United States
Department of
Agriculture

Forest
Service

**Southwestern
Region**

Hyde Park Wildland Urban Interface/Fuels Reduction Project

Public Comment Information

Santa Fe National Forests

Santa Fe County, New Mexico

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410, or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

February 2009

Hyde Park
Wildland Urban Interface/
Fuels Reduction Project

Public Comment Information
36 CFR 215
February 2009

SANTA FE NATIONAL FOREST
ESPAÑOLA RANGER DISTRICT

HYDE PARK WILDLAND URBAN INTERFACE/FUELS REDUCTION PROJECT

Lead Agency: **USDA Forest Service**
Española Ranger District
P.O. Box 3307
Española NM 87533

Responsible Official: **Sanford Hurlocker**
District Ranger
Española Ranger District

For further information, contact: **Dave Isackson**
Española Ranger District
(505) 753-7331

TABLE OF CONTENTS

LIST OF TABLES

Table 1—Summary of Actions in Each Alternative (approximate acres) 17
Table 2—Comparison of Alternatives, purpose and issues 17
Table 3—Comparison of Pre/Post-treatment Vegetation conditions 18
Table 4—Comparison of Post-treatment Wildfire Behavior/emissions 18
Table 5—Comparison of Air Quality/Duration of smoke 18
Table 6—Comparison of other effects 18
Table 7—Other resource effects compared 19
Table 8—Existing Ponderosa Pine (PP) Stand Density 23
Table 9—Existing Mixed Conifer Stand Densities (moister sites) 23
Table 10—Existing Stand Density Index by Sampled Aspect 25
Table 11—Existing Surface fuels (tons per acre) 25
Table 12—Emission Limits 34
Table 13—Estimated Emissions during wildfire 39
Table 14—MIS designated for the Santa Fe National Fores 45
Table 15—Ranking system for MIS evaluations 46
Table 16—MIS Assessment determination 46
Table 17—MIS habitat types affected 47
Table 18—Migratory species that may occur in or near the project area. 51
Table 19—Hydrologic Unit Codes (HUC) 6th and 5th Level 52
Table 20—TES Map Unit and Associated Soil Taxonomy and Soil Surface Characteristics 52
Table 21—Current Predicted Annual Soil Loss 53
Table 22—Predicted Annual Soil Loss 55
Table 23—Relative Cost 57

LIST OF FIGURES

Figure 1—Overall vicinity map 3
Figure 2—Project Area and Vicinity 7
Figure 3—Desired conditions on slope 10
Figure 4—Desired conditions ridgetop 10
Figure 5—Desired conditions for aspen opening 10
Figure 6—Alternative 2 Map 14
Figure 7—Alternative 3 Map 14
Figure 8—Mastication unit at work 21
Figure 9—Typical burn operation in nearby Santa Fe Watershed 21
Figure 10—Two days after broadcast burn in the Santa Fe Watershed 29
Figure 11—Six months after broadcast burn in the Santa Fe Watershed 29
Figure 12—Air Quality Area of Influence 35
Figure 13— $PM_{2.5}$ emissions (micrograms ave. on 24 hour period) during wildfire (> 1,200 acres) 38
Figure 14— $PM_{2.5}$ emissions from prescribed burn/predicted wildfire (24 hour average) 38

1. PURPOSE AND NEED

1.1. Location

Hyde Park Wildland Urban Interface Project area encompasses about 1,800 acres in Santa Fe County, New Mexico, approximately 10 miles northwest of Santa Fe, New Mexico, at T17N, R10 AND 11E, Section 1, 10, 11, 12 and 6. (See Figure 1, vicinity map.). Figure 1 displays the general vicinity of the project area.

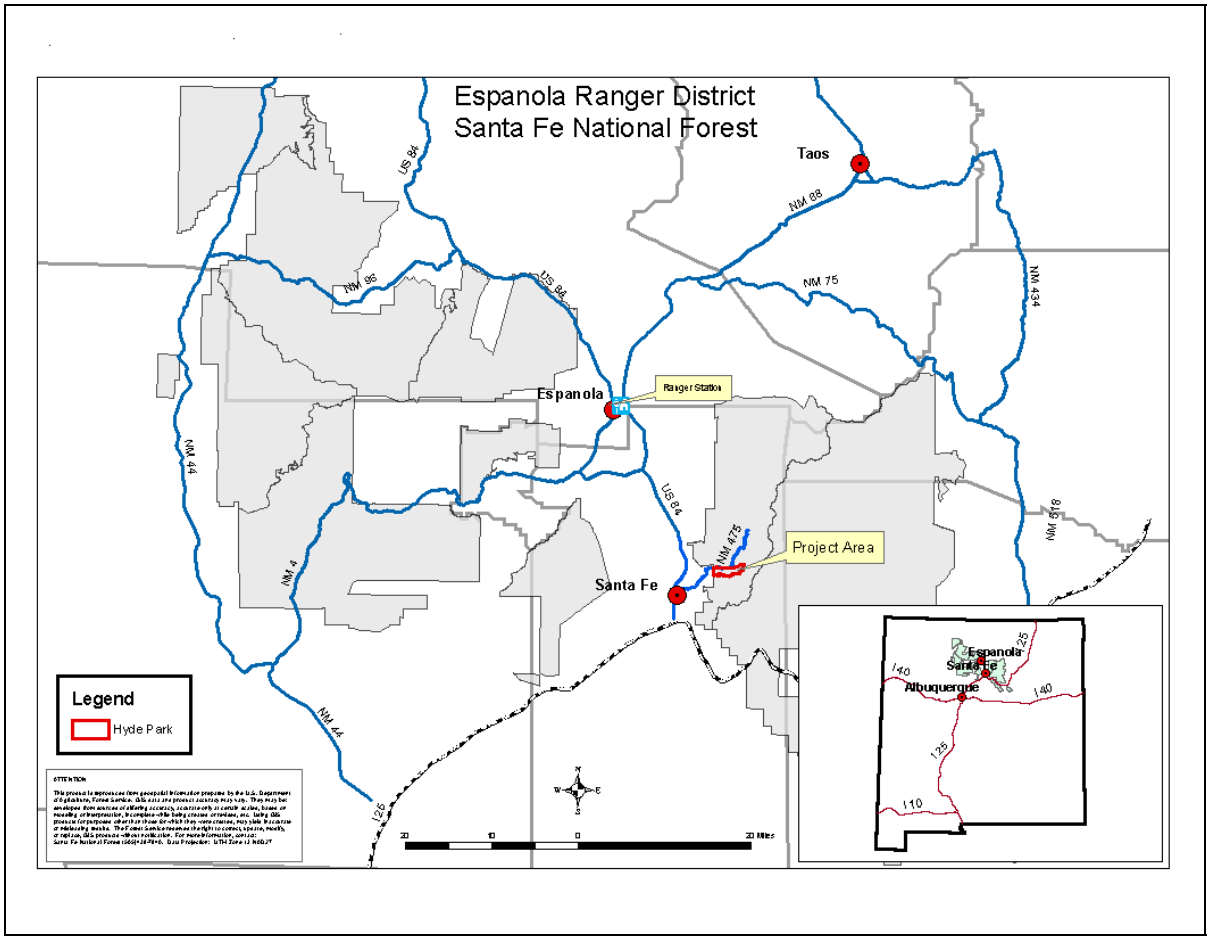

Figure 1—Overall vicinity map

1.2. Background

On February 16, 2006 a decision was made to mechanically thin approximately 860 acres on slopes less than 40 percent using mastication equipment and prescribe burn at low intensity approximately 965 acres, for a total of approximately 1,825 acres. However, an administrative review resulted in a remand of the decision, and the Española Ranger District began to conduct additional analysis and disclosure of the proposal's effects.

In the summer of 2006, the project area was re-evaluated with the intent of providing additional analysis in order to reach a new decision. The original proposal has been refined so that fewer acres would be treated (approximately 1,300 acres) to achieve project objectives, in particular reducing the treated acres on steeper slopes facing south. More densely vegetated north-facing slopes would not be treated under this refined proposal.

1.3. Need for Action

The need for the Project is to reduce the risk that a fire starting in the project area would spread into the tree tops causing what is known as a crown fire. There is also a need to reduce the risk to communities and the environment, and provide for firefighter safety

Favorable conditions for a crown fire include weather conditions (low humidity and high temperatures, strong winds, unstable atmosphere), terrain (steep slopes), and the woody fuel available, in the form of both dead material and live vegetation. Characteristics of these crown-fire inducing fuels include those that are dry, in quantities and arrangement to create heavy fuel loading on the ground. Live vegetation that forms ladder fuels between surface fires and the tree crowns also contributes to this condition. Also, long dry periods reduce the live fuel moisture of living vegetation, which makes it more likely to carry a crown fire. A critical parameter that determines whether or not a surface fire transitions into a crown fire is the height above the ground of the stand's tree crown layer. When a fire transitions to a crown fire, the intensity and rates of spread make firefighting suppression methods ineffective.

Since weather and topography cannot be controlled, this proposed project focuses on the variable that can be manipulated: the structure of the forest. Therefore, this proposal would change the structure to reduce the risk of fire spreading into the crowns. The development and maintenance of a forest relatively free from risk of crown fire is a function of managing the structure of the crown fuels (Agee 1996). Crown fuels are usually thought of as the foliage or needles of trees and shrubs. However they can also include fine branches, lichens, and other small material.

The project area includes or is adjacent to high value resources. The Black Canyon Campground is within the project area and the campground and lodge at Hyde Memorial State Park lies immediately to the north. A crown fire in the project area would threaten both of these campgrounds. Private property, which would also be threatened, lies on the west boundary. New Mexico State Highway 475, a National Scenic Byway, passes along the north boundary of the project providing the only winter access to the Santa Fe Ski Area.

Potential sources for fire starts are common in and around the project area. Of particular concern are dispersed recreation sites along the highway. Under severe fire weather conditions, a fire start along the highway or in the neighborhoods along the western boundary could grow quickly, pushed by the prevailing southwest winds that funnel up the canyon. However, even without human ignition sources, lightning in the spring and summer are common to the area. Over the past 5 years, the Santa Fe National Forest has averaged approximately 140 lightning fires per year. The fire history being conducted in the nearby Santa Fe Watershed by the University of Arizona indicates that prior to 1842 low intensity fires burned through the area every 5 to 10 years. The last large scale fire occurred in 1842 (Balmat 2005) in the upper Santa Fe Watershed and also in the upper Hyde Park project area. Responses in forest structure and composition to altered fire regimes include shifts from predominately fire-adapted tree species, such as ponderosa pine, to non fire-adapted tree species, such as white fir, and from an open forest condition to a dense forest condition.

Within the past ten years large crown fires have become common in the western U.S. Although global climate change (global warming) may relate to this trend, the need to restore these forests to a more fire resistant condition remains. The project adheres to the National Fire Plan's goals of reducing hazardous fuels, restoring fire-adapted ecosystems, and improving fire prevention and suppression (USDA Forest Service 2000 (p. 9), USDA & USDI 2001 (p. 1), USDA & USDI (p. 5)). The fire regime condition class is a rating of departure from the natural vegetation and disturbance regime. The project area is in a condition Class 3; (high departure from natural vegetation, composition, fire frequency, severity, and pattern). This condition class translates to 16 – 22 missed natural fire occurrences. With the loss of these missed fire occurrences, which in the past functioned to clean the forest floor of overgrown vegetation and trees, the vegetation has been growing unchecked. With this increase in fuels, a fire in the area now would have adverse effects to soils and vegetation that have not occurred historically.

In addition to this departure from desired conditions, a fire is likely for the area. A statistical analysis using the computer model PROBACRE determined an annual probability of 19 percent that a fire of 300

acres or larger would occur within the project area. As with any statistical prediction, this is not saying that over a five year period a fire is certain, only that each year there is a 1 in 5 chance of such a fire occurrence. PROBACRE also determined the probability of exceeding a 1,000 acre and 5,000 acre crown fire over the next 20 years is 99.9% and 95.9% respectively. This fire modeling is consistent with the on-ground assessment that the area is susceptible to crown fire initiation and spread (Vegetation/Fuels Report, 2007). Based on experience and model predictions, a crown fire can be expected to burn 900 to 2,900 acres in three hours under extreme fire weather conditions. Extreme fire weather conditions are defined by very low humidity, high wind speeds and dry forest fuels. These conditions, when combined, could result in extreme fire behavior.

Changing the condition class to a Condition Class 1 (long term) and Condition Class 2 (short term) reduces the likelihood that such a fire would occur, although the change cannot completely eliminate the possibility under extreme conditions. Condition Class 1 refers to fire regimes within the natural range where the risk of losing key ecosystem components is low. Condition Class 2 indicates fire regimes that have been moderately altered from their natural range and where the risk of losing key components is moderate.

1.4. Forest Plan Direction

The project area is in Management Area D with emphasis on enhancement of visual qualities and developed recreation opportunities. Management Area D includes primary transportation corridors associated with state highways. These lands provide opportunities for developed recreation and viewing scenery. The project area is located directly south of State Highway 475 and is within an inventoried roadless area (IRA).

The proposed project would be consistent with Santa Fe National Forest Plan forest-wide and management area specific (pp. 112-116) standards and guidelines for soil and water (pp. 78-80), wildlife and fish (pp. 61-66), timber and old growth (pp.68-69A), visual resources (pp. 56-58), and heritage resources (pp. 58-61). The proposed project follows direction for inventoried roadless areas found in FSM 1920, ID 1020-2006-1 (36CFR §§ 294.12(a) & 294.13(a)) no timber will be cut, sold and removed, and no road construction or reconstruction will be authorized.

Fire protection objectives for Management Area D have been predicted through simulations of fire suppression effectiveness. These simulations show that with existing conditions, Forest Plan direction for fire protection cannot be met for Management Area D.

> The suppression objective for Management Area D is to control 90% of the high intensity (4'+ flame length) wildfires at 15 acres or less, and contain low intensity (less than 4' flame length) wildfires at 75 acres or less.

The Forest Plan standard states that to meet this direction, slash from vegetation treatments in and around recreation sites and certain roads be disposed of within one year of project completion. Methods to reduce the effects of slash on fire behavior intensities and rates of spread can include lop and scatter, piling, masticating or burning. Although this standard is intended to apply to logging operations, the proposed Hyde Park project remains consistent with it because it uses the same methods as post-logging brush/slash disposal to reduce the effects of slash on fire behavior (e.g. burning, lop and scatter, etc.).

1.5. Desired Conditions

The desired condition over the long term is a project area where the crown fire hazard under extreme fire weather conditions is low and where fuel conditions result in desirable (low intensity) fire behavior. Should an ignition occur, site-specific objectives for the project area in terms of fire behavior could be described as follows:

- Fewer small trees, defined as those less than 16" in diameter. Tree species would be predominately Ponderosa pine and Douglas fir species. Small trees would be found in the project area, but instead of a continuous distribution, they would be found in scattered clumps across the landscape providing diversity.

- Reduced and or rearranged surface fuels through prescribed fire use, mastication, or lop and scatter. Effectiveness can be measured by tons per acre or changes in the Fire Behavior Prediction System (FBPS) Fuel Model. The FBPS simulates mathematical rates of spread within specific fuel models.
- Flame lengths of 4 feet or less. This would be representative of fuel conditions that support low intensity fire behavior under extreme fire weather.
- A torching index (TI) greater than 35 miles per hour. Effectiveness can be measured by the "torching index" or TI. The TI is the wind speed required to initiate crown fire through torching of individual trees. The higher the TI, the lower the torching hazard. This is accomplished through the reduction of ladder fuels through thinning and or prescribed fire use.
- Reduced crown fuel continuity and reduced crown fuel quantities. The project area would contain openings and breaks in the forest canopy with trees growing in an irregular, clumpy pattern. Effectiveness can be measured in trees per acre and percentage of the area in openings. Effectiveness in reducing crown fuel continuity can be measured by the "crowning index" or CI. The CI is the 20 ft. wind speed necessary to sustain a crown fire once a fire has reached the canopy.
- Scattered stands of regenerating aspen across about 10 percent of the treated area.

1.6. Decision Framework

The Española District Ranger will decide whether to implement the Proposed Action or another alternative that meets the purpose and need, or not at all. The decision will also identify what mitigation measures and monitoring will be required. The decision factors will evaluate the alternatives in terms of the purpose and need and key issues.

1.7. Proposed Action

Within an 1,825 acre project area, the proposed project would thin and prescribed burn approximately 1,300 acres to reduce the risk of crown fire: thinning and burning approximately 1,300 acres the Proposed Action. Figure 2 depicts the Project Area and vicinity. Mechanical thinning would occur on approximately 826 acres with on-site mechanical mastication of thinned trees, followed by prescribed fire. Mastication is the grinding of whole trees into chunks of small but varied size. Mechanical thinning would occur along accessible ridge tops and on slopes less than 40%. Steep slopes adjacent to the Hyde Park Road (State Highway 475) would not be thinned with this method. On approximately 470 acres, where conditions allow, prescribed fire would be used to thin. Prescribed burning would occur in the fall to provide the best burning conditions. The proposed project would start as early as the Fall of 2009 and take one to three years to complete.

The proposed project would create openings where aspen grows now or where evidence indicates aspen had grown but has been suppressed by conifer encroachment. These openings would be no larger than five acres per opening. This would enhance the structural diversity of the area, improving habitat diversity as well. For example, openings offer habitat for songbirds and young aspen shoots for wildlife. Five acres, located south of Black Canyon Campground along Forest Trail 181 would be thinned and the cut material offered to the public as firewood.

The proposed treatments would favor retention of the largest, healthiest fire tolerant species. Because the treatment objectives can be met by thinning the smaller trees, the project proposes leaving trees larger than 16-inches in diameter unless determined on a tree-by-tree basis that a tree must be felled to provide for safety or equipment access.

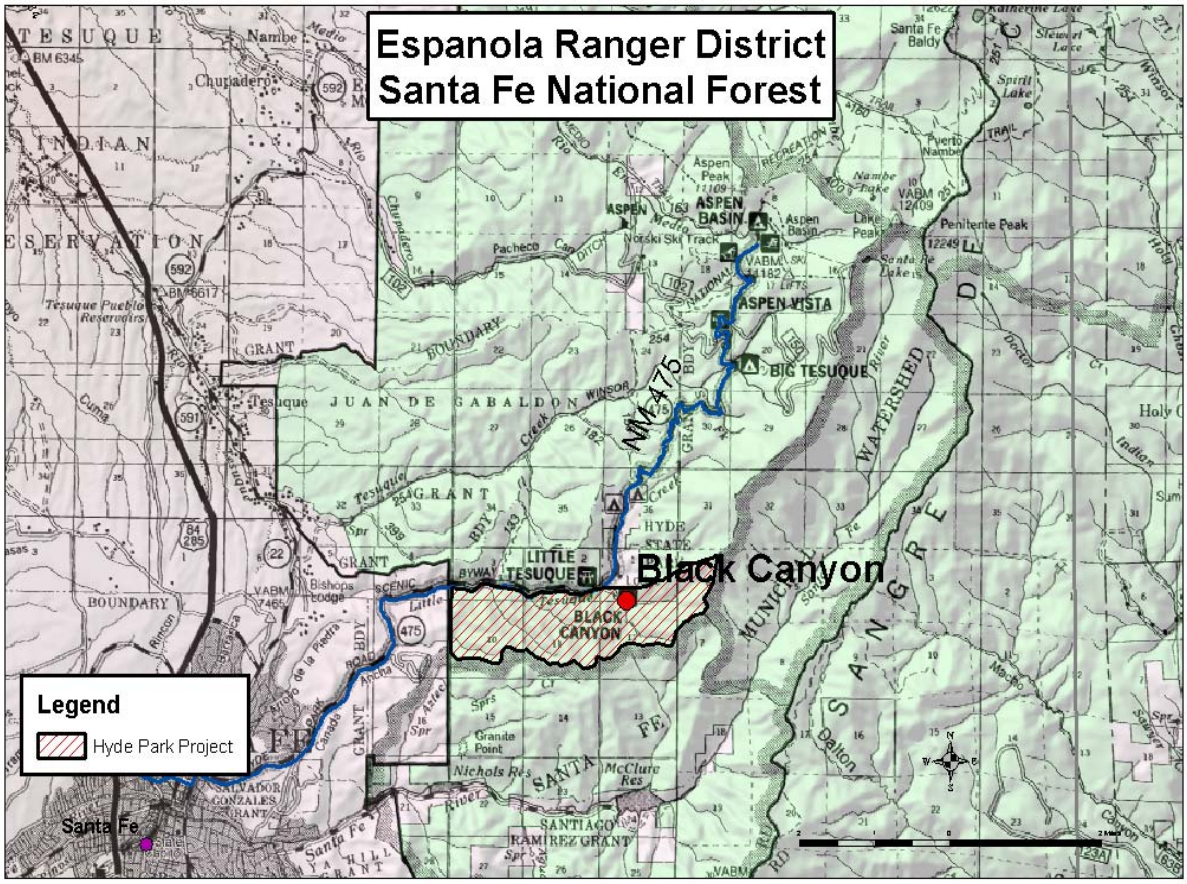

Figure 2—Project Area and Vicinity

Even within the 1,300 acres proposed for treatment, not every acre of ground would be thinned, thus leaving a mix of densities, and not a uniform setting.

The proposed action considered the New Mexico Forest Restoration Principles during design, which in the context of project-scale planning means they offer broad guidelines, not specific prescriptions. Also, they express goals that apply to more than simple fuels reductions projects, such as range and road management. When considering these principles, the planning team looked at how they might apply to the Project. For example, the first principle describes the guideline of engaging a balance and diverse group of stakeholders. Through scoping and outreach, the Hyde Park Project has aimed for that diversity of opinions (next section). As noted above, the main purpose of the project is to reduce the threat of unnatural crown fire (Principle 2). From its inception, the Hyde Park Project has been considered key to a larger strategy of protection of the municipal water supply of Santa Fe. Similarly, a 16-inch diameter limit was applied because this project has a purpose to reduce crown fire potential, and so removing larger trees was not necessary.

1.8. Public Involvement

The public involvement for this project has been on-going since the project was first proposed in July 2005. In the previous analysis, a number of public involvement activities occurred including:

- Listing the project on the Santa Fe National Forest's Schedule of Proposed Actions beginning in January 2003.
- Mailing project scoping letters to more than 120 individual and organization, the City and County of Santa Fe, members of Congress, area Tribal leaders, and other state and federal agencies.
- Hosting an "Open House" on July 20, 2005, where information, ideas and concerns about the project were discussed with about 17 people and Espanola Ranger District staff.
- Providing a second public comment period in November 2005, where additional comments were received and subsequently considered.

After the Española District Ranger decided to conduct additional analysis and prepare an Environmental Assessment, another public scoping opportunity was initiated with distribution of a scoping letter on July 21, 2006.

During the July/August 2006 scoping period, public concerns associated with the project were collected and in general, fit into the following themes:

- Health effects from smoke produced by the proposal.
- Risk of escaped prescribed fire and risk to urban areas adjacent to the project area.
- Questions arose about the need to cut trees 9 inches or greater
- Concerns were raised about the effect this project has on climate change/global warming
- The effectiveness of erosion control methods was questioned.
- A concern was raised that this project must adhere to NM Forest Restoration Principles
- A concern was raised about the cumulative impacts of this project when considered with others.
- A concern was raised about how this project would affect the efficacy of monitoring of the Santa Fe Municipal Watershed Project, occurring in the adjacent drainage. A set of control points from the Santa Fe Watershed Project have been set up along Black Canyon trail and so any treatment has potential to affect those points.

As a result of public scoping, the proposed action has been refined, and issues have been identified to guide development of mitigation measures and alternatives.

1.9. Issues

As a result of interdisciplinary team planning and public involvement, a set of issues was developed. Issues are points of discussion, debate or dispute regarding the environmental effects of an action or set of actions. This allows the planning efforts to concentrate on issues that are important to the proposed action in question, rather than gathering needless detail.

The interdisciplinary team analyzed the preliminary issues raised during scoping and separated them into **"significant"** (also called Key Issues) and **"other"** issues, in accordance with Council for Environmental Quality (CEQ) NEPA regulations in Sec. 1501.7 and 1506.3. Probable effects of the Proposed Project that can not be mitigated or resolved otherwise were defined as key issues and used to develop an alternative or alternatives that might better address those effects. Other issues are those determined through analysis to not be significant, with a brief discussion as to why they will not have significant environment effects. Other issues are resolved through mitigation and/or monitoring; compliance with the Forest Plan, laws, regulations or other broader level decision; are outside the scope of the analysis, or not relevant to the decision to be made.

1.10. Key Issues

1.10.1. Air Quality/Human Health and Safety

Use of low to moderate intensity prescribed fires will produce smoke. Even when following New Mexico State smoke management regulations to keep smoke within the regulatory standards for air quality, smoke may temporarily reduce the air quality for the City of Santa Fe and surrounding communities. A reduction in air quality has particular potential adverse health effects to a segment of the population who are sensitive to smoke. In addition, smoke from prescribed fire has potential to adversely affect air quality in the nearby Pecos Wilderness, a Class I Airshed.

- **Evaluation Criteria:** The effects of smoke will be assessed by the particulate matter emissions, measured in 2.5 micrograms per cubic meter averaged over a 24 hour period as a measure of compliance with state requirements. Smoke is composed of various gases and particulate emissions. Over 90 percent of particulate emissions from prescribed fires are 10 microns (PM-10) or less in diameter. Therefore estimating the amount of particulate emissions will give an indication of how severe smoke effects would be, if the smoke reaches the City of Santa Fe.
- **Evaluation Criteria:** The effects of smoke will also be assessed by estimating the duration of smoke being produced as a result of either a wildfire or prescribed fire. Because a number of factors contribute to the length of this duration, the criteria is more qualitative than quantitative, described as short duration (less than a day); medium duration (2 to 10 days); and long duration (11 days or longer).

1.11. Other Issues

Concerns about wildlife habitat, recreation, and escaped fire were identified during scoping. They are considered "Other Issues" because the probable effects were determined to be either beneficial or adequately mitigated to minimize resource impacts, and therefore require only a brief analysis and discussion of effects (40 CFR § 1501.7(a)(2) and (a)(3).

- Recreation/Visual/Aesthetics: All actions must meet and be managed for a visual quality objective (VQO) of retention. Retention means that management activities are not visually evident to the forest visitor for more than a short duration (usually considered one year). Forest Plan places management emphasis on visual quality and developed recreation opportunity.
- Cultural Resources: A heritage resource survey (using a sample method) was conducted following pre-consultation with the State Historic Preservation Office. No heritage resource sites were found. Several historic isolated occurrences were located, described and documented. They require no additional management consideration.
- Wildlife/MIS/TES species: Any action must consider the impacts to ESA threatened and, endangered, or FS sensitive species animals or plants. In addition because the project area lies within Management Area D of the Santa Fe National Forest Plan the project would improve wildlife habitat thereby enhancing wildlife viewing opportunities.
- Public Safety: Potential impacts to public health and safety from project activities and results of the treatments need to be considered.
- Invasive Plants/Noxious Weeds: Mitigation measures will be used to reduce the chances of introduction and spread of invasive species of plants.
- Soil and Water: All actions must meet appropriate water quality standards, but taking no action at all would likely result in degraded water quality as well, because of the post-fire effects.
- Escaped prescribed burn: All actions must insure that prescribed burns or fires do not escape from established control lines.

In addition to these issues, two other areas of concern have been raised that will be disclosed during this analysis:

- Inventoried Roadless Area: Because the project area lies within an inventoried roadless area (Type 1c and Type 1b), all proposed activities must comply with the 2001 Roadless Conservation Rule. Road

building and timber harvest are prohibited under the rule. In addition, proposed actions need to consider how they may affect the characteristics that give this area its roadless character may be effected.

- Santa Fe Municipal Watershed study plots: Thinning and prescribed fire use within the existing Santa Fe Municipal Watershed study plots may make it difficult or impossible to correlate the pre-treatment data with post-treatment data unless some calibration with the existing/new treatment plots is done.

Figure 3—Desired conditions on slope

Figure 4—Desired conditions ridgetop

Figure 5—Desired conditions for aspen opening

Figure 3, 4 and 5 show three photographs of desired conditions in the Santa Fe watershed that the Hyde Park would seek to reproduce on slopes, ridgelines and aspen. Figure 3 shows typical existing conditions (density and tree size) on the right side of the photograph.

2. ALTERNATIVES

This section of the environmental assessment describes the proposed action, including mitigation measures and monitoring requirements of the proposed action. This section also describes the no action alternative and one action alternative considered in detail. Alternatives considered but eliminated from further analysis are also discussed.

2.1. Alternatives Considered but Not Analyzed in Detail

2.1.1. Thinning with helicopter removal.

An alternative that would have used helicopters to remove forest products was considered, but was eliminated from detailed study. Although this alternative would allow removal of some saleable materials without building roads, it would have been impractical for a number of reasons. First, helicopter operations require construction of large areas for storage of cut trees (landings). There are no areas within a practical radius of the project where large areas can be cleared. Second, Federal Aviation Safety Standards prohibit helicopters from flying with external loads over residential areas and highways. The location of State Highway 475 runs along the most likely flyways for hauling material, which would severely limit operations if the highway to remain open, or require closure of the road during helicopter operations. Finally, even if these restrictions could be resolved, removing the small diameter material needed to meet fuel reduction objectives would not produce a product generally used because most of the material is less than 3 inches in diameter. Whole trees would have to be removed to meet the fuel reduction objective. Experience with helicopter logging indicates the amount of small diameter material coupled with the lack of large diameter material would make this method economically impractical.

2.1.2. Mechanical thinning and mastication limited to ridge tops.

Treating only the ridge tops was considered as an alternative, but not studied in detail because this approach would not change the structure enough to reduce the crown fire potential. Research indicates the construction of fuel breaks and spatially restricted fuel management zones, when used alone, do not influence high intensity crown fires. Fire brands can also easily travel over narrow treatment areas and so a lack of change in the fuel continuity over the steeper slopes of the project area would not achieve the purpose.

2.1.3. Cut only smaller trees

Two alternatives were considered that would have limited the size of trees to be cut in to either less than 4 inches or 9 inches in diameter respectively.

Cutting only trees 4 inches in diameter and smaller has a negligible effect on reducing ladder fuels, which are a key contributor to crown fire initiation. In the project area, trees larger than 4 inches in diameter, especially mixed conifer have branches that extend to the ground. These low lying branches comprise the majority of ladder fuels in these mixed conifer stands. In more technical terms, thinning trees less than 4 inches in diameter would not reduce crown bulk densities because the small trees are not tall enough to contribute to crown bulk densities, which is a measure of the quantity of the upper canopy fuels. Removing these small diameter trees would make only a small contribution to reducing the risk of crown fire potential. Even if the trees greater than 4 inches in diameter were cut and larger trees limbed, minimal change in crown bulk density would occur and so no change in expected crown fire potential would result.

A second alternative would have limited the size to less than 9 inches. This alternative would have been effective at reaching specific objectives in some stands, but the 9-inch diameter limit would not provide sufficient flexibility across a landscape to meet the project's purpose, which is to reduce the likelihood of a crown fire getting started. Also, in order to regenerate aspen, some of the larger trees (9-16 inches diameter) would have to be removed.

2.1.4. Citizen's Alternative

One proposal was offered by a group during scoping, which was offered as a Citizen's Alternative. The proposal calls for various strategies to be followed, from broad-scale steps to specific prescriptions and mitigation measures. The broad-scale steps suggested were completed early in the project's planning and so were not incorporated. For example, delineating stands and gathering the project area's fire history have already been performed to Forest Service protocols, if not in the detail called for in the Citizen's Alternative.

The Citizen's Alternative also made a reference to the following principles: 1) retain all trees of significant size and age, generally 16 inches in diameter or larger; 2) place highest priority (for treatment) on stands where there is a history of low-severity fire and good evidence that fire regimes have been altered; 3) tailor treatments to site-specific conditions; 4) restore fire as a keystone process; 5) strive for heterogeneity at all scales to protect habitat and enhance biological diversity; 6) apply restoration treatments incrementally with minimal impact to aquatic ecosystems; 7) commit to long-term monitoring and adaptive management programs and; 8) burn or otherwise treat thinning and pruning debris (activity fuel) to reduce fire risk. The Hyde Park Proposed Action and alternatives considered these general principles in development.

Similarly, a number of the suggested objectives have also been incorporated. For example, the project area lies in ponderosa pine plant association as well as the lower elevation mixed conifer associations. Both are in a Condition Class 3, meaning they are substantially out of the desired condition for these stands. Higher elevation mixed conifer and spruce fir are not proposed for treatment as part of the Proposed Action, and so a separate alterative to address these areas was not developed.

Where the Proposed Action varies from the Citizen's Alternative is in the specific application of many suggested prescriptive measures. For instance, measures in the Citizen's Alternative that use pre-fire contour felling and/or bundling small trees to make contour soil catchments were reviewed, but they were not included as project design features. Experience in the Santa Fe Watershed Thinning Project on adjacent lands indicates that a matrix of cut trees, tree trunks at all angles to the slope provides good results at stabilizing slopes without the need to use the labor intensive hand placement. As another example, use of mastication equipment would have been limited in the Citizen's Alternative. Experience in the adjacent Santa Fe Watershed with this type of equipment shows that the effects the Citizen's Alternative seeks to avoid are not occurring.

Finally, a number of prescriptions in the Citizen's Alternative called for larger scale actions such as establishing fuel discontinuity network and establishing an extensive monitoring, research and adaptive management programs. Although these suggestions could be considered in a larger context, they have not been incorporated in the proposed action for the Hyde Park Project because larger scale monitoring is conducted at the Forest Plan level context rather than project-specific planning. Project specific monitoring will occur to assure the actions proposed are carried out according to plan. Further, the "Fire-wise Program" that informs residents of the risks of living in a wooded environment are supported by the Forest Service already, and they would continue whether or not the proposed Hyde Park Project were to be implemented.

2.2. Alternatives Considered in Detail

The Proposed Action was developed to meet the purpose and need, as described in Section 1. Issues identified during scoping were used to develop a range of alternatives. Further refinement of the proposed action and alternatives occurred in order to assess the effects of these alternatives. Three alternatives were analyzed in detail: No Action and two action alternatives.

Alternative 3 was developed to address the key issue of 'air quality/human health and safety' identified during scoping. Table 1 displays a comparison of actions proposed in each of the alternatives. Table 2 shows a comparison of how the alternatives meet the purpose and need for the project, Forest Plan Standards and Guidelines for Scenic Byway, and IRA Guidelines. Section 3 of this document describes in detail the environmental effects of these alternatives.

2.2.1. Alternative 1 – No Action

There would be no vegetation or fuel reduction treatments for the foreseeable future. When considered as "no change" from the existing condition, the No Action Alternative provides a baseline against which other alternatives may be compared.

2.2.2. Alternative 2 – Proposed Action

Approximately 826 acres within a 1,300 project area would be thinned and the material masticated on site. Mechanically treated areas would be located along the tops of ridges and on slopes less than 40 percent. The Santa Fe National Forest is using the same methods of treatment in the Santa Fe Watershed with excellent results and minimal adverse affects. In addition to the mechanical thinning, 470 acres on slopes greater than 40% would be burned on the south, east and west facing slopes. There would not be any mechanical treatment on these 470 acres. The slopes adjacent to State Road 475 would be excluded from thinning and burning. The end result would be a matrix of treated and untreated areas.

Openings up to 5 acres would be made where there is aspen or evidence indicates aspen was present in the past. Approximately 10 percent of these masticated areas (about 80 acres) area would be in openings, or about 30 or more openings scattered throughout the project area.

Immediately southeast of Black Canyon Campground is Forest Service Trail 181 that follows the valley bottom up slope on a scenic loop. Near the campground exists an aspen stand of approximately 5 acres with an understory of mixed conifer in the canyon. The proposal would cut and pile the slash of the conifer understory, then open the area to the public for fire wood. The piles would then be burned.

Thinning across the project area would create a clumpy tree distribution favoring the healthiest trees in all size classes. Fire tolerant species such as ponderosa pine would be preferred leave trees. Trees larger than 16 inch diameter at breast height (dbh) would not be cut except for equipment access (expected to be rare since the equipment is very maneuverable) or for safety of woods workers (more likely, but not expected to be often).

2.2.3. Alternative 3 –No Prescribed Fire Alternative

This alternative responds to the potential effects prescribed burning would have on air quality and public health/safety. It would also ameliorate the concern about an escaped prescribed fire. Areas to be masticated in Alternative 2 would also be masticated in this alternative, but to avoid the potential effects of fire and smoke, fuels on the 470 acres proposed for prescribed burning in Alternative 2 would be thinned by hand (e.g. chainsaws and hand tools). Material cut would be lopped and scattered to a fuel bed less than 24 inches from the ground. The cut material would be left to rot.

The size, number and location of openings would be the same as in Alternative 2 but the cut material would be lopped and scattered instead of burned. The five acre stand of aspen south of Black Canyon Campground along Forest Trail 181 would be thinned to the same specifications as in Alternative 2, and this fire wood would be offered to the public. The limbs and tops would be lopped and scattered and left to rot.

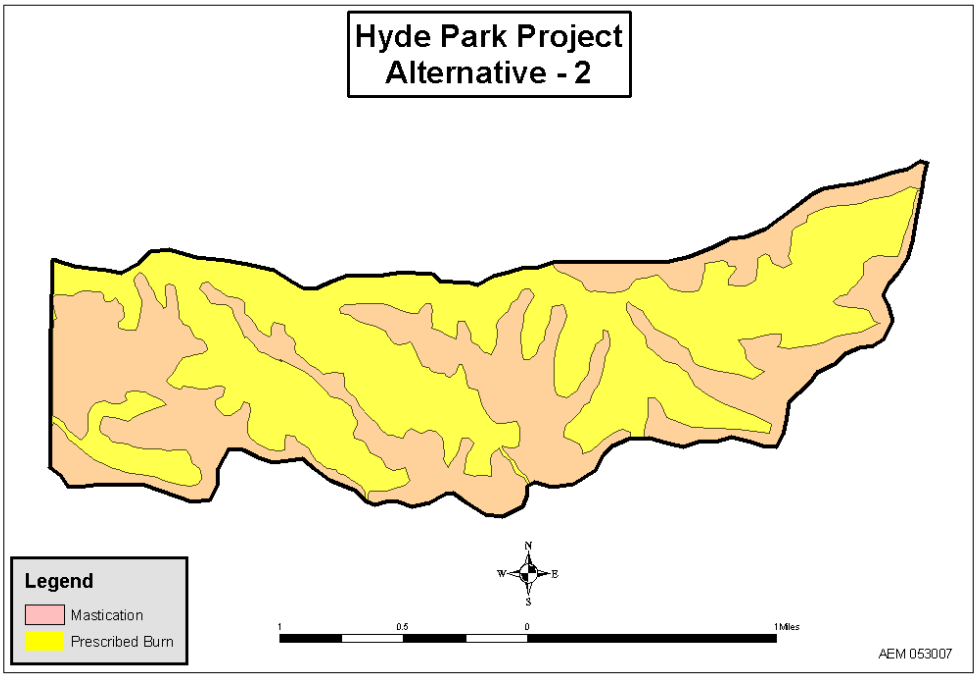

Figure 6—Alternative 2 Map

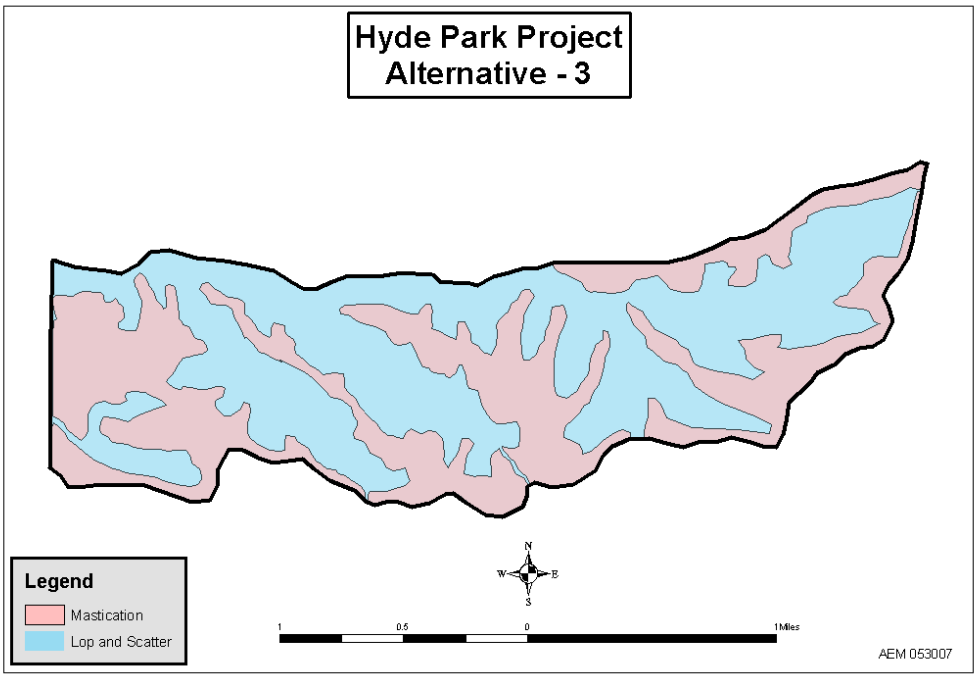

Figure 7—Alternative 3 Map

2.3. Mitigation and Monitoring

The mitigation and monitoring measures contained in this section are common to all action alternatives unless otherwise noted. Mitigation measures are prescribed to avoid, minimize, or compensate for adverse environmental effects that may occur from project implementation. Monitoring determines whether the treatments and mitigation measures were implemented as planned.

2.3.1. Air Quality/Human Health/Safety

Most of the following measures are derived from the USDA Forest Service NEPA Air Quality Analysis Desk Reference, 1995, and the EPA Prescribed Burning Background Document and Technical Information Document for Best Available Control Measures, 1992. Other sources include the SFNF Plan and Best Management Practices.

- Prescribed burning will be coordinated with the State of New Mexico, in compliance with its smoke management plan, to minimize the effects on air quality. Monitoring would comply with NMED direction.
- Activities will be planned to meet applicable Federal, State and local air quality regulations, including protection of Class I Airsheds such as the Pecos Wilderness (Forest Plan, page 80).
- Minimize the amount of soil inadvertently mixed in slash piles to reduce smoldering.
- Notify local cooperators, agencies and public in advance of prescribed burning, through radio, TV, newspapers, and/or personal contacts. This would allow people time to respond to temporary changes in air quality. In addition to these announcements and prior to implementation of a prescribed fire, the District would use a “Call List” to inform people who ask to be informed of the smoke producing activity.
- Post warning signs, where activity may be taking place. This includes highways, trails and when appropriate, Hyde Memorial State Park.
- Close affected trails and work areas to the public that will be affected during project implementation.
- To achieve the objectives described in the Proposed Action, implement prescribed fires incrementally under appropriate conditions to achieve the objectives described in the proposed action. These conditions include (but are not limited to) current and predicted weather (wind, ventilation, temperature, and humidity), fuel moisture, and available resources (personnel and equipment). Accumulation of smoke from previous days burning is also considered.

2.3.2. Recreation/Scenic Byway/Visual Resources

- Treatments adjacent to Black Canyon Campground will be accomplished outside the summer high-use season (mid-May through Labor Day) To minimize disturbance to Black Canyon trail users, the District will issue short term permits to remove firewood and vigas that will be active outside the summer high-use recreation season
- To maintain visual quality in and around Black Canyon Campground, tree removal will be done by hand within and immediately outside the campground. Mechanical treatments will be restricted to the upper slopes of the area. A map of these areas is located in the project record.
- To meet Management Area D retention standards along Forest Trail 181, treatments for 100 ft. on either side of trail will not be evident after one year
- To minimize trail damage, motorized access related to project activities will be restricted to dry weather
- The trail will be opened up as needed on week-ends in the fall for public wood gathering.
- To dispose of wood from thinning near the campground, campfire collection will be allowed.

2.3.3. Cultural Resources

- Should any previously undocumented cultural resources be discovered during project activities, all work will be stopped in the immediate vicinity of the sites and will not be restarted until authorized by the Ranger District or the Forest Archaeologist.

2.3.4. Wildlife/MIS/TES Species

- For cavity nesting wildlife species, snags larger than 16 inches in diameter, unless they are a safety hazard, will not be cut.
- The largest 5 logs per acre, at least 15 ft. in length, will be left. When no large trees are down then cut 2.2 trees per acre to meet objective.
- If any ESA threatened and endangered, or FS sensitive species are discovered during project activities, work in the immediate vicinity of the site will cease until a Forest Service wildlife biologist has investigated and recommended the appropriate protective measures.
- If an active Northern goshawk nest is found, no work will be done within 30 acres of the nest site.
- For raptor perch and roost trees retain all trees within a 200 foot wide stand that have both open crowns and are a minimum 20 inches in diameter on major ridges, along cliffs and in openings. Trees can be living or dead.
- Retain at least two groups of trees per acre with a minimum diameter of 12 inches. Minimum number is 3 for a group. (*Management Recommendations for the Northern Goshawk in the Southwest United States USDA 1992)*
- To protect Abert's squirrel's nest trees will not be cut, nor will any adjacent large trees with diameters equal to or greater than the nest tree with interlocking crown.
- To provide plucking posts for raptors and feeding/lookout stations for small rodents such as chipmunks, two or three stumps (minimum diameter of 12 inches) per acre of thinned trees will be left cut 12" high. (*Stacey 2007)*
- For cavity nesting or roosting wildlife species, retain 220 snags (or potential snags), per 100 acres 10+ dbh on a minimum of 40% of the units on edges of openings. Particular attention will be given to selecting for snag recruitment trees with dead or broken tops, heart rot, and lighting scars.
- No log or wood piling will be allowed in riparian areas (those dominated by riparian hardwood vegetation), wetlands (usually dominated by carex, equisetum, or juncus spp.), or natural meadows.*)*.
- To provide for cover and foraging ares for flammulated owls and neotropical migratory birds maintain two thickets of 5-20 smaller diameter trees of any native species. (*Stacey, 2007).*
- Willow, alder, and cottonwood trees will be favored for retention in riparian areas.
- To the extent feasible, Gambel oak (*Quercus gambeli*) and native shrubs such as wild rose *(Rosa spp.),* mountain mahogany *(Cercocarpus montanus),* Rocky mountain maple *(Acer glabrum),* currants *(Ribes spp.)* raspberry *(Rubus spp.),* will be retained in uplands**.** (*Stacey, 2007).*
- Expand aspen stands where possible by reducing shading and competition from conifers both peripheral and within aspen stands. Cut out conifers (or use mechanical treatment), from the understory and use prescribed burns to stimulate sprouting of aspen). *(Santa Fe National Forest Plan Replacement p. 74*). Per Allen, should be in Proposed Action description for aspen.

2.3.5. Invasive plants (noxious weeds)

- To reduce the likelihood of introduction and transport of non-native invasive species into the project area, all tracked vehicles will be pressure washed prior to entering the Project Area.
- Other vehicles shall be inspected for evidence of mud and vegetation, which shall be removed before entering the project area at the Black Canyon Campground. Weed prevention materials would be handed to wood cutters as part of the permitting process.

2.3.6. Soil and Water

- Mechanized equipment will operate on slopes less than 40% (defined by TEU mapping units). This equipment is restricted to periods when soil moistures are low enough to prevent soil compaction/displacement or when soils are adequately frozen during winter months (if it applies).
- Travel on access routes and trails will be prohibited during periods of wet weather when use results in rutting of road/trail surface or adverse soil erosion/sediment transport.
- To prevent access routes and trails on steep slopes from collecting runoff and contributing to erosion, BMPs such as water bars will be implemented. As necessary, certified weed-free seed will be used to reduce erosion potential.
- Maintain low to moderate severity fire during broadcast burning to maintain the organic layer.
- Non-conifer trees and shrubs that provide bank stability will not be cut in the 5 acre riparian treatment area northeast of Black Canyon Campground.
- All riparian areas will be managed in accordance with Forest Plan guidelines (SNF Forest Plan P. 79). Riparian ecosystems are distinguished by the presence of free water within the common rooting depth of native perennial plants at least seasonally (10 percent of the time or more). Riparian areas are normally associated with seeps, springs, marshes, ponds, or lakes. They commonly comprise a mixture of water (aquatic) and land (phreatic) ecosystems. “Free water” occurs from ground water saturation or concentration of downslope-moving subsurface water. Plants often reliably indicate this condition. In the absence of reliable indicator plants, use soil properties or plant communities. FSH 2509.23 Riparian Area Handbook. Plants that require at least seasonally free water for all or part of their live cycle indicate a riparian ecosystem. Exhibit 1 lists some of these indicator plants. FSH 2509.23 Riparian Area Handbook.

2.4. Comparison of Alternatives

The following tables compare the Alternatives considered in detail. Tables 1 through 7 summarize information found in Section 3 below.

Table 1—Summary of Actions in Each Alternative (approximate acres)

Activity Description	Alt. 1	Alt. 2	Alt. 3
Thinning & mastication followed by prescribed fire on slopes less than 40%	**0**	**826**	**0**
Thinning & mastication on slopes less than 40% with no prescribe burning.	**0**	**0**	**826**
Chainsaw thinning w/lop and scatter of slash on slopes greater than 40%	**0**	**0**	**470**
Prescribed fire on slopes greater than 40% with no initial thinning.	**0**	**470**	
Prescribed fire maintenance treatment	**0**	**1,296**	**0**
Total Treatment Acres	**0**	**1,296**	**1,296**

Table 2—Comparison of Alternatives, purpose and issues

	Alt. 1	Alt. 2	Alt. 3
Total Acres addressing Purpose and Need	**0**	**1,296**	**1,296**
Meets key issue of air quality/human health and safety	**Yes, if no wildfire. Wildfire would expect to have long duration smoke production, which would have adverse effects**	**Yes. Some smoke created during Rx burns, but falls within standards. Consecutive burn days keep durtion short-medium. Wildfire likely to be contained at short-medium duration.**	**Yes, if no wildfire. Wildfire would expect to have long duration smoke production, which could have adverse effects. Long duration wildfire would be more likely than Alt. 2, about the same as Alternative 1 during first 4 years.**

Table 3—Comparison of Pre/Post-treatment Vegetation conditions

	Alt. 1	Alt. 2	Alt. 3
Trees per Acre	200-1000	40-60	30-50
Average Diameter dbh (inches)	4-5	7-10	9-15
Basal Area (sq ft)	81-94	50-80	40-61
Vegetative Structural Stage (VSS)	2	3	3
Crown to Base Height (ft)	5	6-10	5-19
Crown Bulk Density (Kg/m3)	0.05-0.08	0.03-0.04	0.01-0.02
Stand Density Index (%)	40-50	25-30	20-25
Canopy Cover %	50-60	35-40	30-40

Table 4—Comparison of Post-treatment Wildfire Behavior/emissions

	Alt. 1	Alt. 2	Alt. 3
Surface Fuel Loading (total for treatment area, tons/acre)	65	31	75
Crown Fire Likely	Yes	No	Yes (for 4 years following thinning)
Crowing Index	Moderate	Low	Low
Torching Index	High	Moderate	High (for 4 years following thinning)
Rate of Spread (chains/hr)	18	3	44 (for 4 years following thinning)
Flame length (feet)	5	2	11 (for 4 years following thinning)
Wildfire contained after one hour?	No	Yes	No

Table 5—Comparison of Air Quality/Duration of smoke

	Alt. 1	Alt. 2	Alt 3
Meets Air Standards	No	Yes	No
Duration of wild fire first burning period	30 hours	12-20 hours	30 hours
Wildfire Emissions (2.5 µg/m³) during burn period	0.05 to 0.12	0.04 to 0.07	0.09 to 0.16
Duration of Prescribed burn period	0	10-12 hours	0
Prescribed Fire Emissions (2.5 µg/m³) during burn period	0	0.06 to 0.10	0

Table 6—Comparison of other effects

Topic	Alt 1	Alt 2	Alt 3
Probability of fire start	Same in all alternatives (19 percent per year)		
SDI	38-59%	18-30%	18-25%
Surface fuels	6-17 tons per acre	10-15s	10-17
Fuel Model change	8/9 to 10	no change	8/9 to 11 immediately following thinning and then changing to a mix of 8,9, and 10 within 4 years
VSS	2,3	Move to 3, 4, 5	Move to 3, 4, 5
Crown Bulk	0.06 – 1.0 KG/m ^{3}	.01 - .03 KG/m ^{3}	.03 - .08 KG/m ^{3}
Canopy-base-height	2- 4 feet	7-21	4 – 11
Surface fire behave rate	19 chains per hour	3	44
Surface fire flame	5.4	2	11
Suppression effectiveness (initial attack likely effective in first hour)	No. Assume 2 Type 1 crews (hotshot). Limited air support because of fire behavior.	Yes. Assume 1 Type 1 crew and air tanker.	No. Assume 2 Type 1 crews and air tanker.
Crowning index	22 - 28	33 – 45	31 - 40 (figures are for 4 years after treatment)
Torching index	0 - 22	58 – 71 in masticated area./ 10-12 burned only areas	58 - 71 masticated areas. 0 - 68 lop/scatter (figures are for 4 years after treatment)

Table 7—Other resource effects compared

Other resources	Alt. 1	Alt. 1 with fire	Alt. 2	Alt 3
Recreation closures	No closures.	Yes. Likely closed for 15 year of recovery time.	Yes, for short durations when work occurs. Timing restrictions will reduce impacts on hikers during high-use season.	No, unless wildlife occurs. Likely to have effects similar to Alt. 1 with fire.
Screnery	No Change	Redefine/reshape existing landscape character. Dense forest to patchy and open long term. Short term (2-3 years) should recover as grasses and shrubs reestablish.	Minimize impacts from SR 475 and Trail 181 through mitigation. Short duration impacts from thinning along trail (less than a year). Visual recovery after 2-3 growing seasons.	Similar to Alt. 2, except no black or red needles If fire occurs, effects would be similar to Alt. 1
Meets Forest Plan Standards and Guidelines for Management Areas D for Scenic Byway (fuels reduction standard)	No	No	Yes	Yes 20% less than Alt. 2
Cultural Resources	No Effect			
Wildlife (TE)	No change short term. Aspen loss would continue so that species associated with aspen would decline. Large tree loss would continue over long term.	Loss of habitat for species that require in tact forest. Benefit to species that use more open habitats	Benefits, more diverse habitat. Stimulate herbaceous understory. Create more forage as grasses, leaves, flowers and seeds. Burning would limit cover for small mammals for a short period (less than a year), but subsequent growth would provide more cover.	Similar to Alt. 2, except on lop/scatterd acres where wood on ground slows forage production, and could slow fawn movement If wildfire occurs, similar effects as Alt. 1
Wildlife (Sensitive)	No Change	Loss of habitat for northern goshawk with loss of large tree groups	Thinning would move stands toward VSS 4/5, more benefit to goshawk habitat and prey species (small mammals).	Similar to Alt. 2 if no fire. With wildfire, similar to Alt. 1 with fire.
Wildlife MIS	No change	Loss of habitat	New herbaceous plant and shrub growth would benefit many MIS. Snag dependent would not change because of retention of larger trees and snags.	Similar to Alt. 2, unless fire.
Wildlife Migratory birds	No change	Loss of habitat	No adverse effects. Actions to open forest improve habitat conditions	Similar to Alt. 2, unless fire.

Other resources	Alt. 1	Alt. 1 with fire	Alt. 2	Alt 3
Soils	**No change Soil loss estimate of 800 tons per year**	**Soil loss of more than 6,000 tons per year**	**Where masticated, reduce current rates 20% by adding cover on prescribed burn acres increase by 27 percent (about 1000 tons per year) for the first year, returning to more normal as grass establishes cover.**	**Similar to Alt. 2 on masticated acres, and lop/scatter, reducing to 700 tons per year If fire occurs, would have soil effects similar to No action.**
Economic	**No Cost**	**$15 million suppression, restoration**	**$400,000 to treat assume fire suppression makes initial attack more effective and so costs low for fire starts.**	**$560,000 $10 million suppression, restoration costs**
Inventoried Roadless	**No change**	**Reduces habitat, water supply, recreation and landscape character. Diversity over time would be increased as soil and vegetation recovers**	**No effects of this alternative impair the contributions made to soil, water, air; public drinking water; plant/animal diversity; habitat for TES; and recreation of primitive/semi primitive nature**	
Santa Fe Watershed Monitoring Plots	**No Change**	**Continued no change in the plots would continue to provide data. A fire in the area would change that baseline. Additional plots have been established to provide other control points**	**Control points have been established for the wildlife monitoring and so these are no longer necessary for the continued usefulness of that monitoring. Monitoring plan would include these points as project implementation occurs to document changes.**	

2.5. Adaptive Management

Forest Service policy allows for implementing projects over time in an adaptive framework, so long as the decision factors, conditions and policies are revisited following procedures established in Forest Service Handbook 1909.15, Section 18. Review the environmental documentation of actions that are awaiting implementation and those of ongoing programs or projects at least every 3 to 5 years to determine if the environmental analysis and documentation should be corrected, supplemented, or revised.

"After a decision to implement a proposed action has been made and when the consideration of new information leads to the supplementation or revision of environmental documents, a new decision based on the supplemented or revised environmental documents must be consistent with the scope of the new environmental analysis. If new information or changed circumstances relating to the environmental impacts of a proposed action come to the attention of the responsible official after a decision has been made and prior to completion of the approved program or project, the responsible official must review the information carefully to determine its importance.

"If, after an interdisciplinary review and consideration of new information within the context of the overall program or project, the responsible official determines that a correction, supplement, or revision to an environmental document is not necessary, implementation should continue. Document the results of the interdisciplinary review in the appropriate program or project file.

If the responsible official determines that a correction, supplement, or revision to an environmental document is necessary, follow the relevant direction in sections 18.2 - 18.4."

Figure 8—Mastication unit at work

Figure 9—Typical burn operation in nearby Santa Fe Watershed

3. ENVIRONMENTAL EFFECTS

This section describes the predicted effects to the environment of the proposed action and alternatives. These descriptions rely on resource specialist reports, which are in the project record, located at the Española Ranger District office in Espanola, New Mexico. Where there are differences between the information in this section and that of the reports in the project record, this EA reflects the integrated information and so takes precedence. The EA was reviewed by the primary authors throughout the interdisciplinary process after the original reports were written.

The effects disclosed include:

- Direct effects: occurring at the same place and at the same time
- Indirect effects: occurring as a result of this project's actions, but in a place away from the project area or at another time
- Cumulative effects: these effects result from this project's activities when considered in combination with other activities that are known to occur in the past or present, or actions that may be reasonably foreseeable in the future. Activities that may interact with this project vary depending on the particular resource, and so will be listed with those resources.

The following three alternatives are considered in detail in this section.

- Alternative 1- No action
- Alternative 2- Proposed Action
- Alternative 3- No Prescribed Fire

3.1. Vegetation and Fuel

3.1.1. Existing Conditions

The forests in the project area are predominately ponderosa pine, and mixed conifer species, such as Douglas fir and white fir. A small amount of piñon-juniper woodland occurs at the far southwest corner of the area, where low elevation and dry south facing slopes determine the vegetation type. A small amount of riparian vegetation occurs along Little Tesuque Creek and in some side drainages. No perennial streams occur in the project area.

North and east facing slopes tend to be more moist and cooler than south and west facing slopes. The north/east facing slopes and canyon bottoms average between 500 and 800 trees per acre. The oldest trees are ponderosa pine many of which are 180 years old. Douglas fir and white fir seldom exceed 90 years old and most are suppressed in the understory. Douglas fir, white fir, and limber pine have regenerated within the past twenty years while ponderosa pine regeneration is sparse to non existent. Ponderosa pine is shade intolerant and unable to regenerate under a dense canopy. The lack of low intensity wildfires over the past 160 years has resulted in a species composition shift, with declines in fire-adapted ponderosa pine and Douglas-fir and increases in the white fir. The amount of fuel on the forest floor has also increased.

3.1.1.1. Ponderosa pine/piñon pine

South and west facing slopes tend to be warmer and drier than north and east facing slopes. These slopes and ridge tops, have an average of 150-200 trees/acre. Most understory trees are piñon pine in the 2-9 inch diameter class. In the absence of low intensity fires, a shift is occurring away from fire tolerant ponderosa pine to the fire intolerant piñon pine. Past fires on the Santa Fe National Forest demonstrate that wildfires burning under severe fire weather conditions (high temperatures, low humidity and strong winds) in this mix of ponderosa and piñon pine, burn with extreme intensities and rapid rates of spread This density and mix of tree sizes creates a continuous vertical and horizontal arrangement of fuels. This creates conditions favorable to crown fires under extreme (90%) fire weather conditions.

Table 8—Existing Ponderosa Pine (PP) Stand Density

Av. Diameter Class	Av. # Trees/Acre
< 2 inches	10-100 mostly piñon
2-9 inches	70-100 pp and piñon
9-16 inches	50-60 pp
> 16 inches	5-15 pp

Historic timber inventories in the ponderosa pine forests in the mountains of the southwest show an average of 35-36 trees/acre, with about 10 trees/acre 4-inches to 15-inches diameter at breast height (DBH) (Woolsey 1911; Fletcher 1998, pp. 86-93, Cassidy 1998, pp. 5-7). Studies across the southwest (Dahms and Geils 1997, pp. 49-51) illustrate an increase in the smallest trees and a decrease in the largest trees from the early 1900s to the 1980s. The current high tree densities result in stress due to inter-tree competition (for moisture, light and nutrients) and increased susceptibility to insect and disease attack.

Scattered stands of mature aspen occur but are declining due to the lack of fire or other major disturbances. Aspen stands burn cooler than conifer stands and are important in mitigating fire behavior because they act as heat sinks and dampen fire intensities.

Ground cover vegetation (shrubs, grasses, and forbs) in the project area varies depending on location. The slopes and ridges tend to be sparsely vegetated with less than 10% ground cover. Revegetation following severe disturbances is slow. In canyon bottoms, ground cover is generally over 25% and recovery is rapid following disturbance.

3.1.1.2. Ponderosa Pine and Mixed conifer

Tree composition on the moister sites (slopes), is a mixture of Ponderosa pine, Douglas fir and white fir, with lesser amounts of limber pine. Tree densities range between 500-900 trees per acre. Sampling ages of the different strata of trees reveals that the oldest trees in the overstory are ponderosa pine with ages exceeding 180 years. Overstory Douglas fir and white fir seldom exceed 90 years old. Many smaller diameter Douglas fir and white fir in the understory are also 90 years old and have been out competed and remain as a suppressed understory. Douglas fir, white fir, and limber pine have regenerated within the past twenty years. Ponderosa pine regeneration is sparse. Ponderosa pine is shade intolerant and unable to regenerate under a dense canopy. The lack of low intensity wildfires over the past 160 years has resulted in a shift in species composition, with declines in fire-adapted ponderosa pine and Douglas fir, with increases in the white fir.

Table 9—Existing Mixed Conifer Stand Densities (moister sites)

Av. Diameter Class	Av. # Trees/Acre
<2 inches	200-650 (white & Doug fir limber pine)
2-9 inches	150-350 (very few PP)
9-16 inches	20-80 (mostly PP and DF)
> 16 inches	10-45 (mostly PP)

Together this mix of size and age classes creates a continuous vertical arrangement of crown fuel. FVS calculates this vertical arrangement and displays it as crown to base height (CBH). CBH is a measure of the ladder fuels in a stand. Ladder fuels are those fuels that carry fire from the surface fire into the crown of the large trees. The CBH is critical in determining the torching index (TI) which is the wind speed required to initiate crown fire through torching of individual trees. The higher the Torching Index, the lower the hazard for crown fire initiation. The calculations that FVS makes for CBH tend to be higher than observed values. Trees less than 6 feet tall are not included in the FVS calculation for CBH. Needle drape, lichens, and other factors that contribute to fuel ladders are also not included in the FVS calculated CBH figure.

3.1.1.3. Aspen

There are scattered patches of mature aspen. But a shift is occurring, with a decline in the amount of aspen because conifers overtop and shade out the aspen. Dead aspen downfall in places contributes to the fuel loading. There are stands within the proposed project area where the surface fuel has a high percentage of aspen boles and debris but there are no longer any or very few live aspen in the stand. Aspen will continue to decline in the absence of fire or other major disturbance. The aspen, with the exception of the stand in the canyon that runs south of Black Canyon Campground, is small in diameter. Trees seldom exceed 8 inches dbh. The importance of aspen in terms of fire behavior is aspen stands tend to act as heat sinks and help dampen extreme fire behavior. Pure aspen stands burn much cooler than conifer stands and due to their deciduous foliage and low CBDs they interrupt crown fuel continuity.

3.1.1.4. Piñon-Juniper

Most of the piñon-juniper (PJ) in this area occurs on south-facing slopes and is in the western portion of the study area adjacent to the City of Santa Fe. Prior to European settlement natural fire frequency in PJ was about 10-30 years (Southwestern Region 1992), however, the homogenization of the PJ ecosystem by fire suppression, livestock grazing, harvest, and eradication treatments belies the complexity during pre-European settlement times (Fletcher 1998).

3.1.1.5. Herbaceous Vegetation Habitat Types

The slopes and ridges are predominately the following habitat types: Douglas fir-Kinnikinnik, Douglas fir-Oregon grape, Douglas fir-Gambel oak or Douglas fir-Mountain ninebark. The understory of these habitat types tends to be shrubby with less than 10% of the ground covered in herbs and grasses. The understory tends to be sparse reflecting low site productivity. Regeneration of conifers tends to be difficult and establishment of vegetation following severe fire is slow (Guide to Plant Associations of Arizona and New Mexico 1997). Field observations validate what the Guide describes. There was a five acre fire in June of 1993 on a steep north aspect in the project area. Tree mortality was 100%. The burned area has not regenerated with any conifers in twelve years and sparse shrubs now dominate the site.

The canyon bottoms tend to be the White fir-Rocky Mountain Maple Habitat Type. Shrubs and herbs are well represented covering over 25% of the ground. Vegetation recovery following disturbance in this habitat type is rapid. (Guide to Plant Associations of Arizona and New Mexico 1997).

3.1.2. Stand Density

The Stand Density Index (SDI) is a relative measure of competition among trees. When SDIs reach above 25%, crown closure affects light to the understory and the beginning of competition between trees occurs. An SDI greater than 50% indicates the onset of higher competition. This makes the stand more susceptible to insects infestations, tree mortality and drought stress.

Historic stand density index values in much of the ponderosa pine timber type averaged 10-20%. SDI value of 10-20% indicates an open canopy with canopy closure of less than 20%. Canopy closure in the project area now exceeds 40%. An important measure of crown fuel as it relates to fuel hazard and crown fire spread is crown bulk density, usually measured in kilograms per cubic meter (kg/m3).

Mixed conifer tend to have higher crown bulk densities (CBD) than ponderosa pine since they are shade tolerant and maintain more of their crowns for a longer time. Crown bulk densities in the project area are generally above .06 kg/m 3 which is considered moderate to high hazard for crown fire spread. Over the next twenty years CBD increases to 1.0 kg/m 3, considered an extreme hazard.

For the ponderosa/mixed conifer, current Stand Density Index ranges 38-59% indicating a moderate to high degree of stress and susceptibility to insect and disease attack due to inter-tree competition (for moisture, light and nutrients). The risk of tree mortality from insects/diseases would gradually increases over the next twenty years as intra tree competition increases and regeneration of smaller trees continues.

Table 10—Existing Stand Density Index by Sampled Aspect

Aspect	SDI %	Desired SDI
North	44%	Below 25%
South	42%	
West	38%	
Drainage	54%	
Ridge top	59%	

3.1.3. Surface Fuels

Surface fuel quantities have been sampled. Results for these locations can be seen in table 6. On the southern slopes and ridge tops fuel loading is moderate. The fire behavior fuel model (FBFM) is predominately 9 (Scott and Burgan, 2005) long leaf litter. The ridge tops show a greater accumulation of larger, greater than 3 inch material, than the south slopes. North slopes are moderately loaded FBFM 8, mixed conifer, with the majority of fuel loading comprising the larger material. The drainages are a mixture of FBFM 8 and 10, timber and understory, with the majority being FBFM 8.

Table 11—Existing Surface fuels (tons per acre)

Fuel Size Class	South Slopes	North Slopes	Drainages	Ridgetops
0 – 3.0 inch	2.0	2.6	2.0	1.3
> 3 inch	3.9	14.9	9.0	9.1
Total	5.9	17.5	11.0	10.4

3.1.4. Probability of a Fire Occurring

Results of modeling the probability of a fire occurring (using PROBACRE software[1]) show that a 300 acre and 1,000 acre fire have a 19% chance of occurring annually while a 5,000 acre fire has a 13% chance of occurring annually. The probability of exceeding a 1,000 acre and 5,000 acre fire over the next twenty years is 99.9% and 95.9% respectively. A specific fire location cannot be determined; however, high use public areas offer opportunities for a fire to start and are of the most concern.

Ignition sources are common in and around the project area. Of particular concern are the number of campfire rings and dispersed recreation sites along Highway 475. An ignition along the highway or a fire starting in the neighborhoods along the western boundary would grow quickly pushed by the prevailing southwest winds that funnel up the canyon. However, even without these human ignition sources, lightning is a common phenomenon. Northern New Mexico experiences one of the highest levels of lightning activity in the western U.S. resulting in a high frequency of lightning-caused fires (Barrows, 1978.).

[1] PROBACRE is a computer program developed by the Pacific Southwest Research Station for purposes of assessing the long term risk associated with the level of protection provided to an area. The risk of concern centers on the chance that a protection area over time will receive catastrophic consequences from a single or series of wildfire events. PROBACRE can also be used to address more general questions about the variability of burned acres that might be experienced over a given period of time. PROBACRE accomplishes the risk assessment task in two ways. First, it calculates the probability of major single fire events. Second, it computes the long term probability that combinations of fire events, both large and small, will result in total burned acres exceeding some specified number of acres. All probabilities are computed from information on the annual fire frequency data by size class. Burned acreage probability estimates are made on the assumption that the number of fire events in any period follows a Poisson probability model. PROBACRE assumes that the frequency and distribution of fire sizes will remain constant over any assessment time frame.

3.1.5. Other factors

Forest growth was modeled with the Forest Vegetation Simulator/FVS.[2] This program models forest changes over time. FVS estimates that in twenty years the SDI will exceed 60%, indicating a high degree of susceptibility to insects and disease due to overcrowded conditions. Within the past five years there was an outbreak of Douglas fir beetle. Patches of dead Douglas fir are still standing throughout the area. The beetle seems to target Douglas fir larger than 8 inches diameter at breast height (dbh) that exhibit dwarf mistletoe infection. Trees infected with dwarf mistletoe are more susceptible to insect attack than healthy trees. These dead trees are falling over and creating concentrations of fuel.

FVS captures this trend and shows the predominate fuel models (FM) shifting over the next 20 years from FM 8 and 9 which are characterized by being predominately light fuels such as needle cast to a fuel model 10 which has a larger size fuel component which generates higher fire intensities.

Dwarf mistletoe is a parasitic plant that occurs in both the Douglas fir and ponderosa pine. The dwarf mistletoe rating (DMR) for the sampled areas is 1.2, a rating reflecting that over 20% of the susceptible trees (Ponderosa and Douglas fir) are infected with the parasite. Mistletoe tends to be patchy and is contributing to mortality in the Douglas fir. The importance of mistletoe for fuels and fire behavior is that brooms form at infection points in the tree which tend to be bushy and full of pitch creating ideal fuel ladders. FVS shows the DMR rating for the stands declining over the next 20 years. This is not an improvement but reflects accelerated mortality of the infected trees. Trees with dwarf mistletoe are dying faster than the parasite can spread.

Vegetation Structural Stage (VSS) is a classification based on the tree diameter class most frequently represented in an even aged stand. It typically was applied during past even age timber management practices and currently has limited applicability for fuel reduction treatments. Most stands today are not managed as even aged stands but are managed to mimic historic, sustainable conditions. Most stands are now managed to have high structural diversity across the landscape and within each stand. Vegetation management objectives create patchy mixes of trees in different size classes.

Nonetheless, the distribution of predominant diameter classes (VSS) is used to compare pre-treatment and post-treatment diameter class distribution. Most of the stands in the project area are two storied stands and the VSS class indicates the most prevalent size class is saplings and young forest (VSS 2 & 3-sapling and pole size; 1-9 inch dbh). The majority of stands are in VSS class 2 and 3.

Experience from fires in the Santa Fe National Forest and from fire behavior knowledge in general indicates historically when low intensity surface fires occurred frequently, these fires thinned the small trees (regeneration) resulting in fewer trees per acre and low stand density index values. Historical inventories in Ponderosa pine forests in the Jemez Mountains show an average range of 35-36 trees/acre, and only about 10 trees/acre in the 4-15” size class (Woolsey 1911; Fletcher 1998, pp. 86-93, Cassidy 1998, pp. 5-7). Studies across the southwest (Dahms and Geils 1997, pp. 49-51) have illustrated an increase in the smallest trees and a decrease in the largest trees from the early 1900s to the 1980s.

An important measure of crown fuel as it relates to fuel hazard and crown fire spread is crown bulk density, usually measured in kilograms per cubic meter (kg/m3). Mixed conifer tend to have higher crown bulk densities (CBD) than ponderosa pine since they are shade tolerant and maintain more of their

[2] The USDA Forest Service, the State of Washington Department of Natural Resources, British Columbia Ministry of Forests, and several state, university, and private organizations, use a system of computer models to simulate changes in vegetation over time given various management alternatives. This system of models, now called the Forest Vegetation Simulator (FVS), is based on the Prognosis Model (Stage 1973; Wykoff et al. 1982; Wykoff 1986; Crookston 1990; Ferguson and Crookston 1991) and other models that have been adapted for FVS. These other models include TWIGS (Miner 1988), NE-TWIGS (Hilt and Teck 1989), and GENGYM (Edminster et al. 1991) (see References). The time scale of the simulations varies from 0 years to 400 years and the spatial scale is normally one forest stand, between 2 and 50 hectares (4 to 100 acres). Recently, a strong interest in increasing the spatial scope to include landscapes, contiguous areas of several to 1,000 stands, has grown into a fundamental requirement of forest vegetation simulations. The Parallel Processing Extension to the Prognosis Model (Crookston and Stage 1991) represents this expanded spatial scale. The primary capability of the models, and their only universal capability, is to simulate the changes in the trees that make up forest stands. The simulations can represent changes due to managing trees by thinning, adding fertilizer, prescribed fire, wildfire and other management actions.

crowns for a longer time. Crown bulk densities in the project area are generally above 0.06 kg/m 3 which is considered moderate to high hazard for crown fire spread. Over the next twenty years CBD increases to 1.0 kg/m 3, considered an extreme hazard.

3.2. No Action

3.2.1. Stand Density

With no action, the stand density would remain as currently described in Section 3.1.2.

3.2.2. Surface Fuels/ Surface Fire Behavior

With no action, the surface fuels conditions would not change from the existing. Under current conditions, surface fire behavior was modeled using the software "Behave Plus" for the two dominant fuel models under 90th % weather. Fuel models 8 and 9 represent the likely fire behavior, with rates of spread approximately 19.1 chains per hour; flame length 5.4 feet. The probability of ignition would be 100 percent, meaning fire start and advance would be fast.

3.2.3. Suppression Effectiveness

Suppression action for a surface fire was simulated with the computer program Behave1 for a fire burning under 90% weather conditions (extreme weather) through ponderosa and mixed conifer litter and debris. This surface fuel arrangement corresponds to a mix of fire behavior fuel models (FBFM) 8 and 9, a realistic assumption given the heterogeneous nature of the fuels. The weighted average was 55% FBFM 9 and 45% FBFM 8.

The Forest Plan direction for fire suppression in Management Area D could not be met with the current fuel conditions because the fire would spread at a rate too fast for the crews to encircle it with fire line, resulting in an estimate of "unknown" amount of time for containment. Suppression was modeled using production rates from 2 specialized fire suppression (hotshot) crews. The intensity of the fire would not allow the crews to make a direct attack on the fire edge.

Given that the typical fuel model in the project area is FM 8 and FM 9 (brush/timber), the predicted suppression effectiveness with a Type 1 crew ("hot shots") would be that the fire would not be contained in one hour or kept to the Forest Plan guideline area of less than 15 acres. The Hyde Park project area is located in management area D of the Santa Fe National Forest Plan. The Plan states that 90% of high intensity (flame lengths >4 ft) wildfires should be contained at 15 acres or less.

3.2.4. Crowning Index

Crowning Index (CI) is the wind speed (measured at 20 ft above the ground) necessary to sustain a crown fire once a fire has reached the canopy. Local topography can generate high wind speeds or gusts in areas where winds are funneled, such as up State Road 475 and through Black Canyon.

The CI is dependent on the crown bulk density (CBD). The denser the crowns the more fuel is available therefore a crown fire can spread more readily through the crowns. The less the CBD the greater the wind needed to push a fire through the crowns. The CI was calculated by FVS.

With current fuels conditions the crowning index is moderate (between 25 and 38 mph).

3.2.5. Torching Index

Torching index (TI) is the wind speed required to initiate crown fire through torching of individual trees. The higher the TI, the lower the potential for fire to spread into the crowns of the individual trees and initiate crown fire. Existing torching indexes range from 0 – 23 mph in the sampled stands. A low torching index is indicative of low canopy base heights. A low torching index means that the forest is susceptible to crown fire initiation. Canopies that are low to the ground make torching easier under low wind speeds. A 0 mph TI corresponds to a canopy base height of 2 feet, while a 23 mph TI corresponds to canopy base height of 6 feet.

3.2.6. Crown Fire Rate of Spread[3]

With current vegetation and surface fuel conditions, crown fire behavior is expected to be active across south facing slopes, north-facing slopes, drainages and ridge tops. The majority of the project area can be expected to burn with crown fire under normal summer conditions and the entire project area can be expected to burn under summer drought conditions within a three hour period

With the current vegetation and surface fuels, a crown fire burning with a predominant southwest summer wind, fire will spread at a rate of 0.5 – 1.0 mile per hour. After 3 hours, modeling projected the fire size to be between 900 and 1,300 acres after 3 hours.

Crown fires burning under drought summer conditions spread at 1.0 – 1.8 miles per hour. After 3 hours fire size was projected to be between 1,300 – 2,900 acres. These estimates are only for a short burn period and are conservative. Past fires on the Santa Fe National Forest have exhibited crown fire behavior for extended periods of time, sometimes for up to 12 hours.

Experience with crown fires in the region shows that crown fires can be expected to burn for several days and cover tens of thousands of acres. Based upon past crown fires on the Santa Fe National Forest 30 to 40% of the burned area will experience high severity impacts such as hydro phobic soils, severe erosion, and debris flows.

Fires were modeled under normal summer and drought summer conditions over a three hour burn period from local time of 1,300 to 1,600. For the model scenario, the fire start was located on private property to the west of the proposed project area, with prevailing southwest winds.

3.3. Proposed Action - Alternative 2

3.3.1. Changes in Vegetation conditions

Thinning would create a clumpy tree distribution favoring the healthiest trees in all size classes. Fire tolerant species would be preferred leave trees. Trees larger than 16” dbh would not be cut except for equipment access or for safety concerns. Tree densities after thinning would range from 0 – 120 trees per acre (tpa) with an average density between 30 – 60 tpa.

Thinning would encourage the remaining trees to grow into larger diameters, for example VSS class 3, 4 and 5. Canopy cover is currently between 50-70%. The intent is to reduce canopy cover to 30-40% in thinned areas. Basal area would be reduced from 100-120 sq ft to 50-80.sq ft. Percent canopy cover would be reduced from 50-60% to 30-40%.

The 470 acres that would be burned would not see the same reductions in tree densities as the mechanically treated areas. The majority of the mortality will be in trees less than 6 inches in diameter. Burning however increases crown-to base-heights on residual trees because of the scorching that occurs which kills the bottom limbs. Effects would also be patchy since the entire area would not be expected to burn in the fall.

FVS models the treatments to be effective for at least the next 20 years. The change in vegetation following treatment is often enough to cause crown fires to drop to the surface as they move into treated areas. The FVS model shows potential wildfire exhibiting surface fire behavior post treatment versus a crown fire pre treatment. The Espanola District has many examples where crown fires have dropped to the ground and become ground fires after encountering areas treated to reduce fuels (i.e. Oso, Cerro Grande, and Borrego Fires).

[3] The BehavePlus fire modeling system is a program for personal computers that is a collection of mathematical models that describe fire and the fire environment. It is a flexible system that produces tables, graphs, and simple diagrams. It can be used for a multitude of fire management applications including projecting the behavior of an ongoing fire, planning prescribed fire, and training. BehavePlus is the successor to the BEHAVE fire behavior prediction and fuel modeling system. Primary modeling capabilities include surface fire spread and intensity, safety zone size, size of point source fire, fire containment, spotting distance, crown scorch height, tree mortality, wind adjustment factors, and probability of ignition. Behave has become the standard surface fire spread model for the USFS.

Prescribed burning would augment the thinning work and increase canopy base heights (CBH). Tree mortality would be mostly in the smaller tree diameters, less than 6 inch diameter at breast height (dbh).

Figure 10—Two days after broadcast burn in the Santa Fe Watershed

Figure 11—Six months after broadcast burn in the Santa Fe Watershed

Research by Van Wagtendonk, indicates the construction of fuel breaks and spatially restricted fuel management zones, when used alone, do not influence high intensity crown fires. However, these fuel treatments are effective as perimeters for prescribed fire projects. Prescribed fire reduces the fire risk and hazard of a wildfire by reducing ignition potential and fire behavior (Biswell et al. 1993).

The thinned ridges combined with the burned areas would create a matrix of overlapping treatment areas of low fuel hazard in the direction of a fire heading up canyon, the most probable direction that a wild fire would travel. Research by Finney (1999) demonstrates an overlapping fuel treatment pattern is

effective and efficient in disrupting fire growth across landscapes and can mitigate fire behavior and effects within burned areas and even outside treatment areas.

To mitigate smoke effects and fire control, burn units would be divided into blocks of 100-300 acres. Burning would be done over several years. To mitigate the risk of escaped fire—which has been expressed as a public safety concern—broadcast burning would be done in the fall. Spring burns would be avoided unless Fall-like conditions were present. Temperatures are cooler and relative humidity is higher than in the spring or summer which reduces fire intensities and the probability of spotting. Initial prescription parameters, which can change, have been developed for the project.

Experience on the Española District shows that east, west and south aspects would actively burn at this time of year. On north aspects, smoldering and creeping could be expected. The south aspects, exposed to the sun, are drier and warmer than other aspects and will burn with low to moderate intensities (flame lengths less than 4 feet). However experience on the Española District shows that fire would probably burn between 60-80% of the south aspects. Experience has shown on the Española District that southerly aspects will actively burn during Fall burns. Initially approximately 470 acres of non-masticated southerly aspects would be burned under prescription. The additional 826 acres of masticated ridges would be burned in successive years during maintenance burning operations. Also in the fall, temperatures are cooler and relative humidity is higher than in the spring or summer. Burning in the fall reduces the chance of an escape and undesirable fire effects.

Southerly aspects, which are exposed to the sun and are drier and warmer than other aspects, will burn with low to moderate intensities (flame lengths up to 4 feet). It is assumed that north aspects in the fall will burn with low intensities, if at all. Experience on the Espanola District validates this assumption. The mechanically treated areas where the material has been masticated will burn with low intensities during fall burning conditions. Experience with burning masticated fuels in the Santa Fe Watershed confirms this. The masticated material is too compact to permit a sustained flame at this time of year and fire tends to smolder and go out.

The burn would be patchy with scattered unburned islands of vegetation. North aspects in the fall would burn with low intensities, if at all. Mechanically treated areas, where the material would be masticated, would not sustain fire under fall burning conditions. Attempts to burn masticated fuels during the fall have been made in the Santa Fe Watershed without success. The masticated material is too compact to permit a sustained flame during the fall, when temperatures are cooler and humidity higher. Under such conditions, fire tends to smolder, creep around and burn with low intensities. These masticated areas would further reinforce fire lines which would be used during prescribed burning.

Prescribed burning would also reduce surface fuels and increase canopy base heights (CBH). Tree mortality would be mostly in the trees less than 6 inches in diameter (dbh). The thinned ridges combined with the burned south aspects would create a matrix of overlapping treatment areas of low fuel hazard in the direction of a fire heading up canyon, the most probable direction that a fire would travel. Research by Finney (1999) demonstrates an overlapping fuel treatment pattern is effective and efficient in disrupting fire growth across landscapes and can mitigate fire behavior and effects within burned areas and even outside treatment areas.

Openings up to 5 acres would be made where there is aspen or evidence indicates aspen was there in the past. An estimated 10 percent (about 80 acres) of the 826 treated acres would be in openings and a grass and forbs structural stage. Within 10 years these openings would grow into VSS 1 (open vegetation structure associated with meadows) as the aspen regenerates.

Immediately south of Black Canyon Campground is Forest Service Trail 181 that traverses a canyon bottom. There is an aspen stand of approximately 6 acres with an understory of mixed conifer in the canyon. Dead standing aspen are along the trail which are a hazard to hikers and are removed as hazard reduction maintenance. This project would augment that work by thinning along this route as well.

The Project would cut and pile the slash of the mixed conifer understory then open the area to the public for fire wood. Dead aspen identified as a hazard along the trail will be cut. The piles would then be burned.

3.3.2. Stand Density

Tree densities after thinning would range from 0 – 120 trees per acre (tpa) with an average density between 40 – 60 tpa. Basal area would be reduced from 100-120 sq ft to 50-60.sq ft. Percent canopy cover would be reduced from 50-60% to 30-40%.

The Stand Density Index (SDI) measures competition between trees. SDI's above 25% indicate crown closure and the beginning of competition between trees. When SDI is above 50%, trees are susceptible to insects and disease. In the Proposed Action on average the SDI would be reduced to 18-30%. The average diameter of trees would increase from 4 inches to 7-10 inches, reflecting the removal of smaller trees in the stand. The remaining trees would be less susceptible to insect attack after thinning because of reduced competition.

With the Treatments proposed in Alternative 2, the SDI for South slopes and ridge tops would be reduced 18 percent; West slopes reduced 23 percent; and East facing slopes reduced 22 percent following prescribed fire with no prior thinning on 470 acres. North aspects will not be burned and so no change would occur.

3.3.3. Surface Fuels/Surface fire behavior

Experience with prescribed fire on the Espanola District indicates surface fuel consumption would be patchy due to discontinuous fuel continuity. Prescribed burning would be done when the soil is moist. This would protect and mitigate negative impacts to the soil. The FVS model shows, and experience validates, a reduction in surface fuels can be expected following prescribed fire.

Following thinning treatment fire intensity is reduced and fire crews can attack the fire directly in the treated areas. Fire retardant dropped from air planes is effective when areas have been thinned. After thinning, the crowns of the trees are more open, allowing fire retardant to reach the ground fuels and be more effective in retarding the fire spread.

3.3.4. Suppression Effectiveness

Initial attack resources would be likely to contain the fire even during extreme weather conditions. Previously burned areas and masticated ridges would serve as areas to slow a growing fire in untreated patches. Given a Type 1 crew ("hot shots"), with additional support of an air tanker, a fire after treatment is expected to be contained at 6 acres or less.

3.3.5. Crowning Index

The crowning index can be increased by decreasing crown bulk densities. Crown bulk densities can be decreased by mechanically thinning trees or thinning trees with fire. Fire reduces crown bulk density by consuming all or portions of the needles and branches of some trees. Both methods decrease the amount of fuel contributing to crown bulk density. Crowning index was modeled with FVS. Following the proposed treatment on approximately 470 acres identified for treatment with prescribed fire only, crowning index would increase by 27%. Following the proposed treatment on approximately 826 acres, treated by thinning with mastication, crowning index would increase by 19%. This increase in crowning indices indicated a reduction in crown fire susceptibility within the proposed project area.

After treatment as proposed in Alternative 2, the crowning Index would be expected to be Low (38 to 52 mph).

3.3.6. Torching Index

The torching index can be increased through thinning of understory trees or by prescribed fire which prunes the bottom branches of larger trees. The benefit of increasing the torching index is that it reduces the susceptibility to the proposed project area to crown fire initiation. Torching index was modeled with FVS. Following the proposed treatment on approximately 470 acres identified for treatment with prescribed fire only, torching index would increase by 46%. Following the proposed treatment on approximately 826 acres, treated by thinning and mastication, torching index would increase by 63%.

After mastication and initial burning the Torching Index for south and north aspects and drainages would be Moderate (16-22 where masticated; 10-12 where burned on slopes more than 40 percent).

3.3.7. Crown Fire Rate of Spread

Fires were modeled under normal summer and drought summer conditions over a three hour burn period from local time of 1300 to 1600. For the model scenario, the fire start was located on private property to the west of the proposed project area, with prevailing southwest winds. After treatment, crown fire would be reduced to Passive on south slopes, and would not be expected on north slopes, drainages and ridgetops. Fire rate of spread is expected to change from 18 chains per hour in the untreated stands to 3 chains per hour in the treated areas.

3.3.8. Dwarf mistletoe

Dwarf mistletoe infection levels would decrease immediately following thinning since infected trees would be favored to cut but infection levels would gradually increase over the next 20 years to where they are now.

3.4. Alternative 3—No Prescribed Fire

The issues of prescribe fire smoke's impacts on the Class I Air Shed of the Pecos Wilderness and on human health and of prescribed fires escaping are addressed by Alternative

3.4.1. Changes in Vegetation conditions

Approximately 826 acres will be thinned and the material masticated on site. This treatment will be done on slopes less than 40%. Slopes with a southerly aspect which are greater than 40% will be thinned and the cut material will be lopped and scattered to less than 24 inches from the ground. The cut material will be left to rot. Four hundred and seventy acres will be treated this way. There will be no burning. Thinning specifications will be the same as for Alternative 2 but will apply to 1,296 acres. The results of mechanical thinning, such as trees/acre species selection etc, are easily controlled compared to the more random results from prescribed burning on 470 acres proposed in Alternative 2.

Without burning, however, no increase in crown to base heights (CBH) would occur. Crown to base height is a measure of the ladder fuels in a stand of trees. The greater the crown to base height, the lower the potential the fire will move into the crowns of the trees. It is critical in determining the torching index (TI) which is the wind speed required to initiate crown fire initiation.

Following implementation of Alternative 3 the trees per acre will average 30-60, average dbh will increase to 9-15 and SDI will decrease to 18-25%. The differences in measurements for these values between Alternatives 2 and 3 reflect the certainty of outcomes attributable to mechanical thinning compared to the more uncertain outcomes from prescribed fire. FVS indicates that prescribe fire alone as described in Alternative 2 would not reduce tree numbers to the extent that mechanical thinning would.

The size, number and location of openings will be the same as in Alternative 2 but the cut material will be lopped and scattered and left to rot.

The five acre stand of aspen south of Black Canyon Campground along Forest Trail 181 would be thinned to the same specifications as in Alternative 2. The fire wood would be offered to the public. The limbs and tops would be lopped and scattered and left to rot.

3.4.2. Surface Fuels/Surface fire behavior

Surface fuel loading on treated acres is increased following both grinding and lop and scatter treatments. FVS modeled surface fuel loading to increase 6 to 10 tons per acre over Alternative 2 with thinned material not burned. The largest increase and longest duration is in size class for greater than 3 inches. Decomposition is shown to reduce post treatment surface fuel loading of the 0 – 3 inches size class by half 25 years following treatment. The greater than 3 inches size class is reduced by roughly a half ton per acre over the same time period.

The Alternative 3 surface fire behavior exceeds Alternatives 1 and 2. Rate of Spread (ROS) is 60% greater than the no action wildfire, and 94% greater than the proposed alternative. The flame lengths increase from 5 feet in the no action wildfire to 11 feet post treatment. Wildland fire professionals believe the increased risk of higher wildfire rates of spread would be expected for 2 - 3 years following treatment (Garcia, 2006). Once the needles fall off the slash the spread rates would be reduced. In the event of a wildfire lop and scatter stands have been shown to have less severe fire impacts than untreated stands. Lop and scatter treatment has been shown to have less bare soil, increased litter and less crown percentage consumed following wildfire (Cram, et al, 2006). The condition class would be changed in 7 – 8 years.

The surface fire behavior if a fire occurred (assuming fuel model 11) is a rate of spread of about 44 chains per hour and a flame length of about 11 feet.

3.4.3. Suppression Effectiveness

After implementation of Alternative 3, initial attack resources would not be able to contain the fire during extreme weather conditions. Lop and scatter areas would burn with a high intensity and high rate of spread. Direct attack would not be possible in lop and scatter areas. However, lop and scatter would not be contiguous in large continuous blocks and would be adjacent to masticated areas. While increased fire behavior would be seen in the isolated lop and scatter areas, a reduction would be seen when fire moved into masticated areas.

With two type 1 crews ("hot shots") and an air tanker, the fire would not be expected to be contained with the fuels conditions created by this alternative, at least for the four years following treatment it will take to see some of the fuels decay and change burning characteristics.

3.4.4. Crowning Index

Lop and scatter increases the crowning index wind to a Low level, about 37 – 62% over no treatment. The hazard is lowered by decreased CBD and the reduction of tree densities. A low crowning index (49 mph) is expected.

3.4.5. Torching Index

The torching index is increased on the south slopes 45 – 79% above alternative 1, no action, and 61% above alternative 2. Canopy base heights increase in most stands with the removal of a large amount of smaller trees in Alternative 3 versus no removal in Alternative 1 and Alternative 2. There are still some stands which show only small increase in canopy base heights post treatment. A Torching Index would be high for up to four-seven years (18-56 mph) on the slopes where the treatment was to cut then lop and scatter. On the ridges, it would be Moderate, similar to Alternative 2 (38 mph)

3.4.6. Crown Fire Rate of Spread

Post treatment, ridge tops exhibit surface fire behavior due to gentle slope, reduction in ladder fuels, and compaction of surface fuels by mastication. The south facing slopes would no longer support active crown fire behavior but, still exhibit passive crown fire behavior. FVS no longer calculates active crown fire behavior due to the reduction in stems per acre and removal of ladder fuels. Rate of spread for this alternative for short runs would be up to 44 chains per hour.

Rate for spread in this alternative would be higher than either the no action alternative (18 chains per hour) or Alternative 2 (3 chains per hour).

3.4.7. Cumulative Effects to Vegetation

A number of similar vegetation projects have occurred near the project area that have similar effects to vegetation. The largest of these is the Santa Fe Municipal Watershed Thinning Project, which is taking place to the south and east. Some similar thinning has occurred in the private lands to the west, as well as the Hyde Memorial Park to the north and east of the project area.

The additional benefits of past and foreseeable future thinning would be to reduce the risk of crown fires across a larger area. The area of most concern lies adjacent to the State Park and the housing subdivisions, and so as the vegetation is thinned on these lands, the risk overall is reduced.

Although Alternative 3—like Alternative 2—reduces the risk of crown fire in the project area, the fuels left on the ground means that to a greater degree a large fire could affect the project area and surroundings.

3.5. Key Issues: Environmental Consequences

3.5.1. Air Quality/Smoke/Human Health-

Prescribed burning produces smoke. Under certain atmospheric conditions, smoke could settle in areas where people live, work, or recreate. There is a perceived threat that any smoke will affect the local population. In people who have existing respiratory conditions, the smoke could cause respiratory problems. It could also create a safety hazard by limiting visibility on the highway. The measures for this issue are the amount of emissions ($PM_{2.5}$ and PM_{10}) in tons and concentrations of $PM_{2.5}$ in $\mu g/m^3$. For the second aspect of this issue, an estimate of the number of consecutive days of smoke was provided. In extreme events when smoke accumulates over a period of days levels can be reached that are unhealthy for the general population. Such events are more likely to be associated with a large wildfire than with a prescribed burn.

3.5.1.1. Affected Environment

Areas impacted by smoke will vary between day and night because of differences in local terrain effects on wind. During the day the heating of the sun creates currents which carry the smoke upslope. At night cooler, denser air from higher elevations flows down slope, carrying any lingering smoke along with it. Figure 4 shows the most likely direction of smoke transport in the project area. Because the cooler air is heavier and cannot rise above the warm air, the smoke tends to follow the mountain terrain down drainages towards areas where people reside. During the daylight hours, these inversions tend to weaken and disappear as the sun warms the earth's surface. The smoke then lifts and disperses out of the area.

The Clean Air Act establishes a higher standard of air quality protection for those Wilderness areas which were in existence at the time its 1977 amendments were passed.

This includes the Pecos Wilderness just north of the project area. The Clean Air Act (CAA) created two categories of airshed, Class I and Class II. Class I airsheds have certain visibility thresholds. Pecos Wilderness north of the project area is a designated Class I airshed. Everything else lies within the Upper Rio Grande Basin airshed and is considered to be Class II. The project area typically has excellent air quality; the entire area meets National Ambient Air Quality Standards (NAAQS) for all criteria pollutants. A minor amount of smoke is generated seasonally by campfires. In the City of Santa Fe and neighborhoods adjacent to the project area smoke is generated seasonally by wood stoves and fireplaces.

The State of New Mexico follows Federal Guidelines for emissions of hazardous air pollutants, which are:

Table 12—Emission Limits

PARTICULATE SIZE	EMISSION LIMIT
PM-10	150 $\mu g/m^3$ over a 24 hour period
PM-2.5	35 $\mu g/m^3$ over a 24 hour period

$\mu g/m^3$= microgram per cubic meter

The amount of smoke and particulate matter the Forest Service can emit during prescribed burns is regulated by the New Mexico Environment Department Air Quality Bureau (NMED AQB). All prescribed burning would be coordinated with New Mexico Environment Department to maintain

compliance with their smoke management plan. This includes appropriate daily limits on acres burnt and emissions.

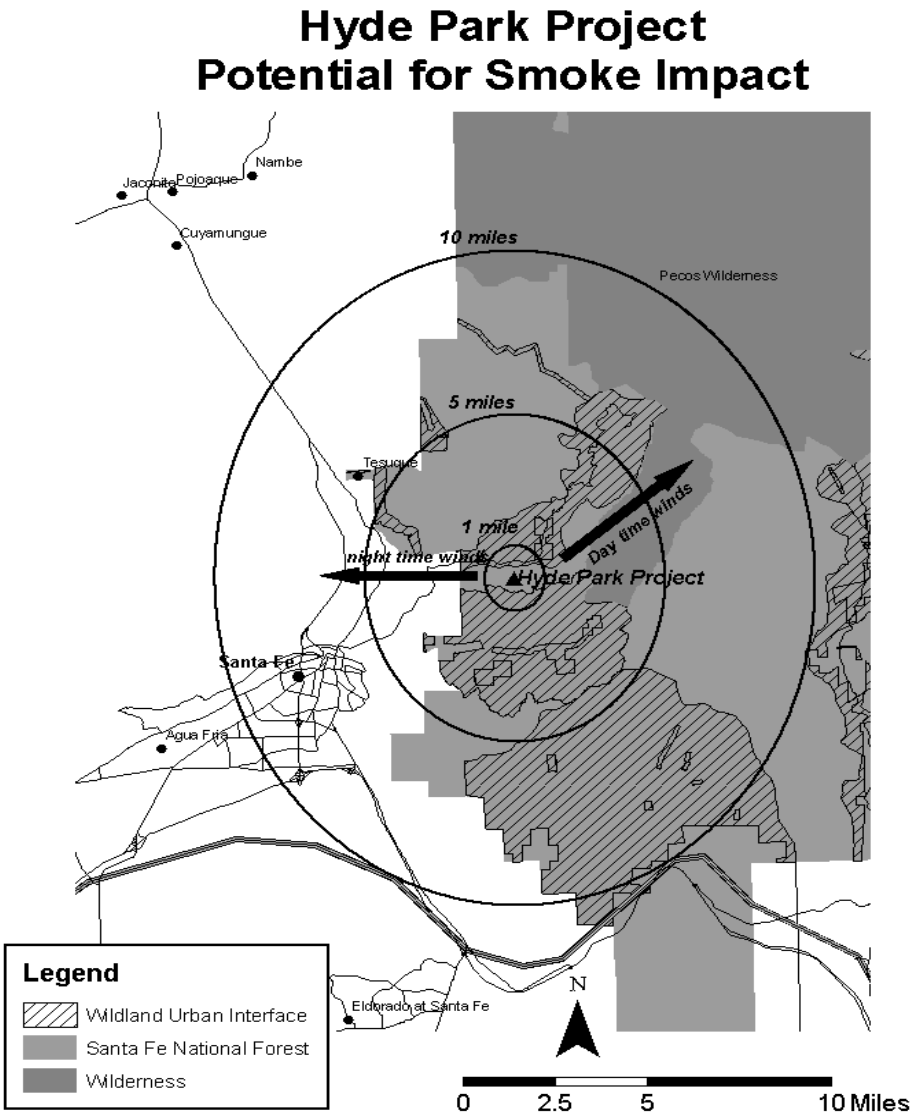

Figure 12—Air Quality Area of Influence

3.5.1.2. Analysis Methods

The Smoke Impact Spreadsheet model (SIS, Air Sciences, 2003) was used to estimate smoke emissions from the Hyde Park project area under three alternatives. Alternative one assumes no action with a wildfire. Alternative two is the proposed project, which includes a combination of thinning and burning. Emissions from a wildfire after treatment are also estimated. Alternative three assumes thinning as proposed in alternative two but with no burning and with lop and scatter treatment on areas that would have been burned without mechanical treatment under Alternative two. A wildfire after treatment is modeled for alternative three.

SIS does not allow for mixed fuel models and uses National Fire Danger Rating System (NFDRS) rather than fire behavior fuel models. Representative NFDRS models were chosen following guidance found in Anderson (1982). SIS allows modeling of wildfire, broadcast burns and pile burns. User input includes fuel model, size and shape of project (or wildfire), date, time of ignition and anticipated weather conditions. SIS relies on the First Order Fire Effects Model (FOFEM) for emissions calculations. FOFEM allows user input for fuel loading, fuel moisture, and percentage of fire expected to be crown fire.

As with all models, the results should be considered as relative values which may be useful in decision making, not as hard and fast depictions of anticipated outcomes.

Table 13 summarizes the results for the emissions modeling of the three alternatives. SIS models concentrations of particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) at receptor points downstream from a fire or burn. $PM_{2.5}$ makes up 80-90% of wildland fire smoke (Hardy, et al, 2001). SIS requires no input for wind direction but rather models maximum impacts downstream regardless of wind direction. This information can be used to determine the best wind direction for burning in order to minimize impacts to communities.

Although SIS produces predictions of maximum concentrations every tenth of a mile, for simplicity benchmarks of 0.1, 1, 5, and 10 miles have been selected for presentation in Table 1. Maximum hourly concentrations and maximum 24 hour averages have been calculated, however, only the 24 hour average concentrations are subject to regulation by the EPA and the State of New Mexico. The one hour concentrations have been included for consideration of potential short term impacts on sensitive receptors such as schools and nursing homes.

Also presented in Table 13 are total emissions for each scenario. This represents the total amount of pollutants in tons over the life of the fire or burn. Included are PM_{10}, $PM_{2.5}$, CH_4, CO, CO_2, NOx, and SO_2. Total emissions can be used to compare the relative overall impact on air resources of burning compared to wildfire.

3.5.1.3. Effects of No Action (Alternative 1)

Without wildfire, there would be no change from the existing conditions described in the narrative above. Without an ignition, there would be no smoke.

In the event of a wildlife, the modeling scenario assumes a late June wildfire with ignition at 2 pm on a dry summer day with a high temperature of 90 degrees, an overnight low of 55 and winds from the southeast at 12 mph. Slightly unstable conditions are assumed. For vegetation conditions (FOFEM) settings reflect Interior Ponderosa fuel type, with fuel loadings adjusted to reflect those in the vegetation section of this analysis, averaged for all aspects. Fuel Moisture settings are from the SIS user guide and reflect a midpoint between a typical (non drought) year wildfire and a drought year wildfire. An estimate of 30% crown fire was used.

In order to represent the estimate of 45% fuel model 8 and 55% fuel model 9 the percentage was applied to the acreage and the fuel model surrogates (NFDRS Fuel models H & U) were modeled separately with the estimated emissions summed to arrive at total emissions and $PM_{2.5}$ concentrations. The resulting values are presented in Table 13.

The wildfire is predicted to burn for 30 hours in the scenario, producing 177.0 tons of emissions. The National Ambient Air Quality Standard (NAAQS) for $PM_{2.5}$ was revised in December 2006 to be set at 35 ug/m^3 averaged over a 24 hour period. Emissions are predicted to be over 17 times the standard, 1 mile downstream of the fire and remains above the NAAQS, 5 miles downstream. Although emissions from wildfires are not subject to regulation, the NAAQS are based on health considerations so it can be assumed that the impact on communities would be significant.

In extreme events when smoke accumulates over a period of days, levels can be reached that are unhealthy for the general population. Such events are more likely to be associated with a large wildfire than with a prescribed burn because the cumulative effects of consecutive burn periods.

The amount of smoke that is generated from a wildfire (which is uncontrolled fire) is much greater than the smoke produced from a prescribed burn, in which smoke management techniques are employed. In a wildfire scenario, large amounts of pollutants are produced that would likely exceed State air quality standards for particulate emissions.

During a large wildfire, smoke would most likely be dispersed over a longer period of time than during a prescribed burn. In 1996, the 16,000 acre Dome Fire impaired both air quality and visibility over 20 miles from the fire in the city of Santa Fe and Interstate 25.

This type of large conflagration could result in a high potential for traffic accidents, road closures, or other impacts to motorists traveling on Highway 475 of which portions are Congressionally designated as a Scenic motorists traveling on Highway 475. There could be impairments to visibility in portions of the Pecos Wilderness and scenic vistas of the Scenic Byway which would affect hikers and other recreationists. People living in the area, who have pre-existing respiratory conditions, heart or lung disease may experience more severe impacts to their health due to the duration of the smoke from an uncontrolled wildfire. The general population will develop a lower tolerance to seeing and smelling the smoke as they deal with it on a daily basis. Psychologically, this may create anxiety and fear within people. When exposed to high concentrations of smoke over long periods of time, as may occur with a wildfire, otherwise healthy people may be negatively impacted as well.

3.5.1.4. Effects of Alternative 2

Since all prescribed burning must assure compliance with the Clean Air Act, exceeding smoke thresholds is not an option and attainment must be met.

Modeling for prescribed burning assumes an October 15 burn with a maximum temperature of 65 degrees and an overnight minimum of 35. Wind speed was set at 8 mph and near neutral stability was assumed. Fuel moistures for a fall prescribed burn were used. Results of modeling for Alternative 2 can be seen in Table 13.

The 24 hour averages for $PM_{2.5}$ are well within the NAAQS for both the 100 acre and 250 acre blocks. In fact the concentrations are very similar for each size project. This is because SIS makes some assumptions about the time required to ignite each block and as ignition proceeds some areas are burning out so that the overall concentrations of smoke downwind remain about the same. The time of burning would be longer for the larger blocks and the total emissions would be more, but the amount of smoke at any given point in space and time would be about the same as for a smaller block.

A wildfire after treatment was also modeled in order to compare with emissions from a wildfire under the no action scenario and a wildfire under Alternative 3 where treatment occurs with no burning. Although it was assumed that all 1,296 acres would be burned in this wildfire for comparative purposes, the Vegetation Effects section of this analysis indicates that a wildfire after treatment would be suppressed at 6 acres, and so the emissions would most likely be much less. Assumptions about weather and timing for wildfire under Alternative 2 are the same as for Alternative 1.

3.5.1.5. Effects of Alternative 3

This eliminates the potential effects of smoke from prescribed fire. It also eliminates the risk of an escaped prescribed fire. Instead of burning, fuels would be mechanically treated, either by mastication or hand thinning with lop/scatter (slopes greater than 40 percent).

A wildfire was modeled using NFDRS fuel model K. Because fuels would be left on the ground, a heavier fuel loading was used in setting up FOFEM for those acres to be lopped and scattered. The modeling for this Alternative (see Table 13) shows emissions somewhere between the untreated scenario (Alternative 1) and the scenario including treatment with prescribed burning (Alternative 2).

3.5.1.6. Cumulative effects

A number of similar vegetation projects have occurred near the project area that have similar effects to vegetation. The largest of these is the Santa Fe Municipal Watershed Thinning Project, which is taking

place to the south and east. Some similar thinning has occurred in the private lands to the west, as well as the Hyde Memorial Park to the north and east of the project area. Finally, the City of Santa Fe has undertaken to thin on parcels of city owned land several miles to the south of the project area.

Specifically, other activities that have potential to add to the effects of the Hyde Park Project in respect to air quality and human health are as follows:

- The Santa Municipal Watershed Project, which has about 2,500 to 3,000 acres of piles to burn.
- Similar prescribed burning within the geographic area that is close enough to contribute smoke in a measurable way.
- The traffic along Highway 475, as well as wood smoke from fire places in Santa Fe and the surrounding communities.

The State of New Mexico Environment Department monitors weather and air quality. By following NEMED requirements, the Hyde Park Project would only be allowed to proceed when smoke produced would not contribute to noncompliance with air quality standards.

The additional benefits of past and foreseeable future thinning would be to reduce the risk of crown fires across a larger area. The area of most concern lies adjacent to the State Park and the housing subdivisions, and so as the vegetation is thinned on these lands, the risk overall is reduced.

Although Alternative 3—like Alternative 2—reduces the risk of crown fire in the project area, the fuels left on the ground means that to a greater degree a wildfire would cause smoke to continue over a longer duration (several days).

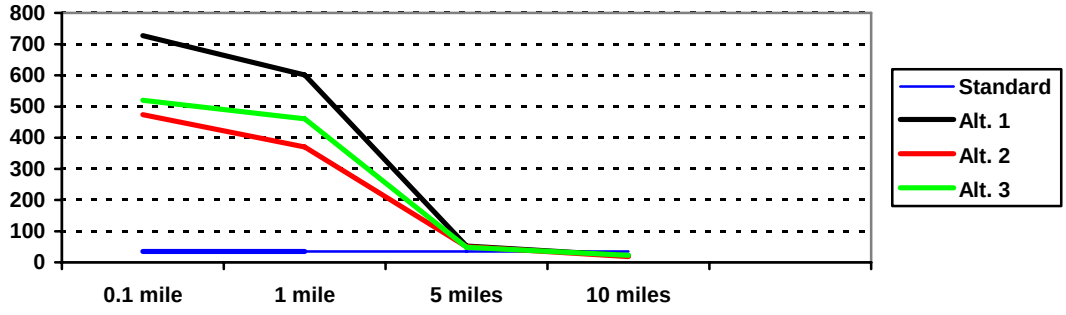

Figure 13— $PM_{2.5}$ emissions (micrograms ave. on 24 hour period) during wildfire (> 1,200 acres)

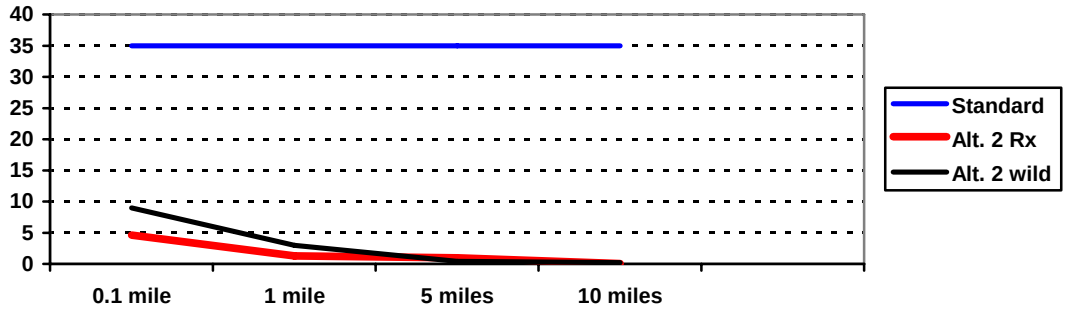

Figure 14— $PM_{2.5}$ emissions from prescribed burn/predicted wildfire (24 hour average)

Table 13—Estimated Emissions during wildfire

	Hyde Park Project		PM2.5 concentrations (µg/m3)								Total
			0.1 mile downwind		1 mile downwind		5 miles downwind		10 miles downwind		
Alternative	Scenario	acres	1 hour avg	24 hr avg	1 hour avg	24 hr avg	1 hour avg	24 hr avg	1 hour avg	24 hr avg	Emissions(tons)
1	Wildfire-NFDRS Fuel Model H (45%)	583	1399.9	388.3	1422.4	291.1	122.3	28.1	78.0	13.9	79.6
	Wildfire- NFDRS Fuel Model U(55%)	713	2001.7	341.4	2229.4	309.7	263.5	23.5	123.3	8.4	97.4
	Total Wildfire	**1296**	**3401.6**	**729.6**	**3651.8**	**600.8**	**385.7**	**51.5**	**201.3**	**22.3**	**177.0**
2	No treatment Fuel Model H (45%)	45	233.6	11.7	51.6	3.0	25.6	2.4	17.8	1.1	5.3
	No treatment Fuel Model U (55%)	55	98.2	5.2	19.0	1.2	11.0	1.0	6.7	0.5	6.5
	Total untreated 100 acres	**100**	**331.8**	**16.9**	**70.5**	**4.2**	**36.6**	**3.4**	**24.5**	**1.6**	**11.8**
	No treatment Fuel Model H (45%)	112.5	239.1	11.8	52.9	3.2	26.2	2.7	19.0	1.3	13.3
	No treatment Fuel Model U (55%)	137.5	91.7	4.4	18.9	1.2	9.4	1.0	6.8	0.5	16.20
	Total untreated 250 acres	**250**	**330.8**	**16.2**	**71.7**	**4.4**	**35.6**	**3.6**	**25.8**	**1.7**	**29.5**
	Treated Fuel Model K 100 acres	100	96.9	4.6	21.6	1.3	11.7	1.1	8.1	0.5	10.1
	Treated Fuel Model K 250 acres	250	97.3	4.3	22.4	1.2	11.5	1.0	8.4	0.5	25.2
	Wildfire - Fuel Model K - treated	**1296**	**2815.7**	**474.3**	**2010.2**	**370.1**	**471.9**	**50.9**	**178.5**	**18.2**	**134.2**
	Wildfire suppressed at 6 acres	6	225.9	9.4	69.1	2.9	6.8	0.4	3.2	0.2	0.6
	Wildfire - Fuel Model K - light fuels	826	2238.7	377.0	2247.2	352.1	142.8	22.3	38.5	9.6	89.3
3	Wildfire- Fuel Model K - heavy fuels	470	1779.8	143.6	1583.5	109.6	92.3	26.1	56.1	13.6	68.4
	Total Wildfire treat but no burn	1296	4018.5	520.7	3830.7	461.6	235.0	48.5	94.6	23.2	157.7

Table 13 summarizes air quality information.

- Alternative 1 and Alternative 3 assumes no acres treated with prescribed fire, and so only wildfire emissions are shown.
- Alterative 2 shows the emissions from prescribed burning, as well as the emissions expected from wildfire after treatment. For comparison, Alternative 2 emissions show for 1,296 acres of burning as well as the wildfire expected after treatment (6 acres).

3.6. Other Resources/Issues: Environmental Consequences

3.6.1. Recreation/Scenery

3.6.1.1. Affected Environment

The project area lies within Management Area D, the most heavily used area on the Española Ranger District for recreation users—the area north and east of the City of Santa Fe, that runs along SR 475. As designated in the Forest Plan, these are primarily transportation corridors normally associated with state highways and high volume roads. They provide outstanding opportunities for developed recreation and viewing scenery as they occur through a variety of ecosystems. In Management Area D, all resource activities are to be managed for a visual quality objective (VQO) of retention. Retention means that management activities are not visually evident to the forest visitor. Management emphasis is on visual quality and developed recreation opportunity.

The area along the highway is highly developed due to the number of visitors. It is very close to Santa Fe, a national and international destination for vacationers. There are a wide variety of recreational activities that take place within the overall area in both dispersed recreation and developed recreation.

An estimated one million visitors per year travel NM State Road 475, adjacent to the project area. In addition to general tourism, the Santa Fe Ski Area is located at the terminus of the road and during the winter months when the ski area is open for downhill skiing, this is the only access route. During the summer months, several trails, campgrounds, and picnic areas are heavily used. The Pacheco Canyon/Aspen Ranch road is open for dispersed recreation in the summer as well. The main access to the Pecos Wilderness and the only National Recreation Trail (Winsor) on the district are accessed via the Ski Area Road.

As one gets away from the road, the use and development diminishes. There is only one Forest System trail in the project area, The Black Canyon Trail. Due to its proximity to town this trail is relatively heavily used year-round, in the summer for hiking, in the winter for skiing. This trail has been traditionally used for environmental education by certain day schools in the Santa Fe area, usually with younger children (ages 3-6) because it is a short and rather easy walk.

There are some “user created” trails, especially in the drainage bottoms, within the project area. These trails do not connect to others, they just end. There also is dispersed recreation (people walking with no trail) but this use is very low due to the steep terrain in the area. There is also relatively heavy dispersed camping.

The Black Canyon Campground provides recreation opportunities available to the Santa Fe community and visitors alike. It is the closest public campground to Santa Fe (seven miles from the Plaza), making it a very popular for visitors who wish to camp and tour Santa Fe rather than get motel accommodations. It is next to the Hyde Memorial State Park, owned by the State of New Mexico and run under the New Mexico State Energy, Minerals, and Resources Department

The existing landscape character of the project area ranges from heavily forested to less dense cover, depending on slope, aspect, and topography. Dense cover of mixed conifers is interspersed with patches of oak and aspen. This uniform canopy is interrupted by groves and clumps of vegetation intermixed with natural-appearing openings along ridge tops and hillsides. Rocky bluffs and outcrops are prominent throughout the area. The understory riparian vegetation is particularly thick along NM Highway 475, restricting views into the project area to 300 feet or less from the road edge.

Popular scenery-based and dependent activities drawing people to the project area include driving for pleasure, aspen-viewing, picnicking, camping, hiking, mountain biking and cross-country skiing. As a result, visitors place a high value on the scenic quality and have an interest and concern in impacts to the resource.

Management of this area includes evidence of timber harvests, dispersed and developed recreation, and fuel wood gathering. These activities are on-going and have occurred in the past, but they are not visually evident to the forest visitor.

3.6.1.2. No Action

A high-severity wildfire could result in the complete loss of day use areas and campgrounds at Chamisa Trailhead, Little Tesuque Picnic Ground (with historic structures), Hyde State Park, Bear Wallow Trailhead, Big Tesuque Campground, Aspen Vista Day Use Area, Vista Grande Overlook, and Santa Fe Ski Area. Developed recreation areas would take from 5 to 20 years to rebuild. Some trails would have to be abandoned due to severe erosion.

The loss of managed recreation would result in more unmanaged recreation, such as user-created campsites and trails. User-created sites cause other detrimental effects, like erosion. User-created sites would most likely be found in easily accessible areas near the highway.

In the event of a high-severity wildfire, the existing landscape character would be suddenly altered with little opportunity to slow or control the change. The VQOs in the project area would not change because fire is considered a natural part of the ecosystem; however, a high-intensity, large-scale wildfire would redefine and reshape the existing landscape character. The appearance and character of the area would shift from densely forested to patchy and open, depending on the severity of the fire. For several decades, the landscape would be dominated by blackened, dead standing trees; if allowed to come down on their own, the trees would likely fall in a dense, jackstraw pattern. This would most likely force the closure of Hyde Park Campground and Trail 181.

Initial public reaction to a fire tends to be negative, as many people do not consider extensive, blackened landscapes to be natural. These effects are often perceived by forest visitors as interesting but as a degradation of the scenic quality nonetheless. In addition, emergency fire suppression actions such as fire lines and emergency post-fire treatments could result in unnatural scars on the landscape. With mitigation measures, the effects of the suppression and emergency treatments would not be evident to the casual forest visitor within 1 to 2 years of completion, although effects from the fire itself would remain visible longer. Within 2 or 3 years, the effects of the fire would be viewed in a more positive light as the understory of grasses and shrubs moved in and as aspen regenerated. Opportunities for scenic viewing, particularly during fall color, would increase and improve with aspen regeneration; however, it would take several years to be realized.

3.6.1.3. Alternative 2

The short term effects of the action alternative would include closure of portions of the area, including Trail 181, while mechanical treatment was progressing to protect the public from harm from the equipment, any falling or flying debris, and to keep the equipment operators safe. Mitigation measures described in the Alternatives section avoids this effect by keeping recreation use away during operations. Another aspect would be smoke in the air which would be visible from the Byway, and the City, and would have an odor to visitors in the area. Flames may be visible from time to time from the Byway. This will have a temporary visual effect as well. Other visual effects would be mitigated as described in the Alternatives section of this document. For example, because of the high use in Black Canyon during the summer and early fall months, it would be crucial to remove this wood during the “off season,” when the campground is closed and trail use is at a minimum. This would mitigate any long-term effects on the visitors to the campground and trail. The campground typically closes in mid-October after the fall leaf changing season and reopens again mid-May.

Trail 181 would be opened up temporarily by permit for vehicular access to gather firewood. This would benefit people who like gathering firewood. However, this may also have short-term negative impacts on hikers who do not expect to encounter vehicles along this trail. Mitigation measures for safety call for closing the trail during implementation. In addition, the trail may need some rehabilitation after completion of firewood gathering to minimize impacts from the vehicular traffic. Impacts on hikers could be minimized by timing the permits for after high-use season (refer to 2380/3130 Letter.) The long-term effects would be beneficial by avoiding the adverse affects of wildfires. The visual quality objective for the area (Retention) would be met by implementing specific measures (e.g. cleanup within one year). Overall, scenic quality would improve as the diversity of tree species, size, and spatial distribution increased.

Most of the proposed activities will be set well back from the highway and will not be visible from Black Canyon Campground, Highway 475 or from other vista points within or outside the project boundaries.

The presence of piled or scattered slash in the foreground of Trail 181 and around the campground would detract from scenic quality for the duration of the project. This impact would be short term, however, because the slash would be gathered by the public for firewood. Activity generated slash not gathered by the public should be removed from the foreground of Trail 181 within 1 year of project completion. The ground disturbance resulting from using machines to pile slash would be noticeable for up to 1 year after project completion, depending on how quickly the areas were rehabilitated and vegetation regenerated.

The presence of red or black trees resulting from burning would present a contrast to the otherwise green surroundings. These contrasts would soften and become less noticeable within two or three growing seasons after project completion as the understory component (i.e. grass, aspen and oak seedlings, etc.) moved in, as singed but not dead trees recovered and greened up, and as dead standing trees fell down.

Because of steep terrain, dense roadside vegetation, and the alignment of NM Highway 475, only limited portions of the project area are briefly visible from three points along the highway. As described in the mitigation measures for the proposed action and alternatives, the impacts to scenery would be minimized by leaving slightly denser stand at these locations where mastication occurs. Burning on the side slopes would not create an unnatural impact to the scenery.

3.6.1.4. Alternative 3

The short term effects of this alternative on recreation and scenic resources are similar to Alternative 2. Smoke and fire effects would no longer be a factor under this alternative because burning would not be undertaken.

3.6.1.5. Cumulative Effects

The boundary for determining cumulative effects on recreation and scenic resources is the NM Highway 475 corridor and extends into the Santa Fe Watershed (SFW). Past, present, and reasonably foreseeable futures actions are (1) the current thinning in the Santa Fe Watershed, (2) the reconstruction of Black Canyon Campground, which will increase visitation to the area, and the (3) the continued use of other developed recreation sites along the corridor.

There would be no long-term adverse cumulative effects to recreation and scenic resources caused by the action alternatives because effects to and from recreation would be short in duration. Since 1990, the major activity in this corridor has been the reconstruction of developed recreation areas and thinning in the Santa Fe Watershed. Because the Santa Fe Watershed is closed to public entry, there would be no cumulative effects from this project to recreation uses. Any cumulative effects to recreation caused by the action alternatives would be positive since the reconstruction efforts have resulted in overall increased visitation due to improved facilities.

As described above, the short-term effects from the project would be from slash resulting from mechanical treatments and burning, if implemented. These short-term visual effects would not have a measurable cumulative effect with the other past, present, and reasonably foreseeable future actions.

3.6.2. Cultural Resources

Pre-consultation with the State Historic Preservation Office in May 2005 concurred with a 15% sample (268 acres) but 297 acres (16.3% sample) were inspected for the project. Six isolated occurrences were located and their information potential has been exhausted through documentation and no further protective measures are required. No sites were located during the 16.3% sample of the proposed project area. Therefore, there are no associated effects (direct, indirect or cumulative) with the proposed alternative.

3.6.3. Wildlife, including TES, MIS and Migratory Birds

This section evaluates the effects of the project to threatened or endangered species (T & E), species proposed for the T & E list, sensitive species, MIS species, migratory birds, and their habitats. The information in this section is summarized from the wildlife specialist's report located in the project record. All the action alternatives are consistent with Forest Plan standards ad guidelines for wildlife. A detailed biological assessment for threatened and endangered (T & E) species and a biological evaluation for sensitive species, MIS, and migratory

birds has been prepared and is included in the project record. Appropriate survey records are available in the project record.

3.6.3.1. Federally Listed Species

Federally proposed, threatened, and endangered habitats are not found within the project area. No potential nest/roost habitat exists for the Mexican spotted owl (MSO). No Protected Activity Center (PAC) for the MSO occurs in or adjacent to the area. No Critical Habitat for the Mexican spotted owl is designated in the area.

The District Biologist reviewed the Santa Fe National Forest endangered and threatened species list (USFS Regional Office Jan 2004), and literature that discusses the habitat requirements of the species on the list.

Fuels reduction projects throughout Forest Service Region 3 (Arizona and New Mexico) were assessed by the Forest Service Southwest Regional Office and a Biological Opinion was issued by Fish and Wildlife Service (FWS) in 2001. Site specific analysis shows that effects of the actions of this project are similar in nature and will have no effect to proposed, threatened, and endangered species or their habitats.

No habitat occurs for:

- Rio Grande silvery minnow
- Mexican spotted owl
- Bald eagle
- Holy Ghost Ipomopsis

Proposed actions will have "No Effect" on the Mexican spotted owl. By definition in the *Recovery Plan for the Mexican Spotted Owl* 1995, restricted habitat occurs along the riparian area of Little Tesuque Creek. No actions are planned that would affect the riparian area. The closest known PAC is over 25 miles away. The area was inventoried according to the Mexican Spotted Owl Inventory Protocol 2003 (FWS 2003) during the field seasons of 2004 and 2005 with negative results. MSO is not known to occur in the area. The adjacent Santa Fe Watershed was also surveyed to protocol for two years with and additional survey in 2000 and a few years with additional surveys by Rocky Mountain Research Station and all results were negative for the MSO.

3.6.3.2. No Action

The present condition of the forest will remain with forage availability generally low. Aspen stands will continue to decline and not regenerate. Species associated with aspen particularly the warbling vireo will also decline in the area. Trees will continue to be suppressed and large trees available to wildlife would be extremely limited as larger trees are lost to disease and old age. Risk to existing habitat from crown fire will continue and risk will increase as time passes. No benefits to wildlife will be gained without change to the forest condition.

In the event of a wild fire, vegetation conditions would change as described in the Vegetation section above. Habitat for species that require an in tact forest would decline (species include:). Species that use the more open habitats would fill in during this time until the forest has recovered.

3.6.3.3. Alternative 2

The alternative using prescribed fire (proposed action) will have a stimulating effect to the herbaceous understory. It would reduce woody debris and recycle nutrients to the soil. It would reduce tree competition and allow for increased tree growth. This would create more forage in the form of grasses, leaves, flowers and seeds for small mammals, mule deer and black bear. Deer use is light in the area but forage available to them would increase with prescribed burning. Wildlife grazing takes place in the spring through fall months as the area receives heavy snow in winter except for the past fours years of drought 1998-2003.

Herbaceous cover after burning would be limited for small mammals for a short period until regrowth occurs. This would make them more susceptible to predation until regrowth occurs. Small mammals would be potentially more abundant due to increased forage and vegetative cover. During summer months grass areas would produce a taller grass cover providing for an abundance of insects which are food for many species including turkey poults, neo-tropical migratory birds and their nestlings, predators, small mammals, and amphibians and reptiles. Taller

grass would provide the best protective cover along streams. It acts as a filter of sediment and provides hiding cover along banks for trout. In drier areas ponderosa pine and pinyon juniper provide cones, mushrooms and forbs as foods for a variety of birds such as the hairy woodpecker, junco, wren, and warblers and squirrel. Insects found in these forests play a major role as a food source. Scavengers and predators hunt the area for small mammals, birds, or carrion. All of these components of wildlife habitat would be only slightly reduced temporarily by prescribed burning because burning would be scheduled in late fall going into winter when plant and insects are dormant. The burned area would create fertile seedbeds for new growth when emerging from snow cover or when monsoons rains occur.

3.6.3.4. Alternative 3

The alternative that does not use prescribed burning (smokeless alternative) will not improve the quantity of available forage. It would reduce tree competition and allow for increased tree growth but the cut woody material that is lopped and scattered will heavily shade the ground and not allow for increased forage. Small mammals, mule deer and black bear will not benefit. The increased woody material on the forest floor could make movement through it difficult for fawns. These areas will be avoided by deer with fawns. It will take several years to decades depending on annual moisture for the material to break down and decay to release nutrients to the soil. This alternative will not benefit wildlife to the extent of the alternative that uses prescribed burning.

3.6.3.5. Forest Service Sensitive Species for the Santa Fe National Forest

3.6.3.5.1. Species Not Analyzed

The following sensitive species have no habitat in the area and they will not be analyzed:

Boreal owl, American peregrine falcon, Western yellow-billed cuckoo, White-tailed ptarmigan, Jemez mountain salamander, Goat peak pika, New Mexican (meadow) jumping mouse, Swift fox, Blue-black silverspot butterfly, Arizona willow, Chiricahua dock, and Rio Grande cutthroat trout.

3.6.3.5.2. Species Analyzed

The only sensitive species analyzed is the northern goshawk. Northern goshawk (goshawk) is a Forest Service Region 3 sensitive species. Potential foraging habitat is present in the area. Limited numbers and groups of large trees are presently suitable for nesting, however, high human activity is a deterent to possible use of the area for nesting. Proposed thinning (mastication) actions will move the stands of young forest to VSS 4 & 5 mid-aged forest with an open understory. This will also benefit prey species such as mice and chipmunks.

Small openings will meet the need of many goshawk prey species, regenerate the forest and regenerate aspen which is declining in the area due to fire suppression. The actions proposed are within those described in *Management Recommendations for the Northern Goshawk in the Southwestern United States* 1992.

3.6.3.6. Management Indicator Species

The Hyde Park Project considered Management Indicator Species (MIS) for the Santa Fe National Forest identified in the Forest Plan (USFS 1987). These species are: elk, Mexican spotted owl, hairy woodpecker, wild turkey, Rocky Mountain bighorn sheep, mourning dove, piñon jay, and Rio Grande cutthroat trout. Rocky Mountain bighorn sheep, elk, Mexican spotted owl habitat, and Rio Grande cutthroat trout are not present in the project area. Further information is available in the Hyde Park Wildland Urban Interface Project MIS Report (revised September 2006) in the project record.

MIS that have habitat in the area are: hairy woodpecker, wild turkey, piñon jay and mourning dove. These species are expected to benefit or experience no change from the proposed action. Elk are not known in the area due to the high level of human presence, constant traffic on State Road 475 (Hyde Park Scenic Byway), extremely steep ground and lack of forage.

3.6.3.6.1. General effects to MIS

New herbaceous plant and shrub growth of mountain mahogany, oak, and acorn production could benefit elk, wild turkey, and mourning dove as food sources. Hairy woodpecker habitat would not be changed because snags and large trees would be retained.

Total acres of ponderosa pine on the Santa Fe National Forest are 420,002 as stated in the Forest MIS Report 2003. The project area is approximately 1,825 acres that are 0.38% of the ponderosa pine available.

3.6.3.6.2. Cumulative Effects to MIS

No cumulative effects are expected to any species of wildlife from the proposal. Other activities in the area are hiking, dog walking, picnicing, camping, mountain bicycling, and driving the Scenic By-way. The area has hiking trails and experiences heavy recreational use. The area is bounded by Hyde State Park, Hyde Park Estates, the north boundary of Santa Fe Municipal Watershed, and State Road 475.

A number of similar vegetation projects have occurred near the project area that have similar effects to wildlife habitat. The largest of these is the Santa Fe Municipal Watershed Thinning Project, which is taking place to the south and east. Some similar thinning has occurred in the private lands to the west, as well as the Hyde Memorial Park to the north and east of the project area. Finally, the city of Santa Fe has undertaken to thin on parcels of city owned land several miles to the south of the project area.

The additional benefits of past and foreseeable future thinning would be to reduce the risk of crown fires across a larger area. Habitat changes would also be beneficial in the treated areas.

3.6.3.6.3. MIS Evaluation by Species

Table 14 shows the Management Indicator Species designated for the Santa Fe National Forest Plan EIS.

Table 14—MIS designated for the Santa Fe National Fores

Common Name	Scientific Name	Other Designations	Habitats Represented
Merriam's Turkey	Meleagris gallopavo		Ponderosa pine zone that allows for grass, forb and mast producing vegetation to grow.
Piñon Jay	Gymnorhinus cyanocephalus		Foraging habitat and mast producing species in the Piñon juniper habitat type.
Hairy Woodpecker	Picoides villosus		Mature forest habitat and snags
Mourning Dove	Zenaida macroura		Mid and low elevation grasslands, woodlands and Ponderosa pine habitat.
Mexican Spotted Owl	Strix occidentalis lucida	FWS Threatened Species	Late seral stage mixed conifer
Elk	Cervis elaphus nelsoni		Mid-elevation grasslands, meadows, and forested habitats.
Bighorn Sheep	Ovis canadensis canadensis		Alpine meadow habitat.
Rio Grande Cutthroat Trout	Oncorhynchus clarkii virginalis	Forest Service Sensitive Species	Represents riparian habitat and water quality.

3.6.3.6.4. POPULATION ESTIMATES FOR MIS

Estimates of populations for MIS species were evaluated from a number of sources for each species and then ranked into descriptive categories for the Santa Fe National Forest (Santa Fe National Forest Management Indicator Species Assessment, 2003). Populations of MIS species would be expected to fluctuate within a category from year to year. However, we would not expect a species to switch from category to category without some long-term change in environmental conditions. For instance a change in ranking from uncommon to rare would be a cause for concern; and would warrant intensive evaluation of a species. A ranking system is based on the predicted number of breeding pairs; or adult females depending on which is most appropriate for the species addressed.

Table 15 displays the ranking system for the Forest-wide evaluation is as follows:

Table 15—Ranking system for MIS evaluations

CATEGORY	BREEDING PAIR/ADULT FEMALE
Not Present	0
Extremely Rare	1-10
Rare	10-100
Uncommon	100-1,000
Common	1,000-10,000
Abundant	10,000-100,000
Very Abundant	>100,000

3.6.3.6.5. MIS EVALUATION OF PROJECT AREA

The project is totally within elevation approximately between 8,000 and 9,500 feet. Table 16 and Table 17 provide the list of selected MIS and rationale for inclusion or exclusion from this assessment.

Table 16—MIS Assessment determination

Common Name	Assessed	Rationale
Merriam's Turkey	Included	Habitat and Species present in area
Piñon Jay	Included	Habitat and Species present in area.
Hairy Woodpecker	Included	Habitat and Species present in area.
Mourning Dove	Included	Habitat and Species present in area.
Mexican Spotted Owl	Assessed in the TE section above	No Critical Habitat
Elk	Not assessed	Species not present in area.
Bighorn Sheep	Not assessed	Habitat and Species not present in Area.
Rio Grande Cutthroat Trout	Not assessed	Habitat and Species not present in area.

Table 17—MIS habitat types affected

Common Name	Habitat Type	Total Acres	Total Acres Affefcted	Percent
Merriam's Turkey	Ponderosa Pine	420,002	1,300	0.38%
Pinon Jay	Piñon/Juniper	452,335	200	0.04%
Hairy Woodpecker	Ponderosa Pine	420,002	1,625	0.38%
Mourning Dove	Pinyon/Juniper	452,335	200	0.04%
	Ponderosa Pine	420,002	1,625	0.38%

3.6.3.6.6. Merriam's Turkey (Meleagris gallopavo)

AFFECTED HABITAT DESCRIPTION

The Merriam's turkey is the most common subspecies of turkey. It is found in many mountainous areas of northern New Mexico. The bird utilizes ponderosa pine, a source of mast and its favorite roosting tree. The ponderosa pine is an essential component of its permanent habitat, while surface water is a requirement. Turkeys prefer to roost in tall mature or over-mature ponderosa pines with relatively open crowns and large horizontal branches starting at 20 to 30 feet from the ground. Trees with a diameter at breast height (DBH) of over 14 inches are used as roosts. These trees usually have excellent protection from the wind, and must be located in sites with an open ridge or rocky ledge nearby to provide ease in entering and exiting the roost site. Hens normally nest within ½ mile radius of water.

A healthy ponderosa pine understory provides the turkey cover, as well as forage. Turkeys forage in grasslands, brush communities, deciduous tree-brush and in ponderosa pine. They eat grasses and grasshoppers in the summer. They eat oak supply mast and mature ponderosa pine seeds in fall. Tall grasses are eaten in the winter when the heavy snows come. The Hyde Park WUI has low quality habitat for the Merriam's turkey due to the lack of herbaceous understory.

ANALYSIS OF EFFECTS

The mastication and prescribed burn treatments should have a beneficial effect on habitat for turkey. Although there could be some temporary and minor disturbance to individual turkeys, causing them to move away from the disturbance for a short period of time, this would not negatively affect their ability to reproduce or survive. Turkeys are very mobile, so all the potential negative effects would not impact the population nor contribute to a downward trend in the population.

POPULATION ANALYSIS

Turkeys are very wary, secretive; and avoid contact with people. The turkey population on the Santa Fe National Forest is ranked as common (1,000-10,000 individuals). This population would fluctuate from year to year based on various environmental conditions and hunter success; and would not be expected to change as a result of project activity. The population trend on the Forest has been rated as stable or increasing. Populations in the project area are expected to follow this same general trend.

EFFECTS DETERMINATION

This project is likely to have no negative impacts on the overall population trends for turkeys in the project area. The potential for incidental loss of a turkey nest would not likely be measurable above the normal population fluctuations that occur from year to year. Implementation of this project is not likely to measurably influence the status or trend of this species.

3.6.3.6.7. Piñon Jay (Gymnorhinus cyanocephalus)

AFFECTED HABITAT DESCRIPTION

Piñon jays nest mainly in stands of piñon-juniper. It needs open woodlands for nesting and an adequate supply of seeds, especially nuts (Terres 1980). They are gregarious and breed in colonies up to 150. They spend the winters in large flocks of 10's or 1,000's moving in search of piñon stands with a successful crop of piñon nuts that are a primary food source along with other seeds, fruits and insects.

Stands of piñon-juniper provide the habitat for the piñon jay on the Santa Fe National Forest. Limited piñon-juniper stands are in the project area, which would provide suitable habitat for this species. Most of the project occurs in ponderosa pine habitat type, which is not the preferred habitat for this species.

ANALYSIS OF EFFECTS

Nesting habitat of the piñon jays would not be affected. Although there could be some temporary and minor disturbance effects to individual piñon jays, causing them to move away from the disturbance for a short period of time, this would not negatively affect their ability to reproduce or survive. Thinning activities would not damage or destroy individual nests because the piñon stands in the area are no longer potential nesting areas due to high mortality from Ips beetles. Potential negative effects would be minor and temporary disturbance, and would not impact the population nor contribute to a downward trend in the population.

POPULATION ANALYSIS

Piñon jay nesting populations are stable or decreasing based on Breeding Bird Surveys in New Mexico. The species occupies New Mexico as a breeding and winter resident. The piñon jay on the Santa Fe National Forest would be ranked as common (1,000-10,000). This project area has limited acres in the piñon-juniper type. Piñon jays are variably residents in mainly middle elevation areas containing piñon-juniper woodlands almost statewide, and are considered uncommon to locally abundant (Ehrlich 1988). Even within these habitats, however, their occurrence may be very unpredictable and seasonally sporadic. In mass movements during years of poor seed crop especially piñon nuts, flocks may move hundreds of miles (USDA Forest Service 1991). Due to the unpredictable movements of these birds, population estimates for project level analysis is not possible.

EFFECTS DETERMINATION

This project is likely to have no impacts on the Piñon jay populations in the project area because most of the piñon trees in the project are dead or dying. Birds are not likely to use or occupy the area because of the widespread mortality in the piñon and the small amount of habitat within the project area. The effects of the project are not likely to be measurable above the normal population fluctuations that occur both seasonally and from year to year. Implementation of this project is not likely to measurably influence the status or trend of this species.

3.6.3.6.8. Hairy Woodpecker (Picoides villosus)

PREFERRED HABITAT DESCRIPTION

The hairy woodpecker is an indicator species for the presence of snags and down logs. The species is a forest generalist, keying in on available snags and live aspen. Nests are primarily in trees averaging 17 inch DBH and approximately 60 feet high. It forages primarily on tree trunks averaging 17 inch DBH and >30 feet high. Down logs are important to support insect populations for foraging. Scott and Church (1988) found that hairy woodpecker densities were negatively correlated with aspen basal area in west-central Colorado. Large trees, which are future down logs and snags, are maintained across the Santa Fe National Forest in accordance with the Forest Plan[4] and the background matrix of current snags and down logs. Snags and down woody debris comprise an important element to the background matrix of the forested landscape. The habitat trend for Hairy woodpecker is considered stable for the Forest.

AFFECTED HABITAT CONDITION

The project area is comprised predominately of ponderosa pine forest with inclusions of aspen, and mixed conifer. Trees (live and dead) in the project area are large enough in diameter to be used by this species. Snags and down logs within the project area have increased due to mortality from the Douglas fir beetle and the drought of the past few years (1996 to the present).

ANALYSIS OF EFFECTS

Under either Alternative 2 or 3 approximately 826 acres of smaller diameter trees will be masticated. While this acreage is habitat for hairy woodpeckers, the mastication of smaller diameter trees and prescribed burns will have minimal effect on the overall habitat quantity and quality on the Santa Fe National Forest. A low potential for incidental loss of a cavity nest tree exists because large trees will be not be masticated. No effects to individual woodpeckers are expected.

POPULATION ANALYSIS

The Hairy woodpecker population is ranked as abundant for the Santa Fe NF. This means that the estimated number of breeding pairs ranges between 10,000 and 100,000. The population of hairy woodpeckers is considered stable to increasing on the Santa Fe National Forest based on the trends seen within the State of New Mexico, observations on breeding bird surveys in or adjacent to the Forest and habitat conditions within the Forest.

EFFECTS DETERMINATION

This project is expected to have no effect to the overall population trend for hairy woodpecker on the Santa Fe National Forest. Implementation of this project is not likely to measurably influence the status or trend of this species.

3.6.3.6.9. Mourning Dove (Zenaida macroura)

AFFECTED HABITAT DESCRIPTION

Mourning Dove is found across North America in many types of habitat including most forest types. It is wide spread except in the Arctic and closed forests. It is abundant and increasing near farms and suburbs. It frequents backyard feeders, suburbs and towns. They are common to abundant in most counties in New Mexico.

Throughout the Santa Fe National Forest, Mourning dove habitat is abundant. This species is primarily found in lower elevations of the Forest, however, they are found in Douglas-fir, ponderosa pine, spruce-fir, aspen, and piñon-juniper forest types. Coniferous trees and ground sites are preferred early in the year before deciduous trees have developed leaves. In all situations however, abundant food and water must be available within 20-30 km. These habitats and grassland habitats found on the Forest meet the feeding requirements for the Mourning dove. Water developments and under burning in ponderosa create favorable feeding areas. The abundance of nesting and cover opportunities on the Santa Fe contribute to maintaining viable populations of Mourning dove. The Hyde Park WUI project area provides suitable habitat for the Mourning dove.

ANALYSIS OF EFFECTS

Thinning and small openings would allow more grasses and forbs that produce seed for foraging. Although there could be some temporary and minor disturbance effects to individual doves, causing them to move away from the disturbance for a short period of time this would not negatively affect their ability to reproduce or survive.

POPULATION ANALYSIS

Mourning Dove nesting populations are stable or decreasing based on Breeding Bird Surveys in New Mexico. This species occupies New Mexico as breeding resident and can be found year round in the southern counties. No threats to the mourning Dove are known except for human encroachment or over hunting. On the Santa Fe National Forest the Mourning dove would rank as common (1,000-10,000). The New Mexico Natural Heritage Program ranked populations of Mourning Dove in New Mexico as “Demonstrably Secure” in October 1997. It is a multiple brooder and the most abundant dove in North America and the most widely hunted and harvested game

bird. Natural mortality factors include predation of adults and free-flying young by avian and mammalian predators and destruction of eggs and nestlings.

EFFECTS DETERMINATION

This project is likely to have no negative impacts on the overall population trends for mourning dove in the project area. The potential for incidental loss of a mourning dove nest would not likely be measurable above the normal population fluctuations that occur from year to year. Implementation of this project is not likely to measurably influence the status or trend of this species. Habitat quantity would not change but the change in quality would be beneficial to dove habitat. Implementation of this project is not likely to measurably influence the status or trend of this species.

3.6.3.7. Migratory Birds

For detailed information, see the Migratory Bird Section of the Wildlife Report. The project area is ponderosa pine with understory of seedlings/saplings and pole-sized white fir and Douglas fir, with brush species such as Mountain mahogany and shrubby Gambel oak and pinon-juniper in the lower elevations.

Woody material in the form of fallen trees and large limbs is present throughout the area. Effects to high priority species from the NM Partners in Flight list not previously analyzed would experience conditions moderately changed to more favorable under the proposed action, Alternative 2.

Temporary impacts of noise and disturbance would occur lasting from as short as a day to a up to a week based on the location of the machinery. Habitat would benefit or the effect would be neutral to species using the area.

Concern about high priority species stem from possible loss of snags, and the effects to habitat from fire suppression, or effects of commercial thinning. Thinning as proposed will not remove snags or large trees unless they present a hazard to workers in the area or restrict equipment movement in a way to cause a safety hazard. Snags will be created by the proposed prescribed burning under Alternative 2. Thinning will enable prescribed fire to maintain the ecological processes as part of this landscape.

3.6.3.7.1. Migratory Bird Effects

No adverse effects will occur to Migratory Birds because the actions will improve habitat conditions over the long term and restore ecological integrity to the vegetation types by reducing the number of trees per acre and protect variable age class structure

On January 10, 2001, President Clinton signed Executive Order 13186 placing emphasis on conservation of migratory birds. The Forest Service, Southwestern Region, currently analyzes effects (impacts) in the following manner:

- effects to Highest Priority listed by Partners in Flight
- effects to Important Bird Areas (IBAs)
- effects to important overwintering areas

Migratory birds and their habitats are protected under the federal Migratory Bird Treaty Act of 1918.

NM Partners in Flight considers eight risk factors in identifying conservation priority species: Global Abundance, NM Breeding Abundance, Global Breeding Distribution, NM Breeding Abundance, Threats to Breeding in NM, Importance of NM to Breeding, Global Winter Distribution, and Threats on Wintering Grounds. Species with the highest risk factors are classified as “highest priority” for conservation action. This evaluation addresses general effects to migratory birds. Specific effects to highest priority species for the main habitats are found in Table 1, which displays habitats and species that may occur in Hyde Park WUI.

No FS Regional or Forest policies have been developed to provide guidance on how to incorporate migratory birds into NEPA analysis. Advice from the Regional Office is to analyze effects in the following manner: (1) effects to Highest Priority species listed by Partners in Flight; (2) effects to Important Bird Areas (IBAs); (3) effects to important over-wintering areas. These notes provide information about migratory bird effects from the Hyde Park WUI.

3.6.3.7.2. Highest Priority

New Mexico State Partners in Flight lists priority species of concern by vegetation type. This analysis reflects a review of all species of Highest Priority for vegetation types found in this project area (ponderosa and piñon-juniper). This review is displayed in Table 18.

Table 18—Migratory species that may occur in or near the project area.

Veg type	Species	Habitat	Habitat Impacts	Disturbance Effects
Piñon-juniper	**Black-throated gray warbler**	**Piñon juniper, mostly in piñon for nesting. Habitat quality is reduced due to high piñon mortality from beetle kill and drought.**	**New, young trees will be available trees and healthier stand over the long term.**	**Temporary during implementation. No disturbance if action takes place after July through April.**
Ponderosa pine	**N. goshawk** **Mexican spotted owl** **Flammulated owl** **Virginia's warbler** **Grace's warbler**	**See TES write-up** **See TES write-up** **Large snags in or near open areas. Low number of snags in area but they will be protected.** **Nests on ground in a variety of understory species and high litter cover. Gambel oak shrub preferred.** **Gleans insects from large trees. Prefers open forest.**	**See TES write-up** **See TES write-up** **Snags will be protected per FLMP direction except for hazard trees.** **New snags will be created through Rx burns.** **Chopping slash benefits ground cover. Oak will benefit from more open understory.** **Mature green trees will be retained in the area. Younger age classes will benefit from decreased competition. Reduced understory beneficial, meets open forest preference.**	**Temporary during implementation applies to all species. None or low disturbance if action takes place after July through April.**

The Ferruginous hawk, Gray vireo, Gray flycatcher, or Bendire's thrasher in the piñon-juniper were not considered because they are not found in the project area. The Greater pewee or the Olive warbler were not considered because they do not occur on the Santa Fe National Forest.

3.6.3.7.3. Important Bird Areas

There is no designated Important Bird Area (IBA) affected by the project. The proposed IBA's on the Santa Fe National Forest are Golondrino Mesa north of Cuba, the Chama River Gorge from El Vado to the north end of Abiqiui Reservoir, the Caja del Rio and the Santa Fe River Canyon below the Caja del Rio on both BLM and FS lands, located more than 20 miles from the project. There is no association or important link between the bird communities in the Hyde Park WUI and these IBA's. Therefore, no IBA is affected by the project.

3.6.3.7.4. Over-wintering Areas

Many important over wintering areas are large wetlands. Important overwintering areas recognized on the Forest include: the Rio Chama and Rio Grande corridor. The Hyde Park WUI is not recognized as an important

over-wintering area because significant concentrations of birds do not occur here nor do unique or a high diversity of birds winter here.

3.6.4. Soil/Water

3.6.4.1. Affected Environment

The Hyde Park Wildland Urban Interface Project is located within the Pojaque River – Rio Grande (HUC 5th Code) watershed. At the smaller watershed scale (HUC 6th Code) the watershed is located within watershed # 130201011001 (Little Tesuque Creek) (Table 19).

Table 19—Hydrologic Unit Codes (HUC) 6th and 5th Level

HUC 5th Level Watershed #	HUC 5th Level Name	Watershed Acres	Project Acres by watershed	% Project Acres by watershed
1302010110	Pojoaque River-Rio Grande	249,849	1,601	0.6
1302020103	Santa Fe River	164,259	218	0.1
HUC 6TH Level Watershed #	**HUC 6th Level Name**	**Acres**	**Project Acres**	**% Project Acres by watershed**
130201011001	N/A	31,863	1,601	5.0
130201011001	N/A	17,934	218	1.2

Little Tesuque Creek and headwater drainages dissect through Precambrian granites, and flows down through the granite/granite derived soils until it enters the (Santa Fe) valley (personal communication, Larry Gore). Soils derived from these granitic parent materials are classified at the Soil Order level as Inceptisols and to a lesser extent Entisols.

Table 20—TES Map Unit and Associated Soil Taxonomy and Soil Surface Characteristics

TES MAP UNIT	Acres of TES Map Unit in Project Boundary	Soil Order	Soil Greatgroup	Soil Surface Texture	Percent of Current Surface Cover			
					Rock Fragments	Vegetation	Litter	Soil
6	14.4	Mollisols	Haploborolls	sandy loam	25	20	50	10
337	5.8	Inceptisols	Cryochrepts	sandy loam	40	5	75	5
353	1336.2	Inceptisols	Dystrochrepts	sandy loam	60	5	60	5
358	155.5	Entisols	Ustorthents	sandy loam	65	10	30	20
359	313.5	Entisols	Ustorthents	sandy loam	65	10	45	5

*Total percent of current surface cover can exceed 100 percent since litter can occur over rock fragments.

Five Terrestrial Ecosystem Survey (TES) map units are found within the project area. TES map unit delineations are based on differences in landform, geology, topography, vegetation and resulting soil types (USDA Forest Service 1993). Common soil surface characteristic for these soils include: sandy loam texture, high percent of surface rock fragments, low vegetative cover, moderate to low litter cover and little exposed soil due to the high percentage of surface rock cover. (Table 21).

Table 21—Current Predicted Annual Soil Loss

TES Map Unit	Acres	Annual Soil Loss								Soil Condition	Erosion Hazard*
		Natural		Current		Tolerence		Potential			
		Tons/ acre	Total (Tons/ Yr)	Tons/ acre	Total (Tons/Yr)	Tons/ acre	Total (Tons/ Yr)	Tons/ Acre	Total (Tons/ Yr)		
6	15	0.1	1	0.5	7.3	2.7	41	4.3	64.3	Satisfactory	Moderate
353	1338	0.2	325	0.4	541.4	3.6	4873	6.1	8121.7	Satisfactory	Moderate
358	157	0.6	89	0.6	101.6	0.9	140	3.7	577.6	Satisfactory	Severe
359	315	0.4	126	0.5	157.5	2.7	851	4.9	1543.5	Satisfactory	Severe
Total (Tons/Year)			541		808		5904		10307		

*** Erosion Hazard - This refers to the relative susceptibility (worst case scenario) to sheet and rill erosion upon removal of all vegetation and litter. A severe erosion hazard indicates that under those conditions soil erosion would result in a loss of site productivity.**

Annual soil loss rates (tons/acre) for each TES map unit are predicted using the Universal soil Loss Equation (USLE). Soil loss rates are not considered as absolute values and are useful as an index for comparison (USDA Forest Service 1993). Current annual soil loss is grater than natural rates and well below the tolerance soil loss, where site productivity is no longer sustained (Table 3x). Soil loss rates are predictions based on the following four categories:

1. Potential is the rate of soil loss that would occur under conditions of complete removal of the vegetation and the litter portion of groundcover (maximum rate).
2. Natural is the rate of soil loss that would occur under conditions associated with a climax class (minimum rate).
3. Current is rate of soil loss occurring under existing conditions of groundcover.
4. Tolerance is the rate of soil loss that can occur while sustaining inherent site productivity.

Over 73% of the project area's soils are mapped (TES map unit 353) as having a moderate soil erosion hazard rating. All soils have a satisfactory soil condition rating, meaning that the three primary soil functions; hydrologic, soil stability and nutrient cycling are functioning to a level where soil productivity and watershed condition is maintained.

Surface hydrology within the project boundary is limited to first and second order intermittent streams with discharge occurring primarily during spring snowmelt/runoff period and on occasion during the monsoon season. Drainages are steeply incised, forming alluvial fans as they become second order drainages and enter wider valley bottoms. Lateral dissected draws, showing little or no sign of a scoured channel, feed into these first and second order intermittent drainages. Typically, these lateral draws have alluvial fans that are dissected at the fan toe and are no longer active. These alluvial fans may be a relic of the Holocene Period, (the last ~ 10,000 years) having a warmer and drier climate. Alluvial fans that have formed at the wider valley bottoms are presently active under current climactic and watershed conditions. Sediment deposition is minimal and occurs during spring snowmelt/runoff periods and to a lesser extent during the monsoon season. Black Canyon Campground is built on coalesced alluvial fans emanating from first and second order drainages.

Intermittent streams within the project boundary all flow into Little Tesuque Creek, which is listed in the 2004-2006 Clean Water Act Integrated 303(d)/305(b) for elevated levels of aluminum. Aluminum is a common, naturally occurring element, often derived from weathered Granites, ash and lava. In general, increases in dissolved aluminum can be linked to sediment transport, but NMED data did not show a correlation between Dissolved Aluminum and Total Suspended Sediment for Little Tesuque Creek (2004-2006, NMED SWQB 303(d)/305(b) list.

3.6.4.1.1. No Action (Alternative 1)

There would be little change from existing condition as described in the Affected Environment. A slight increase in erosion may result from the continued growth and shading of overstory trees upon the soil stabilizing herbaceous ground vegetation.

As described in the vegetation section of this analysis, the probability of a large forest fire occurring encompassing the project area within the next twenty years is high (about 99 percent). This no action alternative scenario assumes that a wildfire will occur in the 1,850-acre project area in a typical mosaic fashion where 40 percent of the project area will burn at a high severity, 35 percent will burn at a moderate severity and the remaining 25 percent will burn at a low severity or remain unburned.

In this scenario, the following predictions have been made about a**nnual soil loss and sediment delivery:**

- Potential annual soil loss rates (maximum rate of soil loss), using the TES, predict the rate of soil loss that would occur under complete removal of the vegetative ground cover (high severity wildfire).
- The hydrophobic effects to soil from fire, the reduction in soil/water infiltration rates, can increase potential soil loss rates. Hydrophobic effects on soil/water infiltration rates for areas that incur a low severity fire compared to unburned-undisturbed areas is similar while areas that incur a high severity fire can cause a 10-40% reduction in soil/water infiltration rates (Robichaud, P.R. 2000).
- Reductions in soil/water infiltration rates increase soil loss and sediment delivery rates. Generally, erosion rates and sediment delivery rates return to base rates within four to five years after a fire event (Agee, 1993). Again, soil loss rates utilizing the TES are not considered as absolute values and are useful as an index for comparison (USDA Forest Service 1993).
- Annual soil loss is predicted using TES map units along with multipliers based on assumptions for burn severity and “water repellency” hydrophobic effects (Soil Report Appendix 1). Annual soil loss resulting from the described wildfire scenario could result in approximately 6,493 tons of soil loss after the first year, over an eight-fold increase from current soil loss rates of 808 tons/year (Soil Report Appendix 1). Predicted wildfire soil loss rates are greater than tolerable soil loss rates, the threshold for sustaining inherent soil/site productivity.
- Sediment delivery is the predicted amount of sediment that would be transported to a stream channel. Post-wildfire sediment delivery is predicted using TES map units along with multipliers based on assumptions for sediment delivery by dominant overstory vegetation and soil erosion hazard rating (USDA Forest Service, 2000). Sediment delivery resulting from the described wildfire scenario could result in approximately 182 tons of sediment after the first year, over a nine-fold increase from current sediment delivery rates of 19 tons/year. It is expected that these sediments, coarse and suspended, would be realized and delivered to Little Tesuque Creek. The majority of larger, mobilized sediments would be retained within the first and second order drainages, building upon existing alluvial fans and channel levee formation.

3.6.4.1.2. Alternative 2

This analysis estimates that mechanical treatment would reduce current soil loss rates by 20%, to 293 tons/year from current soil loss rates of 367 ton/year. Mechanical treatment through mastication of trees will leave chipped and shredded tree fiber on the ground, which will reduce surface soil erosion. It is expected, that over time, a more vigorous herbaceous understory will become established, further reducing surface soil erosion. Soil compaction/displacement is limited to areas that experience multiple passes over the same ground by thinning machinery (primary access skid trails) and does not occur from individual passes during mastication. Observations of the same type of proposed mechanical treatment in the Santa Fe Municipal Watershed indicate less than 2 percent of the soil surface experiences multiple passes (primary access skid trails), or detrimental soil compaction/disturbance. Water baring and seeding of weed free native grasses on primary access skid trails will further reduce the potential of soil surface erosion.

Prescribed broadcast burning with low to moderate burn intensities would occur on approximately 1,300 acres within the project boundary (470 acres in the next five years). Prescribed burning will occur in the fall when air

temperatures are cooler, relative humidity is higher, and soil moisture is higher than in the spring or summer. Low to moderate burn intensities will occur over approximately 70% of targeted acres. The hydrophobic effect (water repellency) to soils from prescribed fire is minimal due to the higher soil moisture and humidity conditions (reduced soil heating times) that occur in the spring and fall (Robichaud P.R. 2000). For comparison, the wildfire scenario "no action" assumptions and multipliers for soil loss and sediment delivery predications were applied to the prescribed burn treatments. Generally, erosion rates and sediment delivery rates return to base rates within four to five years after a fire event. Again, soil loss rates utilizing the TES are not considered as absolute values and are useful as an index for comparison (USDA Forest Service 1993).

Predicted soil loss, for the first year after prescribed burn treatments, could result in a net increase of approximately 220 tons or a 27 percent increase over current annual soil loss rates for these soils of 580 tons/year, well below the annual soil loss tolerance rate of 4,026 tons/year for the affected TES units (Table 22).

Predicted sediment delivery, for the first year after prescribed burn treatments, could result in a net increase of approximately 6 tons or a 30 percent increase over the current annual sediment delivery rate of 15 tons/year. It is expected that these sediments, coarse and suspended, would be retained within the first and second order drainages, building upon existing alluvial fans.

Prescribed fire treatments would be implemented over a three-year period (approximately 400 acres per year) where first year soil loss and sediment delivery increases would diminish incrementally, prior to the subsequent treatment of additional acres.

No treatments within the riparian area are proposed, with the exception of hand thinning 5 acres to the north of Back Canyon Campground. It is estimated that hand thinning will not effect current annual soil loss rates. Trees and shrubs that provide bank stability will not be removed.

Table 22—Predicted Annual Soil Loss

Alternatives	Predicted Soil Loss (Tons/Yr for all soil types))	Predicted Sediment Delivery (Tons/Yr)
Alt. 1 No Action: Existing/Wildfire	808/6,493	19/182
Alt. 2 Proposed Action	986	25
Alt. 3 "Smoke Free"	671*	17*
* Alternative 3 soil loss and sediment delivery assume no wildfire would occur. With a fire, effects would be similar to Alternative 1 for a similar sized fire.		

3.6.4.1.3. Alternative 3

This alternative proposes to mechanically (mastication) treat approximately 860 acres of mixed conifer, Ponderosa Pine and Pinon/Juniper stands on slopes less than 40 percent and treat 470 acres with chainsaw thinning, lop and scattering of slash, on slopes greater than 40%. Hand thinning of approximately 5 acres, to the south of Black Canyon Campground is also proposed.

Annual soil loss predictions for mechanical treatment (mastication) would be the same as alternative 2, but without prescribed burning. Hand thinning treatments with lop and scatter of slash on sloes greater than 40% is expected to provide greater soil ground cover and is predicted to reduce current annual soil loss rates to natural annual soil loss rate.

No treatments within the riparian area are proposed, with the exception of hand thinning 5 acres to the north of Back Canyon Campground. It is estimated that hand thinning will not effect current annual soil loss rates. Trees and shrubs that provide bank stability will not be removed.

It is estimated that thinning on slopes greater than 40% will increase current fuel loading resulting in a slash bed 1 to 18 inches in depth. For a period of about four years after treatments, simulated fire behavior (rate of spread and flame length) under this alternative will be greater compared to the No Action Alternative and so detrimental effects to the soil resource would be more sever due to higher soil surface temperatures, longer burn duration and hydrophobic effect "water repellency" resulting in greater soil loss and sediment delivery. Long-term

site productivity could be compromised with the heavy fuel loads left in place that would reduce vegetative ground cover.

3.6.4.2. Hydrology

Measurable change in peak flows from project activities for alternatives 2 and 3 are not expected at the HUC 5th (0.7 percent of the watershed) and HUC 6th Code level (5.7 percent of the Little Tesuque Creek watershed) as well as the first and second order intermittent streams within the project boundary. Historically, these stream systems have evolved under a more frequent fire regime and have the capacity to accommodate any immeasurable changes in peak flows.

Riparian areas are located along Little Tesuque Creek and portions of first and second order stream drainages. Riparian (area) ecosystems are distinguished by the presence of free water within the common rooting depth of native perennial plants at least seasonally (10 percent of the time or more). Riparian areas are normally associated with seeps, springs, marshes, ponds, or lakes. They commonly comprise a mixture of water (aquatic) and land (phreatic) ecosystems. “Free water” occurs from ground water saturation or concentration of downslope-moving subsurface water. Plants often reliably indicate this condition. In the absence of reliable indicator plants, soil properties or plant communities can be used (Forest Service Handbook. Section 2509.23). Riparian areas will be managed in accordance with Forest Plan guidelines (SNF Forest Plan P. 79).

Proposed alternatives will not increase current levels of aluminum in Little Tesuque Creek, which is listed in the 2004-2006 Clean Water Act Integrated 303(d)/305(b) for elevated levels of aluminum (NMED SWQB. 2004-2006. 303(d)/305(b) list).

3.6.4.3. Conclusion

Proposed activities are not estimated to have a long-term adverse effect on soil loss rates, sediment delivery rates or water quality. Short-term increases in soil loss rates and sediment delivery will likely result with the implementation of the Preferred Alternative, having prescribed burn treatments, and will result in slightly higher soil erosion rates than existing current soil erosion rates and well below soil erosion tolerance rates, and will incrementally recover within five years of treatments. The Smoke-Free alternative will result in slightly lower soil loss and sediment delivery rates than current rates. The No Action Alternative “current condition” will not change current soil loss and sediment delivery rates. The No Action Alternative “fire scenario” will result in elevated soil loss and sediment delivery rates above tolerance levels, reducing soil/site productivity.

3.6.4.4. Cumulative Effects

Cumulative effects are often analyzed by watershed, commonly at the 6th or 5th Hydrologic Unit Code (HUC) level. Cumulative effects analysis addresses the incremental impact of an action when added to other past, present, and foreseeable future actions, regardless of what entity undertakes such other actions (40 CFR 1508.7). Cumulative effects within a watershed can be defined as the total impact, positive or negative, on; runoff, erosion, water yield, floods and water quality that result from the incremental impact of a proposed action, when added to other past, present and reasonably foreseeable future actions occurring within the same natural drainage basin (watershed).

Cumulative effects for the proposed Hyde Park WUI considered the 6th code watershed level. Hyde State Park has recently implemented a fuels reduction project on about 40 acres. Future Wildland Urban Interface (WUI) thinning projects may be proposed and implemented adjacent, and to the north of the proposed Hyde Park WUI, but to date this information is not known. Continued fuels reduction efforts through forest thinning within this 6th Code watershed will lower the threat of a catastrophic wildfire that could result in detrimental soil erosion and adverse water quality.

3.6.5. Economic Considerations

To consider the relative economic difference among alternatives, the software QuickSilver was used to determine net present value (NPV) change. The model displays the results as a "least cost" analysis. A conservative economic analysis shows that a crown fire of 1,000 acres resulted in a cost of approximately $15,000,000 in suppression, rehabilitation costs and lost revenues. By implementing Alternative 2, these costs could be avoided. Implementing Alternative 3 could result in a large fire, but because of intensity is changed, the net savings would be approximately $5,000,000 if similar conditions existed.

Table 23—Relative Cost

	Mastication ($400/ac)	Burn ($150/ac)	Thin ($500/ac)	Total for Treatment	Cost of Wildfire
No Action	0	0	0	0	$15 million
Alt. 2	332,000	70,500	0	402,500	
Alt. 3	332,000	0	235,000	567,000	$10 million

3.6.6. INVENTORIED ROADLESS AREA

3.6.6.1. Affected Environment

The entire project area is within a designated Inventoried Roadless Area (IRA). The 2000 Roadless Area Conservation Rule identified specific characteristics for inventoried roadless areas, considered to be the best criteria to address the effects to inventoried roadless areas from project activities. These nine characteristics are analyzed in the rest of this section.

- **Soil, water and air resources:** More than 73% of the project areas soils are mapped as having a moderate soil erosion hazard rating (TES map unit 353). All soils have a satisfactory soil condition rating, meaning that the three primary soil functions; hydrologic, soil stability and nutrient cycling are functioning to a level where soil productivity and watershed condition is maintained. Little water flows through the project area. Air quality is excellent.
- **Sources of public drinking water:** The project area abuts the Santa Fe Municipal Watershed, which is also in the same IRA and is a source of water for the City. Stream flow in the Little Tesuque Creek provides sources of water to feed wells in the Village of Tesuque and Tesuque Pueblo.
- **Diversity of plant and animal communities:** The project area contains a lower plant and animal diversity than typical in Southwest forests of this vegetation type and elevation. This can largely be attributed to the closed canopy, which limits understory diversity (e.g. shrubs and grasses).
- **Habitat for TES and species dependent on large undisturbed areas of land:** Northern goshawk (goshawk) is a Forest Service Region 3 sensitive species. Potential foraging habitat is present in the area. Limited numbers and groups of large trees are presently suitable for nesting. However, high levels of human activity associated with the highway and campgrounds deters potential use of the area for nesting.
- **Primitive and semiprimitive classes of recreation:** The Recreation Opportunity Spectrum (ROS) for the roadless area is Rural, Roaded Natural, and Semiprimitive Non-Motorized. Typical recreation activities include viewing scenery, automobile touring, bus touring, hiking, bicycling, camping, picnicking, scenery viewing, camping, hunting, nature study, cross-country skiing and snow shoeing. These activities are discussed in more detail in the "Recreation/Scenery" sections above.
- **Reference landscapes for research study and interpretation**: This project area is typical of a stand that has been historically used for wood gathering and grazing.
- **Landscape character and integrity**: The Project Area falls within the West Range character types. It is characterized by mountains that have highly dissected slopes, sharp, angular ridgetops and deep V-shaped canyons. The landform, vegetation and water form are primarily of the distinct variety class.
- **Traditional cultural properties and sacred sites:** No sites were located during a heritage sample survey.

- **Other locally unique characteristics:** No other characteristics of this roadless area would be considered as "locally unique."

3.6.6.2. No Action

As long as fire does not occur, there would be no change from the condition just described in "Affected Environment." If a wildfire occurs at the predicted size and severity, the following changes in conditions would be expected:

- **Soil, water and air resources**: These resources would be impaired after a wildfire. For details, refer to the description of effects found in "Soil and Water" and "Air" sections, which also apply to the roadless area, for a description of the environmental effects to these resources. There is no difference in effects to the roadless area from the effects described in these sections.
- **Sources of public drinking water:** Depending on exact location of the fire, a wildfire would have an impact to the drinking water of Tesuque Village, as well as the Pueblo of Tesuque. In addition, a fire over the ridge in the Santa Fe Watershed would cause a decline in the water supply for this city. Treatments have occurred within the municipal watershed to reduce the impacts of a fire. However, the effects of an uncontrolled fire would likely cause spill over and cause damage to soils, vegetation, and other resources that change drinking water potential.
- **Diversity of plant and animal communities:** Without a fire, the present condition of the forest would remain with forage availability generally low. Aspen stands would continue to decline and not regenerate. Species associated with aspen particularly the warbling vireo will also decline in the area. Trees will continue to be suppressed and large trees available to wildlife would be extremely limited as larger trees are lost to disease and old age. Risk to existing habitat from crown fire would continue and risk will increase as time passes. No benefits to wildlife will be gained without change to the forest condition. If a wildfire occurs, the change in wildlife habitat would shift away from species that use the closed cover types currently found, and move toward species that prefer more open areas. A high-severity wildfire would kill most vegetation for that season and change the species composition for years following. Depending on the intensity of the fire, some vegetation may or may not resprout, with early seral plant communities such as grasses and brush moving into the area as soil conditions allow. After a wildfire, the recovery of diversity would be connected to scale. At a landscape scale, wildfire could increase diversity by opening up the canopy and allowing early-seral stages to establish. At a stand level, habitat conditions after a wildfire would change from live, green forest to burned over forest with widespread mortality and little change in existing low levels of diversity. There would be a sudden, drastic shift in the type of habitat, but as with the existing condition, the habitat would not be diverse. With a shift of habitat comes a shift of animal populations. A low or moderate severity wildfire would result in the most diversity of plants and animals because it leaves a mosaic of habitat types. However, given the current conditions, this severity of fire is not a likely occurrence.
- **Habitat for TES and species dependent on large undisturbed areas of land:** Potential foraging habitat for Northern goshawk (goshawk) would remain as found. A wildfire would open up the area, possibly improving habitat for goshawk.
- **Primitive and semi-primitive classes of recreation:** No change would occur in the no action alternative. With a fire burning the project area, roaded natural opportunities would be reduced as primitive and semiprimitive opportunities would be available once fire recovery occurred. As seen in other places with wildfire, a 3 to 5 year closure would likely need to be imposed for public safety until the fire area stabilized.
- **Landscape character and integrity:** With no action, no change would occur to the landscape character. With a wildfire predicted in Alternative 1, a large fire would change the character by removing vegetation and leading to soil loss that has not historically occurred because of the greater intensity of the fire.

No changes would occur to reference landscapes, traditional cultural properties, or locally unique characteristics.

3.6.6.3. Alternatives 2/3

Treatments proposed in the Action Alternatives would be limited to those requiring no road construction in the roadless area. The following estimates of the effects to roadless characteristics are based on the descriptions found in this environmental assessment for specific resources. Please refer to these sections for more details.

- **Soil, water and air resources:** Both action alternatives will have some impact to soil, water and air, but none of the effects presents an impairment to the contributions of these resources to the roadless character. As described, the context and intensity of these effects is limited, as is the duration. The most prominent impact would be to air quality during a prescribed burn operations, but this impact is short in duration and would have not long-term impact on the roadless character.
- **Sources of public drinking water:** None of the actions proposed in the action alternatives would adversely affect public drinking water sources. They reduce risk of the adverse effects of a wildfire.
- **Diversity of plant and animal communities:** Alternative 2 would improve the diversity of the plant and wildlife by opening up an overgrown forest that currently is less diverse than typical forests of this vegetation type and elevation. Opening up the vegetation will increase forage availability and stimulate aspen stands to regenerate. Species associated with aspen particularly the warbling vireo would benefit.
- **Habitat for TES and species dependent on large undisturbed areas of land:** All proposed treatments would maintain habitat and provide some improvement in diversity for goshawk.
- **Primitive and semiprimitive classes of recreation:** The action alternatives would open up the vegetation of the area, and for a short duration, increase the disturbance during operations.
- **Landscape character and integrity:** The action alternatives move the landscape character toward a more open stand typical of this elevation and vegetation type.

With the action alternative, no changes would occur to reference landscapes, traditional cultural properties, or locally unique characteristics.

3.6.7. Santa Fe Watershed Monitoring Sites

As part of the Santa Fe Municipal Watershed Thinning Project, a monitoring strategy was set up to track the effects of thinning in the Santa Fe Watershed to several resources, with primary focus on birds and small mammals. Rocky Mountain Research Station (the research branch of the Forest Service), has been implementing that monitoring strategy since 2002 by inventorying treated sites in the watershed, as well as untreated sites outside the watershed. Plots outside the Watershed lie within the Hyde Park Project area and to meet project fuel reduction objectives, would eventually be treated. The following actions are proposed to maintain the integrity of the monitoring that has occurred to date:

- The study plan has been changed to include alternate sites closer to the Santa Fe Watershed treatments (e.g. in the watershed).
- These alternate plots are established and a season's data has been collected. The new sites have been reviewed and found to be appropriate to continue with gathering control information.
- When thinning occurs in the project area, treatments that contain the control points would be coordinated so that they can be monitored through the life of the Hyde Park treatments. This would provide for the points to be used by Rocky Mountain Research Station as long as possible, and would provide for the changes in the as data is collected from the alternate sites to establish correlations.

4. CONSULTATION WITH OTHERS

4.1. Persons and Organizations Consulted

This section will be completed and included in the environmental assessment. Specific lists are included in the project file.

- The public involvement for this process has been on-going since the project was first proposed in July 2005. Mailing project scoping letters to more than 120 individual and organization, the City and County of Santa Fe, members of Congress, area Tribal leaders, and other state and federal agencies.
- Providing a second public comment period in November 2005, where additional comments were received and subsequently considered.
- Distribution of a scoping letter on July 21, 2006.
- Distribution of this document will occur in June 2007.

4.2. Agencies and Governments Consulted

- United States Department of Interior, Fish and Wildlife Service (USFWS)
- United States Department of Interior, Bureau of Land Management (BLM)
- New Mexico Environment Department (NMED)
- City of Santa Fe
- Santa Fe County
- Tribal Governments

4.3. Members of the Planning Team

- Claudia Standish, IDT Leader
- Ruth Doyle and Anne Apodaca, Recreation/Scenery
- David Isackson Fuels Management,
- Lawrence Garcia, Fire Management
- William Armstrong, Forestry
- Anne Baldwin, Cultural Resources
- Jeanne Hoadley, Air Quality
- John Dixon, Hydrology & Soils