end of the Project and adjacent to communities. The lighter thinning that would occur, if no new temporary roads were constructed would not reduce wildfire threat adjacent to the communities at risk and would not meet the purpose and need for the project.

Ronald and Alice Bauman (Comment to DEIS) – Alternative Suggested

The commenter recommends prohibiting camping from the Kachina Boulevard entry of 237 to past Pumphouse Wash crossover. The alternative would result in little or no camping available along Forest Service 237 if this suggested alternative was implemented and currently this is about the only area where designated dispersed camping will be allowed. The project will thin areas along the road to a degree, that if an abandoned campfire were to escape that stand conditions will not be conducive to crown fire, which is the concern at present. The IDT review suggests that this alternative would not meet the purpose and need to manage access and recreation to decrease fire starts and balance various resource objectives; rather it would nearly eliminate camping opportunities in the area. The description of effects to wildfire behavior (pages 60-66), describes a lessened risk of human caused wildfire damage to the area, both from the reduced camping and from the thinning treatments.

Bird (April NOI response – April 19, 2001) – Alternative Suggested

The Forest Service and GFFP have not offered information that would preclude a purely process-based restoration alternative. We ask again that the Forest Service fairly and accurately analyze an alternative that would apply prescribed burns only with necessary pre-fire fuels treatments, such as raking needles from trees 24-inch dbh, pruning lower ladder branches, etc.

Response

Prescribed fire without thinning over the entire project area, as a distinct alternative, was not practical from a biological standpoint, nor did it meet the Kachina Village Forest Health Project objectives. There are seven additional types of need identified in Chapter 1, "Project Area Existing Conditions, Desired Conditions and Needs." Therefore, it was not considered as an alternative across the entire landscape. However, this treatment is incorporated into the Proposed Action to achieve a mosaic of various stand conditions and resulting effects. Prescribed fire without any mechanical thinning is proposed for those stands in which it will be effective and the desired effects are likely to be achieved.

The **prescribed fire without thinning alternative** was not developed as a distinct alternative for the entire project area because it did not meet enough of the project objectives. There are two main reasons: 1) prescribed fire alone is not effective in thinning the sizes of tree in the project area and 2) prescribed fire alone does not substantially reduce the risk of future catastrophic wildfire because not enough trees are killed. The following information discusses these two points.

- 1) Most studies indicate that prescribed fire alone is not effective in thinning the sizes of trees in the Kachina Village Forest Health Project.

Prescribed fire is not a very selective thinning tool because a number of fires are required to reduce fuels, change the understory, and overcome the effects caused by fire exclusion (Harrington and Sackett 1990). Gaines et al. (1958), Woolridge and Weaver (1965), and Lindemuth (1960) all reported that fire was a rather imperfect tool for thinning. Harrington (1987) reported significant reductions in tree density within sites

occupied by “dog-hair” thickets, while the same prescribed fire did little to reduce tree density where sites were dominated by larger trees. Sackett (1980), Davis et al. (1968), and Campbell et al. (1977) reported similar results in both prescribed and natural fires (Weatherspoon 1996). In another study, Gaines et al. (1958) reported that even though younger, suppressed classes had been thinned by fire, the commercial overstory suffered substantial injury. The trees Gaines refers to as “the commercial overstory” are the larger, older trees this project wishes to retain for wildlife diversity. Lindenmuth (1960) studied the effects of fire in east-central Arizona and concluded that 24 percent of the potential crop trees were released from competition, however, 17 percent were killed or severely damaged. Again, the trees Lindenmuth refers to as “crop trees” are the larger, older trees this project wishes to retain for wildlife diversity. Harrington (1981) reported an average of 26 percent reduction in stems per acre in southeastern Arizona; however, surveys in years following the burns revealed results that need special attention, which is the subsequent loss of old-growth ponderosa pine trees.

Attempts to use fire alone to thin dense stands frequently resulted in high levels of mortality in the residual stands (Swezy and Agee 1991, Sackett et al. 1996, and Covington and Sackett 1984). Post-fire mortality among old-growth trees was 23 percent higher in burned plots than in the unburned controls over a 20-year period (Sackett et al. 1996). More than 30 years of study (since 1976) at the Fort Valley Experimental Forest has demonstrated that fire alone cannot effectively reduce stand levels enough to protect remaining mature and old-growth trees. Allowing prescribed fires or wildfires to selectively thin the pine forests of the Southwest may be the most detrimental method of retaining old-growth trees (Weatherspoon 1996). Substantial research has demonstrated the effectiveness of thinning as one component in a forest restoration program (Swezy and Agee 1991, Fiedler 1996, Fenny et al. 1996, Weatherspoon 1996, Edminster and Olsen 1996, Covington et al. 1997, Scott 1998, and Harrington and Sackett 1990).

Therefore, some combination of thinning, manual fuel removal, and prescribed burning will be necessary to restore ponderosa pine ecosystems to more natural conditions (Arno 1996; Fiedler 1996, Swezy and Agee 1991, and Oliver et al. 1994).

Most research emphasizes the imperfection of fire as a thinning tool. Prescribed fire by itself is not effective in thinning ponderosa pine trees greater than 3 inches dbh or trees that are over 6 feet tall without significant damage to the larger, older trees. The Kachina Village Forest Health Project wishes to retain the larger, older ponderosa pine trees. The trees in overabundance and in need of thinning are predominantly 5 to 16-inches dbh (PRD's 79 and 79A).

Beginning in the 1930's, research was conducted to evaluate the effectiveness of a range of treatment strategies to reduce stand densities and fuel loads. Many researchers initially believed that simply reintroducing fire would be sufficient to substantially reduce both stand densities and fuel loads. Prescribed fire has been a successful means of fuel reduction in some forest types (Biswell et al. 1973, Knorr 1963, and Weaver 1952).

Folliott et al. (1977) reported a positive thinning response following prescribed fire in northern Arizona. However, basal area was not reduced enough for optimal stand stimulation. Weaver (1947) reported that, 30 years after burning, a young ponderosa pine stand had fewer stems per acre, greater heights, and larger diameters than an adjacent unburned stand.

- 2) Using prescribed fire without thinning does not substantially reduce the risk of a catastrophic wildfire.

One of the primary goals of this project is to reduce the risk of catastrophic (crown) fire. Risk reduction is accomplished by reducing the amount of ladder fuels and tree canopy fuels, as well as by reducing the amount of ground fuels (Ottmar 1997, Agee et al. 1999, Buckley 1992, and Van Wagtendonk 1996). Reducing ground fuels temporarily reduces the fuel load and ground fire intensity that could initiate a crown fire. Removing ladder fuels will reduce the potential for ground fire to

climb into the tree crowns. However, only by recreating a discontinuous canopy layer can a treatment inhibit the rate of spread and the eventual extent of a destructive crown fire.

In a report by the National Commission on Wildfire Disasters, Sampson (1994) states many forest situations will require mechanical removal of excess trees via thinning before fire can safely be re-introduced. In an extensive 1995 report to Congress, the authors of the Sierra Nevada Ecosystem Project (ponderosa pine is a major forest type in the Sierra Nevada) concluded that an extensive modification of forest structure by thinning and burning is needed to minimize severe fires in the future (McKelvey et al. 1995). In an extensive scientific evaluation (involving over 100 scientists) of the effects of Forest Service management practices on the sustainability of eastern Oregon and Washington ecosystems (ponderosa pine is a major forest type), Everett et al. (1994) found a need to use thinning as one of several actions to restore wildfire to a more natural behavior. In contrast to the destructive crown fire, a more natural fire behavior for ponderosa pine forests is a low-intensity ground fire, with flame lengths of less than 2 feet.

Bird (July 23, 2001) – Alternative Suggested

Develop a non-commercial alternative, restoration alternative that uses non-commercial treatments in the WUI*. Focus efforts on private homeowner education and assistance, encouraging re-introduction of fire outside the WUI. Homeowner education would be a coordinated program of public presentations, direct mail education, media public interest education, and news features. The local economy stimulated through local landscape businesses and construction companies retrofitting home sites for protection. Jobs and income generated by activities on Federal lands that prepare the forests outside the WUI for re-introduction of fire.

Goals include:

1. improve protection of homes;
2. economic opportunities;
3. clean water and healthy watersheds;
4. restore wildfire to forest ecology;

5. improve scientific understanding of fire ecology; and

6. improve public understanding of fire ecology and forest management.

Alt. Based on work of Jack Cohen: 40 meters of home most important; beyond 40 meters has little effect on the likelihood a home will burn.

* Inside WUI—focus on most flammable material—brush and weeds and lower branches of trees. Prioritize treatments around communities. Outside the WUI use prescribed fire—prioritize use—in conjunction with non-commercial preparation such as brush removal, needle raking and lower branch pruning. If small tree removal is scientifically justified, offer as public fuelwood by permit only.

Response

The respondent has overlooked that this project has a purpose and need which goes beyond the purpose and need for reducing fire potential. The purpose and need is aimed at long-term improvement of forest health. Seven additional topics are intertwined with fire hazard/risk reduction as identified in the Purpose and Need (see Chapter 1). The description of work proposed by the respondent within the WUI and outside the WUI are very similar. As described in the previous response, these actions would not meet the objectives of the Kachina Village Forest Health Project. Prescribed fire with only raking or pruning will not meet most of the purpose and need for this project.

The Federal Government does not have the authority to require homeowners to change physical conditions present on private land. However, the city and county have some authority through ordinances and such. In the Flagstaff community, the Forest Service and local fire departments have provided education, as well as assistance, to private landowners to reduce wildfire risk. The Proposed Action includes ongoing efforts such as working with homeowners adjacent to the communities of Flagstaff, Kachina Village, Mountaineer, and Forest Highlands. Local fire departments, as well as the Forest Service, have conducted public presentations and completed direct mail education. Almost daily, there are articles in the paper and news media across the West regarding homeowner preparedness. However, these actions in and of themselves will not solve the problems south of Kachina Village and Forest Highlands.

There are numerous small businesses in the Flagstaff area that conduct thinning and prescribed burning on private land and are replacing shake-shingle roofs with metal roofs. Many of the goals of your alternative are similar to our goals and the

goals of the Greater Flagstaff Forests Partnership. However, your goals will never be met with the alternative you have recommended, especially Item 1, “Improve protection of homes.”

All lands adjacent to Forest Highlands and Kachina Village that are in need of treatment to address declining forest health and reduce high fire hazard are proposed for treatment. A fire in this area, as shown with Farsite Fuels Modeling (PRD 73), will easily travel 2.5 to 3 miles in one afternoon, thereby prompting us to look at the entire area to protect MSO PAC’s, old-growth habitats, old trees, northern goshawk habitat, cultural sites, the Oak Creek Watershed, and homes in Forest Highlands and Kachina Village. Direction in the Forest Plan provides guidance on the size and scale of the urban interface. Page 93 of the Forest Plan defines the urban interface as an area up to 10 miles long in a southwesterly direction from urban areas.

Reducing stand densities throughout the Kachina Village Project area is critical to reducing fire potential. The single most ecologically damaging and life threatening forest fire is the crown fire. The intensity of crown fires prevents direct fire suppression. The massive blizzard of embers associated with crown fires leads to long-range spot fires, which travel over and beyond areas with little fuel. The presence of numerous spot fires leads to erratic fire behavior and rapid acceleration in a fire’s growth. The most critical element in fire management is the prevention of crown fires. It is important to evaluate fire potential miles away from communities as well as immediately adjacent to them.

Nowicki – Suggested Alternative

In fact, even a 12-inch dbh cutting limit would not impede the treatments from achieving the stated objectives, as a large proportion of the trees in the project are smaller than 12-inches dbh. That is, thinning treatments would be able to create a diversity of stand densities and structures by implementing varying levels of thinning the trees less than 12-inches dbh. This analysis and cutting limit is absolutely necessary to protecting vital components of the current forest structure, and the next generation of old-growth that will develop in the forest.

Response

A 12-inch limit was analyzed using the Forest Vegetation Simulator (FVS) computer model and applying professional knowledge to decide if would result in a viable alternative for the Kachina Village

Forest Health Project. The analysis looked at the viability of a 12-inch limit over the entire area, as suggested by the comment provided.

FVS was used to model various thinning scenarios. These scenarios showed the resulting differences in diameter, density, and mortality conditions after thinning. These scenarios analyzed certain alternatives, such as what happens if we impose a 12-inch limit on cutting trees. Seven stands were selected to model that show a range of both densities and site indexes that reflect the Kachina project area in general. In all the scenarios, only ponderosa pine was simulated for cut, even though many of the stands have an oak component.

A 12-inch limit scenario attempted to cut stands to a 50 basal area (BA) and an 80 BA, which is needed to meet goals and objectives in the Proposed Action such as reducing wildfire potential, increasing understory, and increasing individual tree growth. In most cases, 50 BA could not be achieved, even when the model cut almost everything (a cutting efficiency of 0.95) between 5 to 12-inches dbh. Four out of the seven stands that were modeled still had considerable BA over 50. The 12-inch limit scenario also tends to have slightly lower future growth rates for the remaining trees than other alternatives modeled. Growth was evaluated over a 50-year period. The model also indicated a higher mortality rate in stands treated with a 12-inch limit over the same 50-year period. Overall, the target densities recommended in the Proposed Action (Alternative A) could not be met with the 12-inch limit. Objectives to enhance understory, create grassy openings, and reduce wildfire potential could not be met in the majority of the project area if a 12-inch diameter limit were imposed. To enhance understory, it is desirable to reduce BA to less than 40. Diameter limits in general reduce our ability to create grassy openings, due to the distribution of trees on the landscape. A 12-inch diameter limit would make it impossible to meet our objective for creating 10 percent grassy openings within treated stands. Higher BA’s resulting from a 12-inch cutting limit would not adequately decrease stand densities and achieve our goal of reducing fire potential. Fire potential would remain moderate to high across most of the project area.

Alternatives Considered in Detail

The Proposed Action (Alternative A) and four additional alternatives are considered in detail. Alternative B is the no-action alternative, under

which the project area would have no project activities at this time and would remain subject to natural or ongoing changes only. The other action alternatives represent different means of satisfying the purpose and needs, to varying degrees, by responding with different emphases to the significant issues discussed in Chapter 1. **The alternatives for the Kachina Village Forest Health Project are differentiated primarily by a limit on the size of tree to be thinned, the intensity of the treatments proposed in thinning units, and miles of temporary road.** Maps of all alternatives considered in detail are provided in Appendix C (“Alternatives A, C, D Thinning” and “Alternative E Thinning”). Figures 12 and 13 (displayed on following pages) provide an overview of the various treatments and intensities.

Visual simulations produced by *Visual Nature Studio* Software are included to compare and contrast the alternatives. The visual simulations are a photo realistic power tool from 3D Nature, makers of the award-winning World Construction Set. They portray actual places using stand data and present complex spatial concepts to display forest management proposals. The visual simulations are discussed in detail in Appendix D. Figures 6 through 11 (on the following pages) provide visual simulations of varying basal area conditions so that the reader might have a better understanding or image of the treatments as they are described in alternative discussions that follow. Visual simulations will also compare the visual effects of treatments located north of Kelly Canyon (Figures 14 through 19) and compare the visual effects of treatments in Mexican Pocket (Figures 20 through 22). These are located in “Comparison of Alternatives” later in this chapter. Larger scale maps of the alternatives are contained in the project planning record.

Alternative A - Proposed Action cutting some trees over 16-inches dbh under specific criteria only.

Alternative B - No Action.

Alternative C - Proposed Action cutting no trees over 16-inches dbh.

Alternative D - Proposed Action cutting some trees over 16-inches dbh under specific criteria only and cutting no trees over 18-inches dbh.

Alternative E - Proposed Action with modifications based on issues of roads and concerns for wildlife habitat posed by the Southwest Forest Alliance.

(Alternatives A, C, D, and E have many similar actions that were previously described in “Items Common to All Action Alternatives,” “Project Specific Mitigation,” and “Monitoring.”)

Differences in basal areas are displayed in Figures 6 through 11 to compare and contrast the various alternatives.

Proposed Action (Alternative A)

Administrative and Strategic Direction for the Project Area

Retain all existing mature ponderosa pine trees or old “yellow-barked” trees. Thinning objectives will be met by primarily thinning smaller diameter ponderosa pine trees. Alternative A does not include a diameter limit. We recognize and acknowledge the important role that 16 inch and larger trees play in the ecosystem. Snag recruitment, future old-growth objectives, and managing for the Northern goshawk are important considerations to take into account before cutting a 16-inch dbh pine. However, some black-barked trees larger than 16-inches dbh may be removed to achieve important and valuable objectives, such as creating grassy openings, and reducing wildfire potential. This alternative includes a strict set of guidelines regulating the size of trees that would be thinned. Ponderosa pine trees larger than 16 inches may be removed only to:

- create grassy openings;
- enhance existing forest openings;
- enhance growth and health of larger ponderosa pine to promote future old-growth; and,
- reduce fire potential.

Temporary road or landing locations needed to achieve removal objectives will avoid large diameter trees where possible. Temporary road construction will be required to conduct thinning within the project area. We have estimated 5.75 miles of temporary roads will be required to implement the Proposed Action (PRD 132b). These temporary roads will be obliterated following thinning treatments. Level 2 and 3 roads will be used for thinning activities as well. Some roads will need to be improved before the initiation of thinning activities.

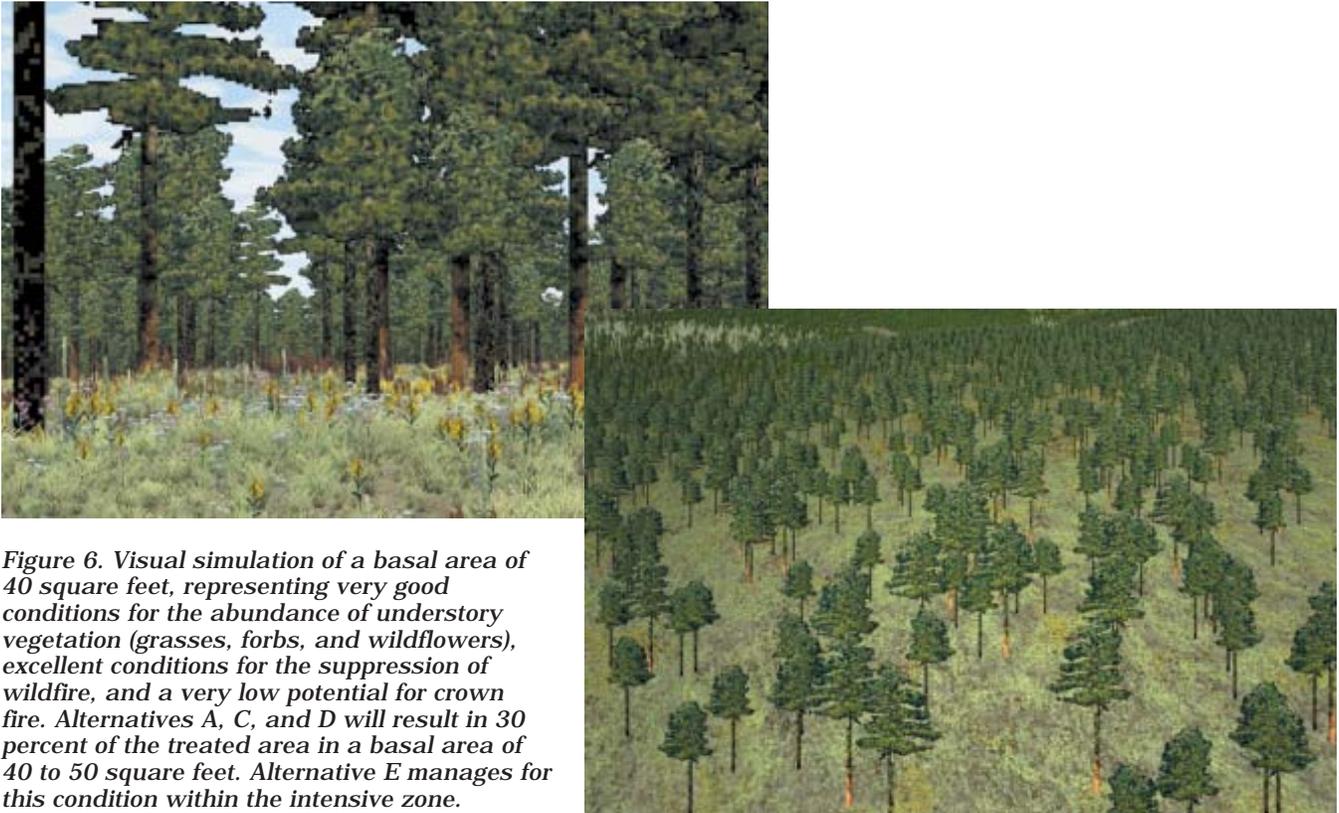


Figure 6. Visual simulation of a basal area of 40 square feet, representing very good conditions for the abundance of understory vegetation (grasses, forbs, and wildflowers), excellent conditions for the suppression of wildfire, and a very low potential for crown fire. Alternatives A, C, and D will result in 30 percent of the treated area in a basal area of 40 to 50 square feet. Alternative E manages for this condition within the intensive zone.

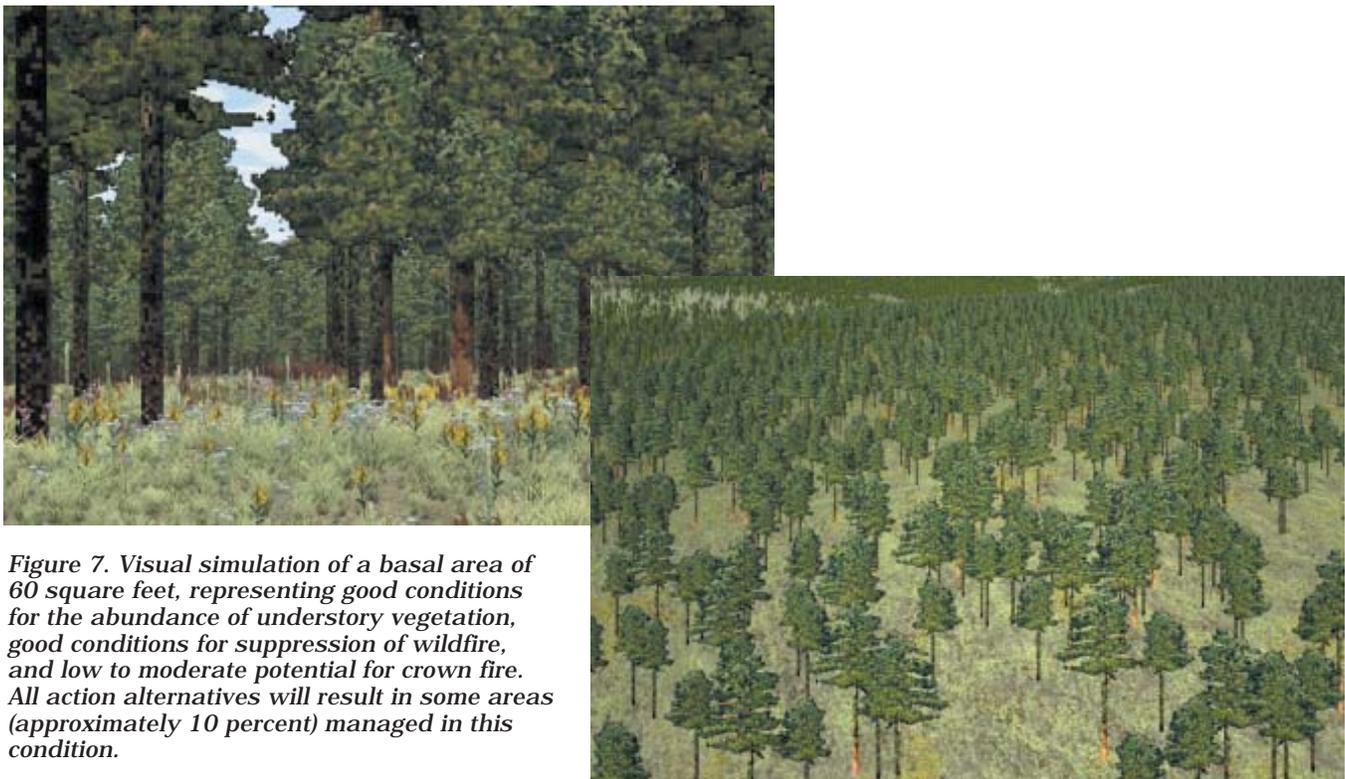


Figure 7. Visual simulation of a basal area of 60 square feet, representing good conditions for the abundance of understory vegetation, good conditions for suppression of wildfire, and low to moderate potential for crown fire. All action alternatives will result in some areas (approximately 10 percent) managed in this condition.

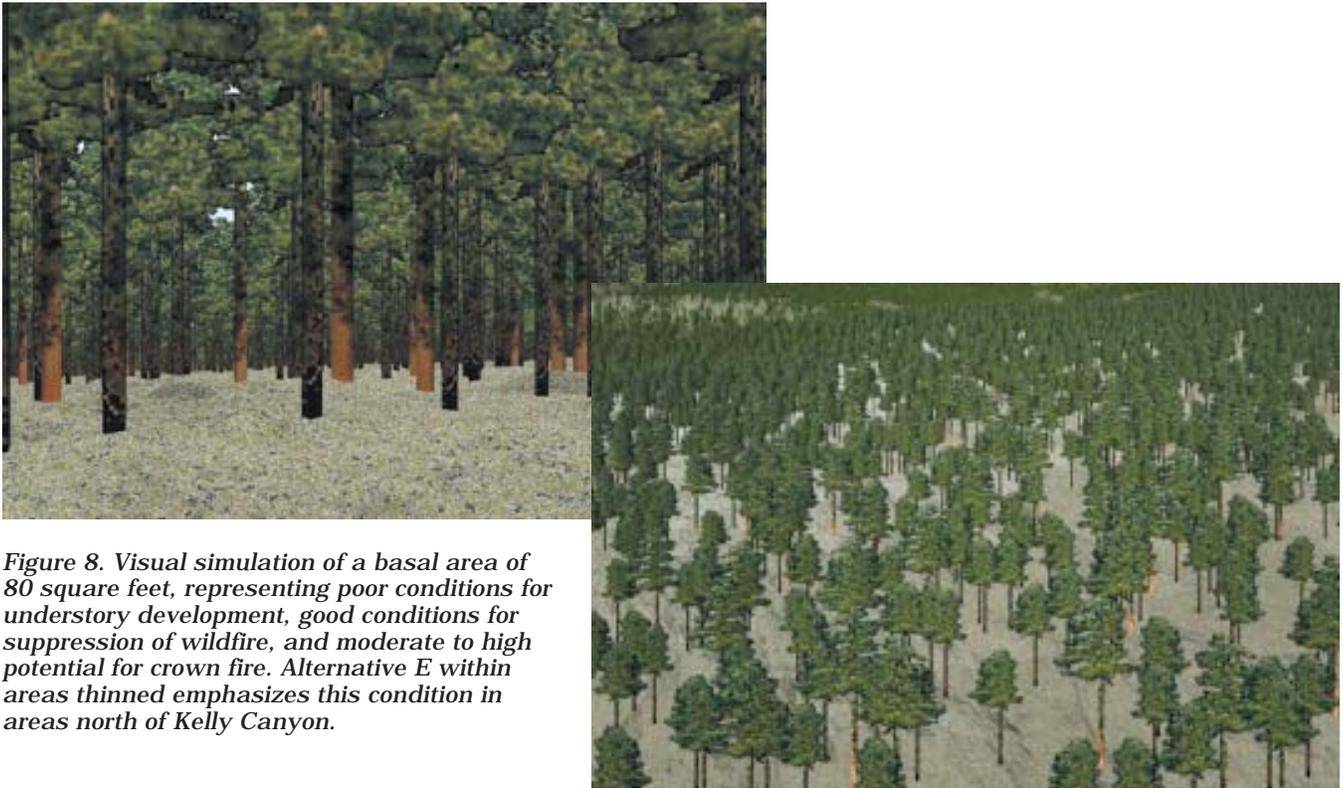


Figure 8. Visual simulation of a basal area of 80 square feet, representing poor conditions for understory development, good conditions for suppression of wildfire, and moderate to high potential for crown fire. Alternative E within areas thinned emphasizes this condition in areas north of Kelly Canyon.

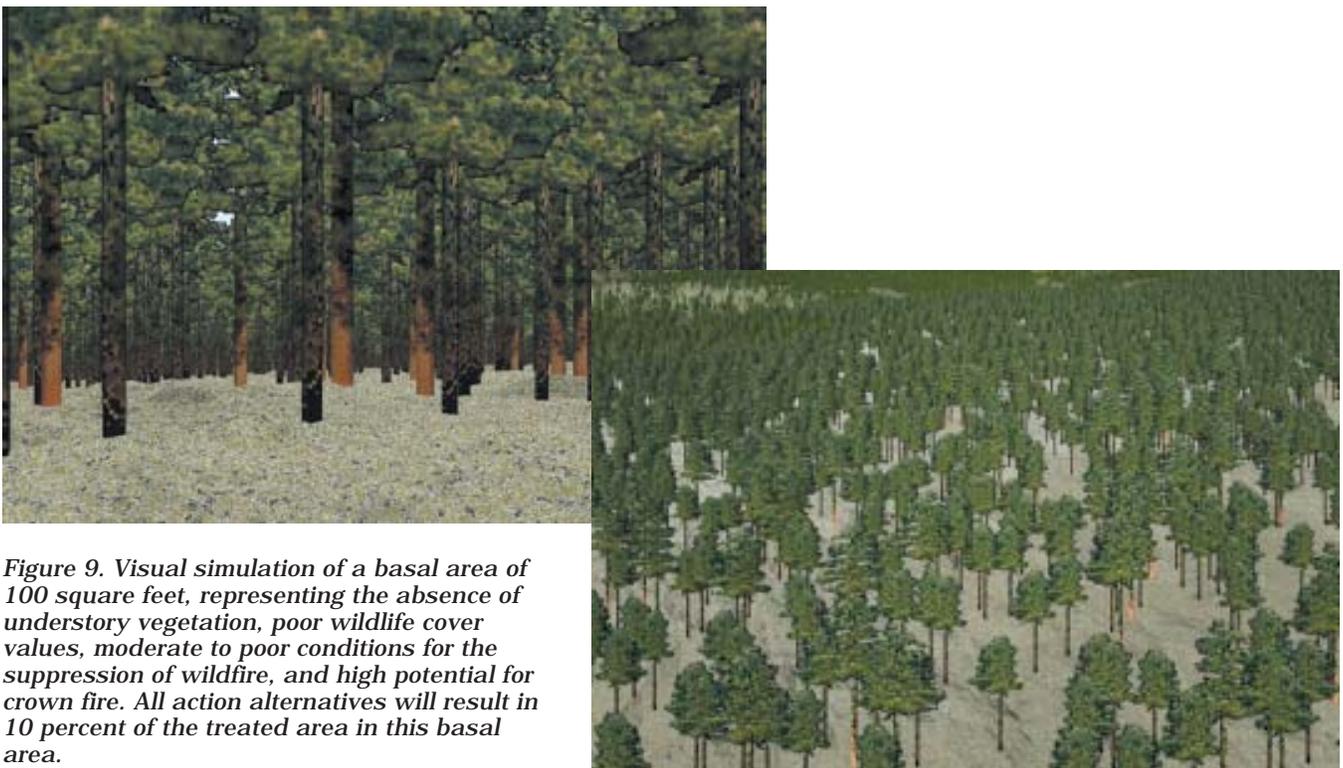


Figure 9. Visual simulation of a basal area of 100 square feet, representing the absence of understory vegetation, poor wildlife cover values, moderate to poor conditions for the suppression of wildfire, and high potential for crown fire. All action alternatives will result in 10 percent of the treated area in this basal area.

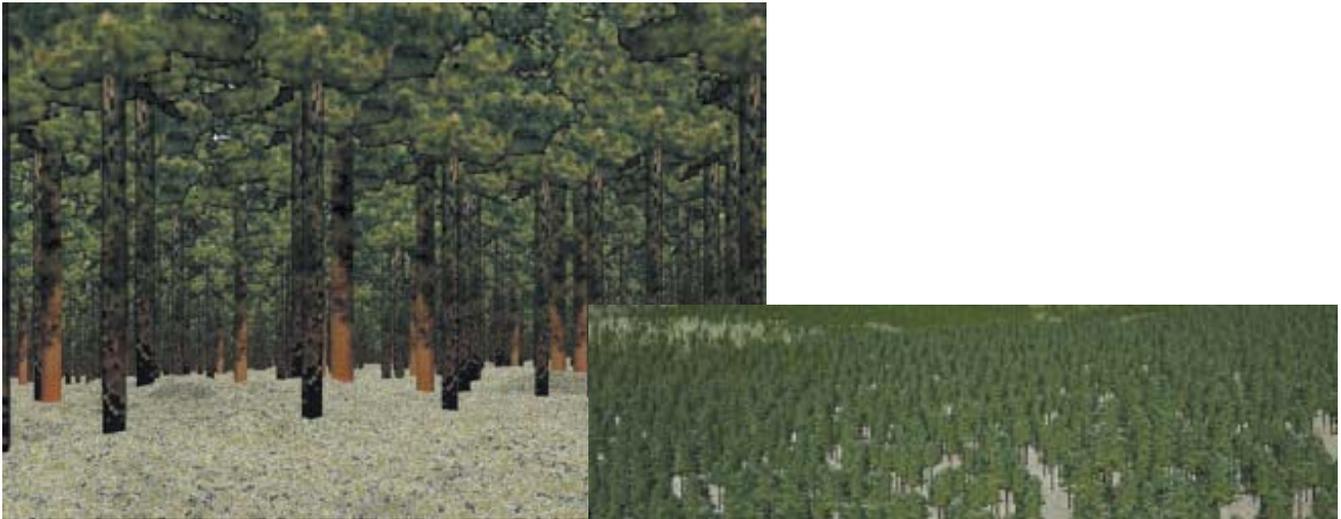


Figure 10. A visual simulation of a basal area of 120 square feet, representing the absence of understory vegetation, moderate to good wildlife cover values, moderate to poor conditions for the suppression of wildfire, and high potential for crown fire. Alternatives A, C, and D will manage for this stand density within Mexican spotted owl (MSO) areas. Alternative E will manage for this condition on 46 percent of the area. The 9-inch thinning limit will manage for basal areas of approximately 100 to 200 square feet.



Figure 11. A visual simulation of a basal area of 200 square feet, representing the absence of understory vegetation, good to excellent wildlife cover values, high potential for wildfire, and extreme potential for crown fire. All action alternatives maintain dense stand conditions within the canyons. Alternatives A, C, and D maintain small patches of this condition south of Kelly Canyon for wildlife cover. Alternative E, in areas with a 9-inch thinning limit, would result in this condition on some sites.

Snags and logs will be created from some of the 16-inch dbh black-barked trees as we work toward meeting guidelines for these habitats. Emphasis for snag and log recruitment will be in the areas south of Kelly Canyon, in northern goshawk PFA's, and in developing old-growth. Data has been collected on existing log, snag, and yellow-barked trees and will be used to select recruitment areas and describe recruitment densities. Selection of logs and snags will be made during marking for the project as described in PRD 120.

Actions to Meet Objectives for Reducing Fire Potential – Improving Forest Ecosystem Health – Fuels and Vegetation Management

1. Fire potential reduction and forest health improvement – North of Kelly Canyon and Lower Highway 89A Corridor (Variable thinning 40 to 120 BA with creation of openings 10 percent)

Thinning from below is proposed on 1,924 acres in areas north of Kelly Canyon and along the Highway 89A corridor. Thinning will focus on reducing wildfire potential by reducing ladder fuels and breaking up continuous crown canopies. The thinning of small trees will develop clumps of trees in a mosaic of varying densities, ranging from 40 to 120 square feet of basal area⁵. The clumps will be selected based on existing structure. Canopy closure will be reduced to 40 to 50 percent, with crown base height raised to an average of 15 feet. All old trees will be deferred from treatment and remain on the site. Thinning will occur around old trees to reduce competition for light, moisture, and nutrients to improve their longevity. Approximately 10 percent of the area will be managed to provide for grassy openings. Grassy openings will be managed by using the existing areas on the landscape where open areas may have occurred in the past or have been created. Trees around the edges of the openings or within the interior of the opening will be removed to expand the size of the opening. The openings will be irregular in shape to create stringers of openings that will improve the understory and reduce fire potential. Thinning will also occur around large Gambel oak trees and clumps to improve their longevity. No Gambel oaks will be cut. This thinning will be very similar to the thinning proposed around the old trees. Thinning will

enhance vigor and growth of oak in the area and reduce fire potential. Removing the pine canopy surrounding Gambel oak will reduce the potential for fire ladders.

2. Dense Canopy Retention for Improving Forest Resiliency of Goshawk Habitat (Variable thinning to average of 80 BA with openings created)

Within northern goshawk post fledging areas (PFA's), 124 acres will be thinned to lessen fire potential by removing ladder fuels and creating some canopy breaks. Scientists who developed management recommendations for this species recommend this type of treatment to reduce fire potential and improve northern goshawk habitat. A more dense stand or stands with higher canopy closure will exist after treatment than is prescribed for much of the area surrounding this PFA (as described above). Canopy cover will average 60 percent within the 124 acres of treatment.

3. Improving Old Tree Longevity and Gambel Oak Habitat (Variable thinning around old trees and Gambel oak)

Four hundred eighteen acres of thinning from below will be conducted within and around mature ponderosa pine trees and Gambel oak. In these stands, there are opportunities to conduct limited thinning around the old trees and Gambel oak to improve their longevity. Openings created around Gambel oak and mature ponderosa pine will reduce fire potential, decrease competition for sunlight, moisture, and nutrients, and create grassy openings. Where opportunities arise to improve the distribution and abundance of openings in these stands, additional thinning may occur.

4. Fire potential reduction, forest health improvement, and wildlife cover management – South of Kelly Canyon (Variable thinning 40 to 100 BA with 25 percent cover patches maintained with the creation of openings 10 percent)

South of Kelly Canyon, between James and Kelly Canyons, and South of James Canyon, 1,411 acres of thinning from below will occur to lessen the fire potential. Along the rims of the canyons, a fire line approximately 3-foot wide will be constructed either by using a drag, small bobcat, or hand crews. The fire line will be constructed approximately 200 to

⁵ Basal area is a measure used to describe tree density. Basal area can be visualized as the amount of ground that is covered in wood. Higher basal areas mean more trees are left (higher densities) than lower basal areas (lower densities).

300 feet above the steep break of the canyon below. The 200 to 300-foot area between the edge of the canyon and the fire line will assist in prescribed burning activities and will maintain key habitat for bear and turkey using the edges of the canyons for wildlife movement. Beyond this fire line, the ridge between James and Kelly Canyons and south of James Canyon will be thinned to create an open ponderosa pine habitat with dense cover patches. Up to 25 percent of the area will be in dense patches of variable size, with a minimum of 35 trees per dense clumps (small clumps). The size of these clumps will vary from approximately 1/10th of an acre to 1 acre. Some light thinning may occur within the patches to reduce ladder fuels or remove trees with poor crown development. The clumps will be closed canopy clumps, with the limbs and needles of the trees interlocking. These clumps are important to a variety of bird species and to Abert squirrel and deer for bedding. The dense clumps will be selected using the existing vegetation or existing structure and consideration of fire hazard. Around these dense clumps, the area will be open ponderosa pine habitat. The thinning around the clumps will maintain tree densities between 40 to 100 square feet of basal area. The savannah or open area around the clumps will reduce fire potential, increase the herbaceous understory, and benefit wildlife species, such as blue birds, rabbits, turkey, and deer, requiring open habitats for foraging.

As described above for areas north of Kelly Canyon, the following will also occur south of Kelly Canyon. All old trees will be deferred from treatment and retained. Thinning will occur around old trees to improve their longevity by reducing competition for light, moisture, and nutrients. Approximately 10 percent of the area will be managed to provide for grassy openings by using the existing areas on the landscape where grassy openings may have occurred in the past or have been created. Trees around the edges of the openings or within the interior of the opening will be removed to expand the size of the opening. The openings will be irregular in shape and will create stringers of openings to improve understory development and reduce fire potential. Thinning will also occur around large Gambel oak trees and clumps to improve their longevity. This thinning will be similar to the thinning proposed around the old trees. No Gambel oaks will be cut. This will enhance vigor and growth of oak in the area and reduce fire potential. Removing the pine canopy surrounding Gambel oak will reduce fire laddering potential.

Site-specific implementation will include layout and assistance with marking and thinning from the Arizona Game and Fish Department and USFS wildlife biologists.

Within the Mexican Pocket area, thinning similar to that proposed for areas south of Kelly Canyon will be conducted. However, the dense cover patches, as described above, will be focused on north-facing slopes. The dense patches will be less evenly distributed. Two hundred forty-six acres

have a high density of old yellow pine clumps, providing for more dense patches throughout much of the area. These old yellow pine groups will be maintained. Thinning around the groups will help improve their longevity, lessen fire potential to the groups, and improve aesthetic values in the area.

Site-specific implementation will include layout and assistance with marking and thinning from the Arizona Game and Fish Department and USFS wildlife biologists.

5. Thinning from Below – Griffiths Spring Drainage

Eighty-two acres of thinning involving trees less than 9-inches dbh will occur along the Griffiths Spring drainage. Light thinning is proposed to reduce fire potential and balance visual quality concerns in a heavily-used area.

No Action (Alternative B)

Description of Alternative B

The No Action Alternative would propose no future management activities within the project area at this time. It does not preclude activities in other areas at this time or from the project area at some time in the future. The Council on Environmental Quality (CEQ) regulations (40 CFR 1502.14d) require that a “no action” alternative be analyzed. This alternative represents the existing condition against which the other alternatives are compared.

Summary of Significant Issues That Developed Alternative B

No significant issues raised during scoping or comment to the Proposed Action are addressed by the No Action Alternative. However, many comments and non-significant issues are addressed through the No Action Alternative (see Appendix A).

Purpose and Need Evaluation

The No Action Alternative does not meet the purpose and need for the proposed project.

Specific Outputs and Differences Between the Proposed Action (Alternative A) and Alternative B

The No Action Alternative would maintain current conditions within the project area. Wildfire potential would remain high. There would be no improvement in forest health. Recreation and road management would continue to contribute to the current high fire risk and would continue to impact wildlife habitat, soil, and watershed conditions.

Alternative C

Description of Alternative C

This alternative is identical to the Proposed Action (Alternative A) except that this alternative will not cut any trees over 16-inch dbh (Appendix A).

Administrative and Strategic Direction for the Project Area

Retain all existing mature ponderosa pine trees or old “yellow-barked” trees. Thinning objectives will be met by primarily thinning smaller diameter ponderosa pine trees. Ponderosa pine trees greater than 16-inch dbh will be retained. This alternative would drop the creation of logs and snags.

Summary of Significant Issues That Developed Alternative C

Issue 1: 16-Inch Diameter Limit Issues

Cutting trees greater than 16-inch diameter would affect future old-growth in the area, resulting in fewer acres being able to qualify as old-growth forest structure in the future.

Purpose and Need Evaluation: The alternative generally meets the desired future conditions described under the purpose and need of the project. There are only slight differences when comparing Alternative C to the Proposed Action (Alternative A). The implementation of a 16-inch diameter limit would result in approximately 7,000 fewer trees thinned from the landscape compared to the Proposed Action. Based on professional experi-

ence and modeling, this is estimated to result in 50 percent fewer grassy openings created, thus leading to less improved habitat for Navajo Mountain Mexican voles and sensitive plant species in the project area. The alternative would result in slightly higher fire potential.

Specific Outputs and Differences Between the Proposed Action (Alternative A) and Alternative C

Related to Issues

Issue 1: Cutting trees greater than 16-inch diameter would affect future old-growth in the area, resulting in fewer acres being able to qualify as old-growth forest structure in the future.

A detailed analysis of old-growth is located in Chapter 3. The effects analysis states there is relatively no difference between the Proposed Action (Alternative A) and Alternative C (16-inch diameter limit) in regard to future old-growth recruitment.

Map of Alternative C: A detailed map of Alternative C is located in Appendix C.

Alternative D

Description of Alternative D

This alternative is identical to the Proposed Action (Alternative A) except that this alternative would not cut any tree over 18-inches dbh (Appendix A).

Administrative and Strategic Direction for the Project Area

Retain all existing mature ponderosa pine trees or old “yellow-barked” trees. Thinning objectives will be met by primarily thinning smaller diameter ponderosa pine trees. Ponderosa pine trees greater than 18-inches dbh will be retained.

Creating Logs and Snags - Snags and logs will be created from some of the 18-inch dbh black-barked trees as we work toward meeting guidelines for these habitats. The alternative maintains the element of creating logs and snags from the trees 16 to 17.9 inches dbh. Emphasis for snag and log recruitment will be in the areas south of Kelly Canyon, in northern goshawk PFA's, and in developing old-growth. Data has been collected on existing log, snag, and yellow-barked trees and will be used to select

recruitment areas and describe recruitment densities. Selection of logs and snags will be made during marking for the project as described in PRD 120.

Summary of Significant Issues That Developed Alternative D

Issue 2: 18-Inch Diameter Limit Issue

All project objectives could be met with an 18-inch diameter limit and request that a quantitative analysis is provided.

Purpose and Need Evaluation: The alternative meets the desired future conditions described under the purpose and need of the project. There are only slight differences when comparing Alternative D to the Proposed Action (Alternative A), as described in Chapter 3. Cutting no trees greater than 18-inches dbh would result in approximately 2,000 fewer trees thinned from the landscape. Grassy openings created would be the same as Alternative A. An evaluation conducted by specialists found little to no difference between the Proposed Action (Alternative A) and Alternative D upon detailed study.

Specific Outputs and Differences Between the Proposed Action (Alternative A) and Alternative D Related to Issue 2

There is little to no difference between the Proposed Action (Alternative A) and Alternative D.

Map of Alternative D: A detailed map of Alternative D is located in Appendix C.

Alternative E

Description of Alternative E

Alternative E is different from the Proposed Action (Alternative A). The thinning units are the same, however, different thinning prescriptions are applied to the units based on issues. The alternative looks at thinning prescriptions that change the intensity of thinning and a 16-inch diameter limit is in place like Alternative C. There are fewer temporary roads and less mechanized equipment used. (PRD 95c, 101, 107, 110a, 114, 119, 1137f, Appendix A)

Administrative and Strategic Direction for the Project Area

Retain all existing mature ponderosa pine trees or old “yellow-barked” trees. Thinning objectives will be met by primarily thinning smaller diameter ponderosa pine trees. Ponderosa pine trees greater than 16-inches dbh will be retained.

Temporary roads or landing locations to achieve removal objectives will avoid large diameter trees where possible. Temporary roads would be used to thin the “Intensive Zone” described below. Approximately 2.5 miles of temporary roads would be required. These temporary roads will be obliterated following thinning treatments. Level 2 and 3 roads will be used for thinning activities as well. Some roads will need to be improved before initiation of thinning activities.

Reducing Fire Potential – Improving Forest Ecosystem Health – Fuels and Vegetation Management

“Intensive Zone” Thinning – Adjacent to Private Land (Variable thinning 40 to 50 BA). Implement thinning from below to create a fuel break north of Kelly Canyon within the “intensive zone,” i.e., 1/8 mile (660 feet) immediately adjacent to homes. The “intensive zone” should leave very few interlocking crowns and provide a fuel break adjacent to private land. Temporary roads could be established to thin the “intensive zone” (Nowicki - PRD 119). The “intensive zone” is 439 acres.

Fire potential reduction and forest health improvement – North of Kelly Canyon and Lower Highway 89A Corridor (Variable thinning 60 to 120 BA). Beyond the 1/8-mile “intensive zone,” implement a variable “thinning from below” to 60 to 120 BA north of Kelly Canyon on 1,746 acres.

Fire potential reduction and reducing temporary road construction—North of Kelly Canyon and Lower Highway 89A Corridor (to reduce temporary road construction do not thin any tree over 9-inches dbh). In the areas north of Kelly Canyon, 363 acres could not be reached using the existing road network and would require temporary road construction. The alternative discussed with Brian Nowicki on several occasions resulted in these units having a 9-inch diameter limit. South of Kelly Canyon, 363 acres would be thinned from below, with nearly all 9-inch trees thinned, stacked, and burned.

Reducing disturbance to soils and wildlife – South of Kelly Canyon, including Mexican pocket area (No use of heavy equipment, all treatments completed with hand thinning methods only, do not thin any trees over 9-inches dbh). South of Kelly Canyon 2,020 acres would be thinned from below, with nearly all 9-inch and smaller trees thinned, stacked, and burned.

Thinning from below – Griffiths Spring Drainage. Sixty two acres of thinning involving trees less than 9-inches dbh will occur along the Griffiths Spring drainage. Light thinning is proposed to reduce fire potential and balance visual quality concerns in a heavily-used area.

Summary of Significant Issues That Developed Alternative E

Issue 3: “Intensive Zone”

The Proposed Action does not reduce fuels sufficient to protect the immediate wildland-urban interface. An “intensive treatment zone” around private land is requested for evaluation.

Issue 4: Lighter Thinning Methods

Thinning north of Kelly Canyon as described in the Proposed Action goes beyond what is needed to reduce fire risk. A lighter treatment of 60 to 120 basal area and no trees cut over 9-inches dbh to reduce the need for temporary road construction is requested for evaluation.

Issue 5: Road Issues

Temporary roads lead to increased soil compaction, transport of exotic weeds, and have long-lasting impacts on forest structure, therefore, we request that no new temporary roads be created even if only for the duration of the project.

Issue 6: Mechanized Equipment

Mechanized equipment and excessive thinning will increase soil compaction and cause disturbance to wildlife in areas south of Kelly Canyon. The area south of Kelly Canyon should only be treated with hand thinning and was requested for evaluation.

Purpose and Need Evaluation

Alternative E falls severely short of achieving the desired outcomes specified in the purpose and need. Alternative E will result in very little protection of T&E habitat and urban areas from wildfire. Thinning no trees over 9-inches dbh does very little to

reduce flame lengths and results in little or no change in expected fire behavior when compared to the No Action Alternative. Nearly 2,400 acres treated under Alternative E would remain in high wildfire potential with flame lengths averaging 7.2 feet. Tree mortality following a wildfire is estimated at 80 to 100 percent. Other differences in outputs include the creation of very few openings, with Alternative E creating less than 1 percent new openings. Alternative E has long-term negative impacts on developing old-growth and stand health. Alternative E showed very little improvement to wildlife habitat.

Specific Outputs and Differences Between the Proposed Action (Alternative A) and Alternative E Related to Issues

Issue 3

The Proposed Action does not reduce fuels sufficient to protect the immediate wildland-urban interface. An “intensive treatment zone” around private land is requested for evaluation.

The “intensive treatment zone” concept is analyzed in detail in Chapter 3. The effects analysis states that on the Coconino National Forest, a 660-foot-wide fuel break has not proven to be an effective fire stop against fires approaching from beyond such a strip. An illustration is the Slate Fire (1996). An entire strike team of wildland fire engines was unable to even slow down the forward spread of the fire at any of three separate breaks similar to the “intensive zone” treatment proposed.

Issue 4

Thinning north of Kelly Canyon as described in the Proposed Action goes beyond what is needed to reduce fire risk. A lighter treatment of 60 to 120 basal area and no trees cut over 9-inches dbh to reduce the need for temporary road construction is requested for evaluation.

Alternative E would fail to meet other fire-related objectives within 1 mile of the residential neighborhoods, since flame lengths and fire intensity generated by the model were not reduced from the existing condition. The probability of large tree (12 to 20" dbh) mortality would remain very high at over 90 percent. However, the flame length that would likely be needed to transition into a crown fire would be increased to 7.9 feet by this alternative (within this northern zone). Farther than 1 mile, yet north of James Canyon, the model indicated Alternative E would reduce flame lengths from 7.2 feet to approxi-

mately 4 feet and the probability of tree mortality from 90(+) percent to 16(-) percent for a wildfire originating in this zone. Within this zone, the model indicated the only significant difference in tree mortality between the action alternatives was among trees less than 12-inches dbh. Alternative E leaves a higher degree of closed canopy (in this middle zone) that could increase tree group torching and spotting.

Issue 5

Temporary roads lead to increased soil compaction, transport of exotic weeds, and have long-lasting impacts on forest structure, therefore, we request that no new temporary roads be created even if only for the duration of the project.

Alternative E results in 2.5 miles of temporary road construction compared to the Proposed Action (Alternative A), which results in 5.75 miles of temporary road construction (PRD 132b). This translated to a difference of 8 acres on the ground. The change to forest structure is insignificant, as only .0017 percent of the project area is affected by this action. There was no detectible change to soil compaction due to the short-term duration of use and mitigation applied to the Proposed Action (Alternative A). Alternative E would reduce the potential for invasive and noxious weed invasion on 8 acres of the landscape, an insignificant change when considering there are 177 acres or 50 miles of existing roadways. Temporary roads will result in little change to invasive and noxious weed spread.

Issue 6

Mechanized equipment and excessive thinning will increase soil compaction and cause disturbance to wildlife in areas south of Kelly Canyon. The area south of Kelly Canyon should only be treated with hand thinning and was requested for evaluation.

The effects from Alternative E on soil compaction will be slightly less due to the limited equipment use in areas south of Kelly Canyon. However, undesirable effects from the proposed activities will be mitigated through the implementation of Best Management Practices and the effects of activities proposed in Alternative A are minimal. Effect analysis completed for Management Indicator Species, Threatened, Endangered and Sensitive species concluded that disturbance effects would be minimal under the Proposed Action (Alternative A) Proposed Action with mitigation measures applied as described previously in this chapter. There was very little difference in disturbance effects associated with the action alternatives.

Map of Alternative E: A detailed map of Alternative E is located in Appendix C.

Comparison of Alternatives

This section compares outputs, objectives, and effects of the alternatives in terms of the significant issues for the Kachina Village Forest Health Project. The discussions of effects are summarized from Chapter 3, which should be consulted for a full understanding of these and other environmental consequences.

Figures 12 and 13 are provided to contrast and compare the alternative treatments and intensities. The visual aids are followed by a discussion of each significant issue, comparing the alternatives in terms of that issue. The relevant numerical data is displayed to compare outputs, objectives, and effects of the alternatives.

Lastly, Table 5 provides an overview comparison of the alternatives **relevant to the purpose and need for the project (Chapter 1, “Purpose and Need”)**. The table does not include Alternative B (No Action) which has no outputs or activities.

The alternatives for the Kachina Village Forest Health Project are differentiated primarily by a limit on the size of tree to be thinned, the intensity of the treatments proposed in thinning units, and miles of temporary road.

Table 1. Comparison of Action Alternatives Based on Key Differences

Key Differences	Alternatives			
	A	C	D	E
Diameter limit	None ¹	16-inch dbh ²	18-inch dbh ³	16-inch dbh ⁴
Thinning acres that will reduce crown fire potential	4,266	4,266	4,266	2,328
Miles of temporary roads	5.75	5.75	5.75	2.5

¹ For trees being thinned over 16-inches dbh there is specific criteria.
² No trees over 16-inches dbh will be harvested for any reason
³ For trees being thinned between 16 and 17.9-inches dbh, there is specific criteria
⁴ No trees over 16-inches dbh will be harvested for any reason

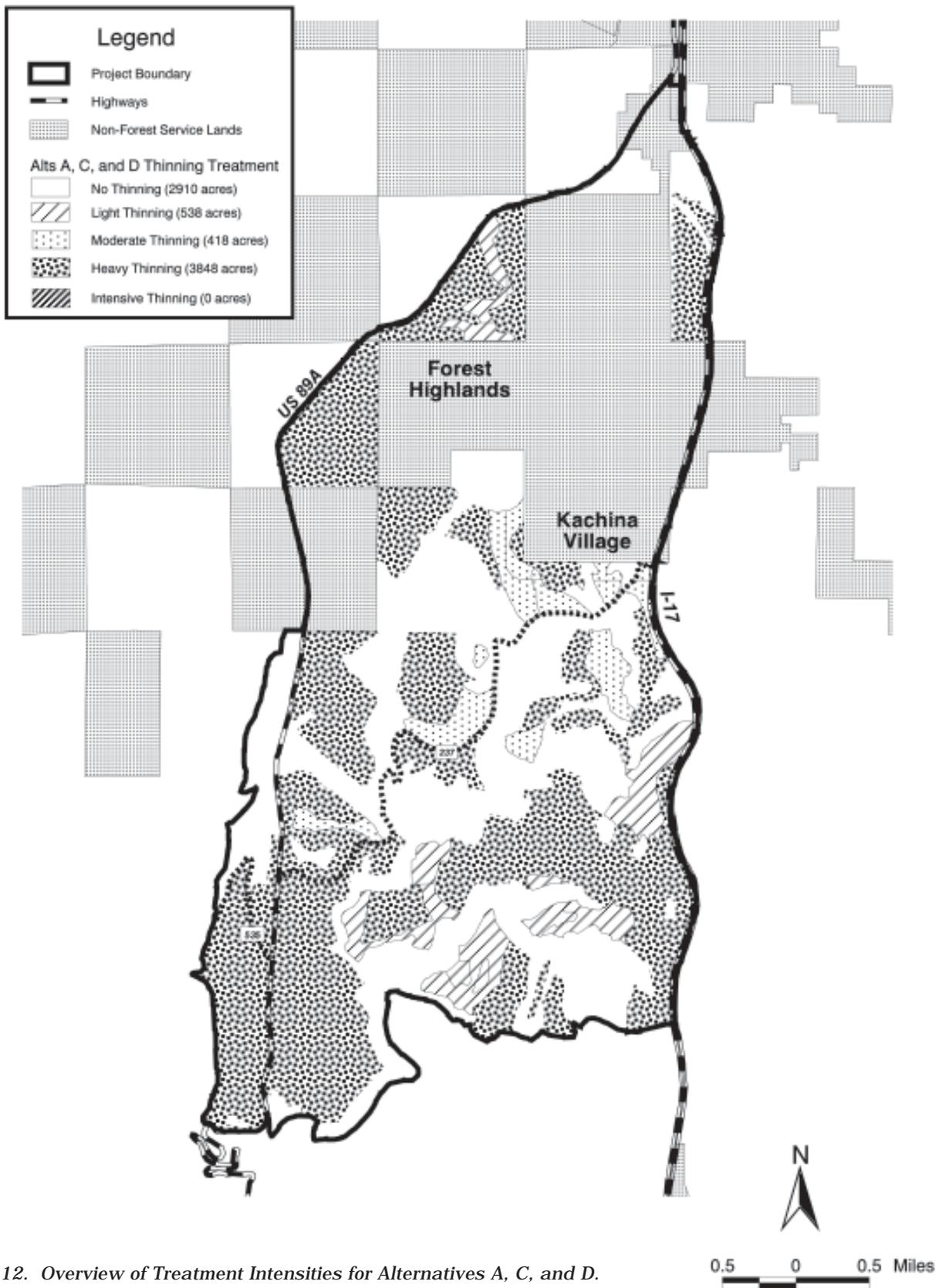


Figure 12. Overview of Treatment Intensities for Alternatives A, C, and D.

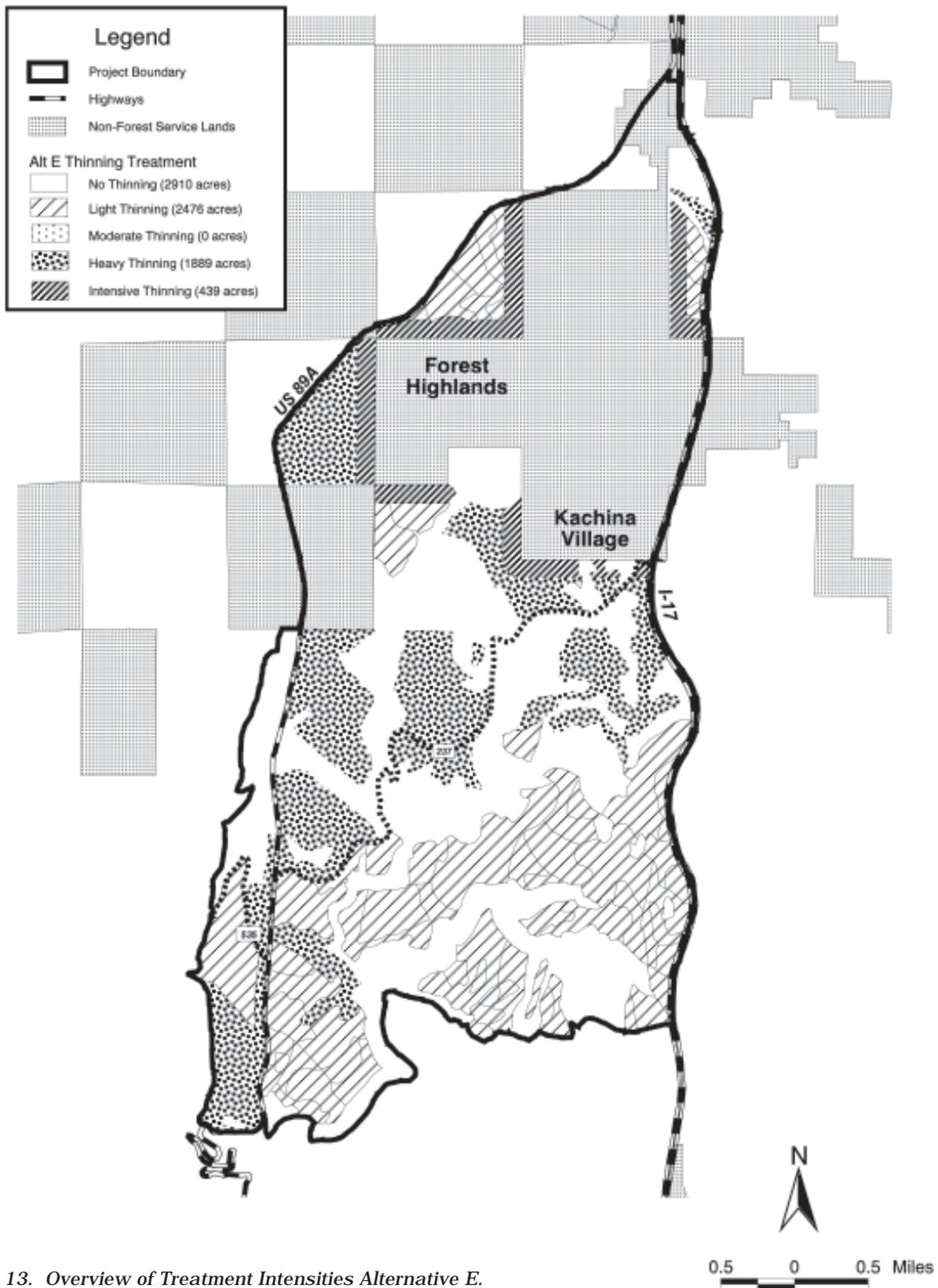


Figure 13. Overview of Treatment Intensities Alternative E.



Figure 14. Existing conditions just south of Kachina Village with Interstate 17 in the lower, left-hand corner.

Figure 15. Alternative A, following thinning as proposed for fire potential reduction and forest health improvement north of Kelly Canyon and the lower Highway 89A corridor (variable thinning 40 to 120 BA with creation of openings 10 percent). See Chapter 2.

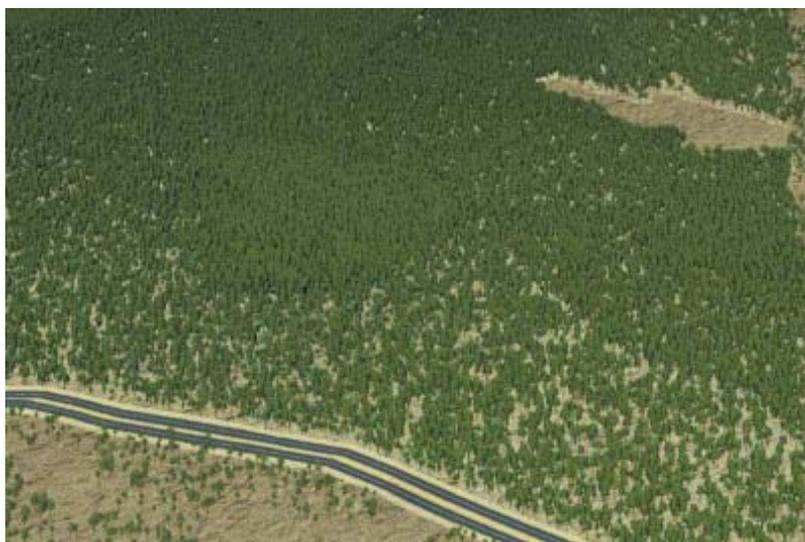


Figure 16. Alternative E, following thinning as proposed for intensive zone adjacent to private land (variable thinning 40 to 50 BA) and fire potential reduction and forest health improvement north of Kelly Canyon and the lower Highway 89A corridor (variable thinning 60 to 120 BA). See Chapter 2.

Figure 17. Existing condition, location/site 345/01, immediately south of Kachina Village. Interstate 17 is shown in the bottom of the picture.



Figure 18. Alternative E, location/site 345/01 following thinning as proposed for intensive zone adjacent to private land (variable thinning 40 to 50 BA). See Chapter 2.

Figure 19. Alternative A, location/site 345/01 following thinning as proposed for improving old-tree longevity and Gambel oak habitat (variable thinning around old trees and Gambel oak with 10 percent openings created). See Chapter 2.

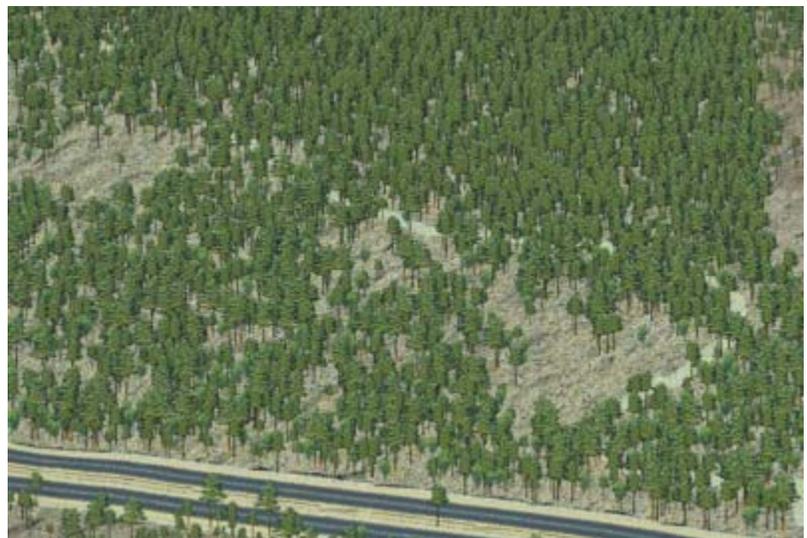




Figure 20. Existing conditions in the Mexican Pocket area, location/site 345/17. Pumphouse Canyon is visible as the dark area on the right side and Highway 89A is visible as the straight white line on the left-hand side (left photo). The picture on the left displays a high oblique; the picture on the right is a low oblique.



Figure 21. Alternative A, following thinning as proposed for fire potential reduction, forest health improvement, and wildlife cover management, south of Kelly Canyon (variable thinning 40 to 100 BA with 25 percent cover patches maintained with the creation of openings 10 percent). See Chapter 2.



Figure 22. Alternative E, following thinning as proposed for reducing disturbance to soils and wildlife, south of Kelly Canyon, including the Mexican Pocket area (9-inch thinning limit; treatments completed with hand thinning methods only. No use of heavy equipment). See Chapter 2.

Comparison of Alternatives — Issue 1: 16-inch Diameter Limit

Issue: Cutting trees greater than 16-inch diameter would affect future old-growth in the area, resulting in further degradation of old-growth forest structure.

Old-growth

Alternatives A, C, and D would thin from below both existing and developing old trees resulting in the greatest decrease in stand densities. Thinning will improve the health, growth, and vigor of the old-growth tree component and decrease the risk of wildfire, thus promoting development of old-growth habitat. All existing old-growth trees would be maintained across all action alternatives. Additionally, the different thinning prescriptions would result in varying tree densities across the landscape. This is desirable for wildlife and would help create a diversity of species across the project area. Over a period of 50 years, these alternatives would result in the greatest recruitment for old-growth into VSS 5 and VSS 6. There is relatively no difference between the Proposed Action (Alternative A), Alternative C (16-inch diameter limit), and Alternative D (18-inch diameter limit) in regards to future old-growth recruitment.

Under Alternative B (no action), the dense nature of the forest would persist. Old tree mortality would occur at a greater rate than in thinned stands due to biological stresses, such as competition, insects, disease, and wildfire. Without treatment, many old-growth recruitment areas would decline in health and vigor, with some never reaching old-growth conditions due to high tree densities. In 50 years, there would be no recruitment into VSS 5 and VSS 6. Because 95 percent of developing and existing old-growth sites have expected fire behavior rated as high to extreme, wildfire may result not only in the loss of old-growth trees but also blocks of old-growth trees.

Under Alternative E, trees would have smaller diameters due to slower growth rates. With limited treatment in sites where no trees over 9-inches dbh would be thinned, old-growth recruitment areas would decline in health and vigor, with some never reaching old-growth conditions due to high tree densities. The high fire hazard potential would persist for old-growth stands. In the event of a large wildfire, old-growth sites would be compromised and trees would be lost, thus affecting form and function

of old-growth. In 50 years post-treatment, there would be little recruitment into old-growth conditions, with an increase of 18 percent in VSS 5 and no recruitment in VSS 6.

Economic Analysis

Economic analysis was conducted using techniques and methods developed by Dr. Debra Larson of Northern Arizona University. The analysis focused on the economic question of how 16 inch and greater diameter trees would contribute to total return estimates. Modeling runs were conducted using two product mixes and two logging systems reflecting local markets. Alternative B (No Action) could potentially result in a loss of over 1 billion dollars if Forest Highlands Subdivision were impacted severely by a large catastrophic fire event (Jim Pond, Highlands Fire Department personal communication). Estimates to fight such a fire were estimated at 3 million dollars. Long-term impacts to Oak Creek Canyon, wildlife habitat, and T&E habitat would be significant. Alternative A without a 16-inch diameter limit would result in a 5-10 percent positive change per thousand cubic feet (CCF) when compared to Alternative C. The estimated value of the 7,000 trees thinned using Alternative A is approximately \$498,000 based on an estimated value per CCF, which is taken from Larson (2000 in press). However, given the poor tree form expected of the 16 inch diameter trees removed, the grade of these trees may not be realized in the market, which was analyzed.

Table 2. Comparison of Cost Per Thousand Cubic Feet (CCF), Number of Trees Removed Greater than 16-inches dbh, and Estimated Value for All Action Alternatives.

Economic Evaluation	Alternatives			
	A	C	D	E
Number of 16" and Greater Diameter Trees Removed	5000 (16.1-17.9) 2000 (18"+)	0	5000 (16.1-17.9)	0
Estimated Value of 16" and Greater Diameter Trees	\$498,000	0	\$373,500	0

Table 3. Economic Improvement

Alternative	Amount Generated or Cost
A	\$510,090 generated from trees thinned.
C	\$238,886 generated from trees thinned.
D	\$402,045 generated from trees thinned.
E	Thinning will cost \$670,975.

Comparison of Alternatives — Issue 2: 18-inch Diameter Limit

Issue: All project objectives could be met with an 18-inch diameter limit and request that a quantitative analysis is provided.

The issue is addressed in Alternative D. The specific issue was that all project objectives could be met with an 18-inch diameter limit. A review of Chapter 3 finds very few differences between the Proposed Action (Alternative A) and Alternative C and that project objectives were met equally to the Proposed Action (Alternative A).

Comparison of Alternatives — Issue 3: “Intensive Zone”

Issue: The Proposed Action does not reduce fuels sufficient to protect the immediate wildland-urban interface. An “intensive treatment zone” around private land is requested for evaluation.

Fuel Reduction - “Intensive Zone”

The “Intensive Zone” is a component of Alternative E only. The most important aspect to reducing wildfire potential was to manage the entire project area to reduce fuels. The “Intensive Zone” treatment area did not result in additional protection of the area immediately adjacent to private land. This alternative proposes an “Intensive Zone” treatment for a width of 660 feet along the forest abutment with private property to mitigate the fire effects of not thinning any trees over 9-inches dbh and higher canopy closures over the rest of the project area. Initial attack has been quite effective against fires starting in such a fuel break. However, on this forest a 660-foot-wide fuel break has not proven to be an effective fire stop against fires approaching from beyond such a strip. An illustration is the Slate Fire (1996). An entire strike team of wildland fire engines was unable to even slow down the forward spread of

the fire at any of three separate breaks similar to the “intensive zone” treatment.

Comparison of Alternatives - Issue 4: Lighter Thinning Methods

Issue: Thinning north of Kelly Canyon as described in the Proposed Action goes beyond what is needed to reduce fire risk. A lighter treatment of 60 to 120 basal area and 9-inch thinning limit (where a temporary road is needed) is requested for evaluation.

Fuel Reduction

Each of the action alternatives affects the potential for a large stand replacing fire to varying degrees. The differences of effects in meeting all of the objectives listed above are largest between Alternative E and the other action alternatives.

Alternative A has the greatest reduction in crown fire potential and severe fire behavior. Alternative A provides a higher degree of habitat protection (a fire-related objective) by reducing the probability of tree mortality more than the other alternatives (induced by both wild and prescribed fires). By reducing the probability of mortality among large trees (12 to 20-inches dbh) more than the other alternatives, this alternative is also most likely to retain and recruit mature ponderosa pine trees (a fire-related objective).

Alternative B calls for no action as stated in the existing condition section, the current fuel and vegetative conditions would be likely to generate severe fire behavior. Modeling indicated significant torching and spot fires more than half a mile ahead of a running crown fire.

Alternative C is difficult to model with precision, since relatively few trees larger than 16-inch dbh would be removed under Alternative A. The model did not indicate any difference in expected flame length or probability of large tree (12 to 20-inches dbh) mortality between Alternatives A and C. Alternative D appears to reduce the fire hazard to both the nearby communities and the forest itself as much as Alternative A. Within this project area, it provides only slightly less canopy break and almost as much reduction in fire-laddering fuel as Alternative A.

Alternative E has the least reduction in crown fire potential and severe fire behavior, but in most instances it showed improvement over the existing

condition. The fuels analysis shows that there is little difference in fire effects between the proposed thinning of 40 to 120 BA in Alternatives A, C, and D and the 60 to 120 BA thinning in Alternative E. However, the 9-inch thinning limit in Alternative E in areas where no new temporary roads were constructed resulted in unacceptable wildfire potential within 1 mile of the Forest Highlands and Kachina Village residential areas. South of Kelly Canyon, the 9-inch thinning limit maintains high fire potential threat to wildlife and T&E habitat.

Comparison of Alternatives - Issue 5: Road Issues

Issue: Temporary roads lead to increased soil compaction, transport of exotic weeds, and have long-lasting impacts on forest structure, therefore, we request that no new temporary roads be created even if only for the duration of the project.

Transportation System/ Soil Compaction and Exotic Weeds

All action alternatives intend to rehabilitate 17.65 miles of existing roadway by closing, scarifying, and re-vegetating. These areas will not likely return to full productivity for many years, but will become stable after only a few years. The area of rehabilitated roadway amounts to 43 acres.

Alternatives A, C, and D will require 5.75 miles of temporary road. Alternative E requires 2.5 to complete the “intensive zone” thinning (PRD 76, 137f). There was little or no difference described in effect analysis for soil compaction or transport of exotic weeds. Alternative E would result in 8 fewer acres of disturbance than other action alternatives.

The No Action Alternative results in no change.

Table 4. Miles of Temporary Roads, Road Maintenance, and Rehabilitation.

Alternative	Temporary Road	Road Maintenance	Rehabilitated
A, C, and D	5.75 miles, 14 acres	36 miles, 87 acres	17.65 miles, 43 acres
E	2.5 miles, 6 acres	36 miles, 87 acres	17.65 miles, 43 acres

Comparison of Alternatives - Issue 6: Mechanized Equipment

Issue: Mechanized equipment and excessive thinning will increase soil compaction and cause disturbance to wildlife in areas south of Kelly Canyon. The area south of Kelly Canyon should only be treated with hand thinning and was requested for evaluation.

Soil Compaction

In Alternatives A, C, and D, provided that mitigation measures described in the soil and water mitigation section are followed, there will be only minor impacts to on site soil quality and productivity from the proposed activities. Some compaction from skidding equipment will occur in all treatment areas except hand treatment.

In Alternative E, treatment acres and erosion hazard are the same as other alternatives. The difference in this alternative is that only 2,330 acres will be mechanically treated or a little over half of the other alternatives. Consequently, we can expect about half of the impacts to soil quality and productivity to occur. Provided that mitigation measures described in the soil and water mitigation section are followed, there will be only minor impacts to on site soil quality and productivity from the proposed activities.

In Alternatives A, C, and D, the combination of thinning to open the stand and burning will likely result in the promotion of herbaceous vegetation over litter as the major component of ground cover. Stand canopy conditions and fuel loading will be reduced so that the potential effects of intense wildfire are reduced. This effect will be strongly reduced in Alternative E, where thinning only to 9 inches will limit thinning treatments.

South of James Canyon the model indicated that Alternative E would not reduce flame lengths from 7.2 feet nor would it decrease tree mortality from 90(+) percent. The model indicated that a fire occurring in this zone after Alternative E was applied would almost certainly produce multiple spot fires in Kelly and James Canyons. Fires in these canyons would, in turn, generate severe fire behavior, spotting over long distances, and threatening several communities to the north. Within this southernmost zone, the probability of tree mortality would remain over 90 percent in all size classes.

Under Alternative B there are no mechanized equipment effects.

Wildlife Habitat (MIS Species)

Abert squirrel: All alternatives provide greater than 20 percent forage and cover habitat. Considering cover and forage together, Alternative B offers the best quality habitat for Abert squirrel. None of the action alternatives would greatly affect Abert squirrel.

Elk: There would be adequate cover under all alternatives. Best foraging opportunities would occur under Alternatives A, C, and D. Considering cover and forage together, all action alternatives would improve habitat quality for elk, with Alternatives A, C, and D, offering better habitat quality than Alternatives B or E.

Hairy Woodpecker: Considering cover and forage together, Alternatives A, C, and D would offer better habitat quality than Alternatives B or E. The greatest increase in VSS 5 class would occur under Alternatives A, C, and D. This class contains large trees which are recruitment trees for snags.

Northern Goshawk: Considering cover and forage together, Alternatives A, C, and D would offer better habitat quality than Alternatives B or E.

Mule Deer: Considering cover and forage together, Alternatives A, C, and D offer the best quality habitat for mule deer. Thinning of stands, creation

and/or expansion of openings, and broadcast burning will stimulate understory plant growth. This would provide more forbs and browse for mule deer.

Pygmy Nuthatch: Considering cover and forage together, Alternatives A, C, and D offer the best quality habitat for pygmy nuthatch. These three alternatives would increase the percentage of late seral stages of the forest the most.

Turkey: Alternatives A, C, and D would offer the most foraging and nesting habitat based on more created openings. Openings would promote greater amounts and vigor of growth of the understory vegetation and offer more edge effect. Alternatives A, C, and D would also offer the most roosting habitat due to an increase in VSS 5 class (refer to the tables at the beginning of the wildlife section).

Conclusions

Overall, Alternatives A, C, and D would offer better habitat quality for management indicator species (PRD 151). The exception is with Alternative B offering better quality habitat for Abert squirrel.

High fire hazard potential would persist under Alternatives B and E. With the advent of a large wildfire, habitat for forest-dependent management indicator species would be destroyed.

Table 5. Comparison of Alternatives Based on Improving Conditions Stated in the Purpose and Need.

Purpose and Need	Alternative A	Alternative C	Alternative D	Alternative E
Reduce Potential for Stand Replacing Wildfire	Fire potential reduced on 4,266 acres with crown fire potential reduction.	Fire potential reduced on 4,266 acres with crown fire potential reduction; 16-inch dbh limit lessens effect slightly.	Fire potential reduced 4,266 acres with crown fire potential reduction; 18-inch dbh limit will have little to no effect.	Fire potential reduced on 2,328 acres; 9-inch dbh limit will not lessen crown fire potential on other acres treated.
Improve Forest Ecosystem Resilience — Wildfire, Mistletoe, and Bugs.	Ecosystem resilience improved on 4,266 acres. Dwarf mistletoe and bug infestation decreased.	Ecosystem resilience improved on 4,266 acres; 16-inch dbh limit lessens ability to treat dwarf mistletoe.	Ecosystem resilience improved on 4,266 acres; 18-inch dbh limit lessens ability to treat dwarf mistletoe slightly.	Ecosystem resilience improved on 2,328 acres. On 1,898 acres the 9-inch dbh limit will result in 50% less dwarf mistletoe and bark beetle treatment.

Table 5. Comparison of Alternatives Based on Improving Conditions Stated in the Purpose and Need (continued).

Purpose and Need	Alternative A	Alternative C	Alternative D	Alternative E
Maintain or Enhance Old Growth	29.3% of the area designated as existing and developing old growth; 33.5% of the area in VSS 5 and 6 in 50 years.	Manage 29.3% of the area designated as existing and developing old growth; 33.5% of the area in VSS 5 and 6 in 50 years.	Manage 29.3% of the area designated as existing and developing old growth; 33.5% of the area in VSS 5 and 6 in 50 years.	Manage 29.3% of the area designated as existing and developing old growth; 15% of the area in VSS 5 and 6 in 50 years.
Protect Threatened, Endangered and Sensitive Species	The absence of a diameter limit effects bald eagle habitat slightly.	The 16-inch dbh limit effects development of old-growth stand conditions, and is less desirable for promoting old tree development.	The 18-inch dbh limit is better for bald eagle habitat.	The 9-inch dbh limit will result in 50% less old tree development for the future with impacts to promoting Bald Eagle habitat.
Protect Oak Creek Watershed From the Effects of Wildfire	Most reduction in fire potential.	Reduction in fire potential, however the 16-inch dbh limit lessens wildfire reduction slightly.	Most reduction in fire potential.	The 9-inch thinning limit maintains high wildfire potential that could damage the watershed.
Protect Habitat for Species Requiring Dense Stand Conditions	Meets need due to the inclusion of cover patches and deferral along canyon rims south of Kelly Canyon.	Meets need due to the inclusion of cover patches and deferral along canyon rims south of Kelly Canyon.	Meets need due to the inclusion of cover patches and deferral along canyon rims south of Kelly Canyon.	Meets need somewhat less because the 9-inch thinning limit maintains more cover, but places the cover at high risk of loss from wildfire.
Improve Understory Productivity (Desired Condition is 10% Openings)	Grassy openings created on 10% of acres treated and canopy cover conditions improved on 30% of the project area to support a diverse understory.	Grassy openings created on about 5% of the acres treated. Canopy cover improves understory on 30% of the project area. The 16-inch diameter limit reduces the number of grassy openings.	With grassy openings created on 10% of acres treated and canopy cover conditions improved on 30% of the project area. The 18-inch dbh limit reduces the number of grassy openings slightly.	Grassy openings would be created on 1% of acres treated and canopy cover improved on 5% of the project area. Both the 9-inch dbh limit and 16-inch dbh limit reduce the number of grassy openings.
Enhance and Recruit Old Trees and Gambel Oak¹	For both short and long-term management there would be an increase of 225% large diameter trees in 50 years.	For both short and long-term management there would be an increase of 225% large diameter trees in 50 years.	For both short and long-term management there would be an increase of 225% large diameter trees in 50 years.	For both short and long-term management there would be an increase of only 18% large diameter trees in 50 years.

¹ All alternatives retain all existing mature ponderosa pine trees or old "yellow-barked" trees. Temporary road or landing locations to achieve removal objectives will avoid large diameter trees where possible.

Table 5. Comparison of Alternatives Based on Improving Conditions Stated in the Purpose and Need (continued).

Purpose and Need	Alternative A	Alternative C	Alternative D	Alternative E
Improve Conditions for Natural Fire	Treatments reduce wildfire potential to work toward natural fire cycles.	Treatments reduce wildfire potential to work toward natural fire cycles.	Treatments reduce wildfire potential to work toward natural fire cycles.	The treatments do not reduce wildfire potential to work toward natural fire cycles on approximately 50% of the project area.
Improve Vegetative Structural Stage (VSS) Distribution² for Northern Goshawk Habitat	VSS 5 (27.5%) and 6 (4.5%) structural stages nearly meeting VSS 5 and 6 conditions of northern goshawk guidelines in 50 years. VSS 3 is 12% after 50 years.	VSS 5 (27.5%) and 6 (4.5%) structural stages nearly meeting VSS 5 and 6 conditions of northern goshawk guidelines in 50 years. VSS 3 is 12% after 50 years.	VSS 5 (27.5%) and 6 (4.5%) structural stages nearly meeting VSS 5 and 6 conditions of northern goshawk guidelines in 50 years. VSS 3 is 12% after 50 years.	VSS 5 (10%) and 6 (3%) structural falling considerably short of meeting VSS 5 and 6 conditions of northern goshawk guidelines in 50 years. VSS 3 is 12% after 50 years.
Manage Roads, and Recreation to Decrease Fire Starts, and to Better Balance Human Uses With Wildlife Habitat and Watershed and Soil Conditions	All alternatives change some areas to day-use recreation only, adjust dispersed camping to designated sites in some areas, identify and construct trails and trailheads, maintain some roads and close others. Where actions occur, wildlife habitat, soil, and watershed resources are improved. Risk of human-caused wildfire is reduced.			
Improve Riparian Habitat at Kelly Seep	All alternatives improve riparian habitat at Kelly Seep.			
Provide Wildlife Cover Movement Corridors	All alternatives contain dense forest cover habitat and a wildlife movement corridor is maintained.			
Protect Cultural Sites³	Potential damage to sites from wildfire is reduced on 4,266 acres.	Potential damage to sites from wildfire is reduced on 4,266 acres with crown fire potential reduction; 16-inch dbh limit will affect slightly.	Potential damage to sites from wildfire is reduced on 4,266 acres.	Potential damage to sites from wildfire is reduced on 2,328 acres.

² The need for fire reduction resulted in improvement of VSS distribution among VSS 3, 4, 5 and 6. VSS 1 and 2 remain mostly unchanged under all alternatives.

³ All project activities follow mitigation measures designed to protect cultural sites.