# Chapter 3: Affected Environment and Environmental Consequences

## Affected Environment – Fuels

### Project Area Description and Management Objectives

The project area is within Upper Hayfork Creek Watershed, to the east and directly adjacent to the rural community of Wildwood, California (see Appendix A maps). The project area is approximately 4,790 acres of the 26,389 Late-Successional Reserve (LSR) identified as RC331- Chanchelulla. Dominant vegetation in the project area is mid-successional Douglas-fir overstory, with mixed conifer and hardwood understory.

Management objectives within LSR are to maintain, protect, and enhance conditions of late-successional forest ecosystems. Protection includes reducing the risk of large-scale disturbances, including stand-replacing wildfires. In the Forest-wide LSR Assessment[50] it states that local LSR are included in an area of elevated risk to large-scale disturbance due to changes in the characteristics and distribution of the mixed-conifer forests resulting from past fire suppression. That assessment also encourages the development of fuels reduction projects as long as they are consistent with the overall recommendations for LSR management. Emphasis of management activities should be placed on reducing the amount of fine fuels, associated rate-of-spread, and flame lengths.

The Fuels Analysis and Strategy portion of the Shasta-Trinity National Forest Fire Management Plan, issued and updated annually, identifies on a forest-wide scale: Hazards, Values at Risk, and Risk of Future Fire Occurrence for the forest.[51] This analysis is one of the tools used to prioritize areas on the forest in need of fuel treatment. Fire risk is the chance (probability) that a wildfire will start, either from natural or human causes, based on recent fire history. Fire hazard is determined by the characteristics of fuels combined with the influences of topography and weather. Values represent monetary worth and non-monetary values such as wildlife habitat and scenery. The fuels characteristics apply to both dead and live fuels, and include loading (tonnage), size and shape, compactness, horizontal continuity, vertical arrangement, fuel moisture content, and chemical properties. Topographic and weather influences, combined with fuels characteristics, determine the rate of forward spread of a fire and the intensity at which a fire will burn. The project area is rated as having, high hazards/low to moderate risks, and high values, with a combined overall rating of high.[52] Given the management objectives and high values at risk in the LSR, the consequences of stand-replacing, or crown fire are considered unacceptable.

Research shows that reducing surface fuels using vegetation management treatments (such as the proposed thinning from below) decreases the likelihood that surface fires will transition to crown fires, the most destructive and hardest to control type of wildfire. The most effective strategy for reducing

[50] USDA Forest Service (1999)
[51] The STNF Fire Management Plan (USDA-FS, 2007) is updated annually and available for review upon request
[52] Details on the combined analysis for hazard/risk/value are in the STNF Fire Management Plan, Appendix G

crown fire occurrence and severity is to reduce surface fuels, increase height to live crown ratio, and reduce crown bulk densities.[53]

## Wildland Urban Interface (WUI)

The National Fire Plan prioritizes fuel treatments near Communities at Risk (CARs). CARs are listed in the Federal Register as urban interface communities within the vicinity of federal lands that are at high risk from wildfire. Wildwood was listed in the Federal Register[54] as a CAR. Approximately 3,058 acres of the project area is within the designated Wildwood WUI, with the community itself directly adjacent to the southwest of the project. Additionally, the eastern project boundary is parallel to the Platina WUI boundary, with the community of Platina approximately 7 air miles to the east.

There are three categories of communities that meet the description of WUI. Generally, Federal agencies are to focus treatments on communities that are described under categories 1 and 2. The rural community of Wildwood would fit under the category 2: an intermix community. This is where structures are scattered throughout a wildland area. An alternate definition for intermix community emphasizes a population density of between 28 to 250 persons per square mile.

## Existing Fuels

Fuels are defined as various components of vegetation, living and dead, on the site. An adequate description of the fuels on a site requires identifying the existing fuel components. Fuel loading, size class distribution of the load, and its arrangement (compactness or bulk density) determine whether an ignition will result in a sustaining fire.

Overall average fuel loading for the area is in excess of 12 tons-per-acre, with most of the tonnage in the smaller size classes. Fire and Fuels Managers consider fuel loadings in these ranges to be high, and along with the accumulation of smaller trees that act as fuel ladders, there is increased likelihood of future large and destructive wildfires that are dangerous and costly to suppress. During summer months, a wildfire start in these stands could easily transition into a crown fire, resulting in a large stand replacement type fire.

[53] Graham et al. (2004)
[54] August 17, 2001

**Figure 3-1. Current conditions in project units showing the abundance of small trees that can act as fuel ladders to carry ground fire into the overstory canopy**

Pre-commercial sized conifer plantations are also scattered throughout the project area, most of which are overstocked and ingrown with brush. The plantations originated in the 1980s, prior to the Northwest Forest Plan, when more intensive timber harvest occurred on National Forest lands. A wildfire burning into these unthinned plantations can be expected to intensify, producing faster rates-of-spread and increased fire intensities, which have a high probability to result in extensive tree mortality.

## Fire Regimes and Fire History

Natural fire regimes[55] of the Pacific West were the primary managers of historic forests. Historic fire regimes were characterized by frequent, low to moderate severity fires, playing a dominant role in regulating fuel accumulation and stand structure of these forests. In California's Mediterranean climate, decomposition rates are generally slow, and are limited by temperature. Neither historically, nor presently, has decomposition been the primary remover of biomass in a mixed-conifer forest.

A century of successful fire suppression has excluded the frequent low to moderate intensity type fire, leading to biomass accumulation at abnormally high levels throughout the landscape, both in living understory and dead and down woody material on the forest floor. This fire exclusion and fuels buildup

[55] A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning (Agee, 1993). More information about fire regimes in the U.S. is at http://www.fs.fed.us/fire/fuelman/firereg.htm.

has altered the historical fire regime from frequent low to moderate intensity fires to one of infrequent moderate-to-high intensity stand-replacing fires. Altering the historic fire regime has resulted in today's overstocked stands with dense, multi-layered canopies. Understory vegetation is now crowded with shade-tolerant, fire-intolerant species. Larger trees within these overstocked stands must compete for available moisture and nutrients, making the entire stand more susceptible to disease, insects, and mortality. Currently the fuels types, amounts, and arrangements present a hazardous fire condition, not only for the proposed project area, but also for adjacent lands.

**Figure 3-2. Existing conditions showing typical understory ingrowth with shade tolerant species**

A fire history study was conducted on the Hayfork Ranger District in the Jud-Rusch Creek area.[56] Data collected from tree rings indicated the average time between fires for all sites in the study area was 12 to 19 years. Since a fire suppression policy was adapted on Forest Reserves in 1905, fire rotation length (the time it takes for fire to burn the overall area) in the study area is 12 to 15 times longer than anytime in the previous three centuries. The Jud-Rusch Creek fire history site is approximately 12 miles

[56] Taylor & Skinner (2003)

northwest of the project site, with the same vegetation and climate, so fire rotational lengths and fire regimes would be similar.[57] Greater fire rotation length means greater fuel buildup between fires, and a much greater probability of high-intensity fire and high rate of spread when it does burn.

Within LSR – RC 331, there have been a total of 119 fires recorded, with an average of 13 fire starts per decade. Recorded fire history specifically for the Gemmill project area shows there have been 14 fire starts. Average fire occurrence in the project area from 1920 to 2005 has been one start every six years. The existing fuelbreak running north to south along the ridgeline and bordering the project area along the eastside was instrumental in containing a human-caused fire start off State Highway 36 in 1980 that burned 187 acres, 6.5 of which was in the project area. This same fuelbreak has now grown over and is in need of maintenance and/or reconstruction to function correctly. Both action alternatives allow maintenance and/or reconstruction of the fuelbreak to occur; the no action alternative does not.

**Figure 3-3. Existing fuelbreak with high surface and ladder fuel loading**

[57] Personal communication with Carl Skinner, P.S.W. Research Station, Redding, CA.

### Fire Condition Class

The National Fire Management Plan (NFMP) has three different Condition Class descriptions that represent the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure.[58] Condition Class 1 is our desired future condition for the landscape.

**Condition Class 1 areas have the following attributes**:

- Fire regimes that are within the historical range;
- The risk of losing key ecosystem components is low;
- Vegetation attributes (species composition and structure) are intact and functioning within their historical range, especially at a landscape scale.

**Condition Class 2 areas have the following attributes**:

- Fire regimes have been moderately altered from the historical range;
- The risk of losing key ecosystem components has increased to moderate;
- Fire frequencies have departed (either increased or decreased) from historical frequencies by more than one return interval. This results in moderate changes to one or more of the following: Fire size, frequency, intensity, severity, or landscape patterns;
- Vegetation attributes have been moderately altered from their historical range.

**Condition Class 3 areas have the following attributes**:

- The fire regime has been significantly altered from its historical range;
- The risk of losing key ecosystem components has increased to high;
- Fire frequencies have departed from historical frequencies by multiple return intervals, which results in dramatic changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns;
- Vegetation attributes have been significantly altered from their historical range.

The NFMP priority areas for fuel treatments are those with frequent and mixed severity fire regimes-Condition Class 2 and 3. Condition Class 3 best represents the current departure from the fire return interval within the project area and surrounding landscape. If an action alternative is selected and implemented, the treated lands would be moved toward a Condition Class 2. If the No Action Alternative is selected, the area will remain in Condition Class 3.

## Environmental Consequences – Fuels

The following section discloses fuels-related effects of the 3 alternatives evaluated in detail. Direct effects are those that occur at the time of the action, and indirect effects occur later in time and/or space from the action. Fuel loading and fire effects were estimated using fuel models as described in *Aids to Determining*

[58] More information about Fire Regime Condition Classes is at:
http://www.nwcg.gov/teams/wfewt/message/FrccDefinitions.pdf

*Fuel Models for Estimating Fire Behavior*.[59] Indirect fire/fuels effects are often discussed in terms of potential future wildfire behavior and effects that are likely some time in the future after the project is implemented. These indirect effects are predicted using the Behave fire behavior analysis. Fire behavior analysis commonly uses 90th percentile weather conditions and above for prediction of wildfire effects. The 90th percentile represents the worst average weather conditions that exist approximately 10% of the time from August through September. The Fire Family Plus program[60] was used to obtain 10 years of historical weather data from the Yolla Bolla Remote Access Weather Station, which is located approximately 6 miles south of the project site. Specific weather data used included the 10 year averages of 1, 10, and 100 hour fuels moistures, live woody fuel moistures, and wind speeds. The Behave Fire Prediction Program (Version 4.4, February 1997) was used for predictions of fire behavior and stand mortality that could be expected under these conditions, specifically 90th percentile fire weather.

## Alternative 2 – No Action

### Direct Effects

The No Action Alternative proposes to not implement any activity within the project area. This is the only alternative considered in detail that does not meet the purpose and need statement.

If Alternative 2 is selected, neither commercial nor non-commercial thinning with associated activity fuel treatments would be accomplished. Early- and mid-successional stands on suitable lands would not be thinned. Thus, the opportunity to improve stand vigor, resistance to insect and disease impacts, and speed productivity toward late successional characteristics would be forgone within these stands.

This alternative would not improve Fire Condition Class for the area. The LSR will not be protected or enhanced by this alternative, and will be at risk to loss from a wildfire. Existing hazardous fuel loadings adjacent to and within the Wildwood WUI would not be treated. Wildfires originating within the project area could be expected to continue onto surrounding private lands and Wildwood WUI, with extreme threats to life and property. With the opposite also true, a fire start on adjacent private lands could burn into the project area and LSR 331 unrestricted, with extreme damages to high-value late-successional habitat.

Existing fuelbreaks in the activity area are currently ineffective due to lack of maintenance. Alternative 2 will not allow necessary maintenance, rendering them useless as a fire suppression tool or safety area for fire fighters. Because proposed road re-construction and maintenance would not be implemented, the arrival of fire suppression vehicles to future wildfires will continue to be affected by the poor road conditions that have been identified.[61] Proposed road decommissioning, although not expected to substantially delay future fire suppression in the general area, would not occur and therefore access for future fire suppression in the area would not be affected.

Direction and guidance for land and resource management as specified in the Shasta-Trinity National Forest Land and Resource Management Plan (Forest Plan), the Forest Wide LSR Assessment (LSRA), the

[59] Forest Service General Technical Report, Anderson (1982)
[60] Fire Family Plus Version 3.0 - Winter 2001
[61] Forest Road Analysis - July 2002 and the Gemmill Roads Analysis Report - March 2006

Shasta-Trinity National Forest Fire Management Plan (FMP), the National Fire Management Plan (NFMP), and Forest Service Manual 5150- Fuels Management (FSM-5150) would **not** be met with Alternative 2.

## Indirect Effects

Existing conditions and the No Action Alternative are best represented by fire behavior fuel model 10.[62] Fuel model 10 shows fire burning in surface and ground fuels with greater fire intensity than the other timber litter models. Dead-down fuels include greater quantities of 3 inch or larger limb-wood resulting from over-maturity or natural events that create a large load of dead material on the forest floor. Crowning out, spotting, and torching of individual trees are more frequent in this fuel situation, indicating violent fire behavior and potential fire control difficulties. Any forest type may be considered if heavy down material is present; examples are insect or disease ridden stands, wind thrown stands, and over-mature stands with deadfall, or with aged slash from light thinning or partial-cut harvest. Total fuel load (dead-down & live) 3 inches in diameter and less is equal to or less than 12 tons per acre. Dead fuel loading of ¼ inch diameter and smaller fuels is in the 3 tons per acre category, live fuels foliage is around 2 tons per acre, and the fuel bed depth is approximately 1 foot deep.

Fire behavior/effects modeling results for the No Action Alternative are displayed below. Assumptions and limitations associated with the model are described in the model publications by Andrews.[63] Assumptions inherent in the model are that fuel structure is homogeneous throughout the analysis area, and that weather and topography conditions are uniform and constant.

**Table 3-1. Fuel models and fire effects for No Action Alternative 2**

| Alternative 2 | Fuel Model | Flame lengths | Rate-of-spread | Percent Mortality | Fire Size in 1 Hour |
|---|---|---|---|---|---|
| No Action | FM 10 | 12.8 feet | 48 chains\hr | 91% | 50 acres |
| Fire size after 2 hours would be approximately 202 acres. | | | | | |
| Fire size after 4 hours would be approximately 807 acres. | | | | | |
| Fire size after 6 hours would be approximately 1,815 acres. | | | | | |

The following table correlates flame lengths and fire intensity to the type of suppression resource effectiveness. Generally flame lengths much beyond 8 feet in height are beyond the capability of fire suppression resources to control.

[62] Fuel models are described in Anderson (1982)
[63] See Andrews (1986) and Andrews & Chase (1989)

**Table 3-2. Flame lengths and Suppression Effectiveness**

| **Flame Length** (ft) | **Fireline Intensity** (Btu/ft/s) | **Interpretations** |
|---|---|---|
| < 4 | < 100 | Fires can generally be attacked at the head or flanks by persons using hand tools. Handline should hold the fire. |
| 4 – 8 | 100 – 500 | Fires are too intense for direct attack on the head by persons using handtools. Handline cannot be relied on to hold fire. Equipment such as dozers, engines, and retardant planes can be effective. |
| 8 – 11 | 500 – 1,000 | Fires may present serious control problems-torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective. |
| > 11 | > 1,000 | Crowning, spotting, and major fire runs are probable. Control efforts at the head of the fire are ineffective. |

**Based on**: Roussopoulos and Johnson, 1975.

Wildfire starts currently have the potential to produce severe stand replacement type fires under severe fire weather conditions, presenting a significant threat to the Wildwood WUI and Chanchellula LSR. Alternative 2 would do nothing to correct this situation, allowing the already hazardous fire conditions to increase into the future.

No action implies conditions within the project area will stay the same, or remain static, and that is incorrect. Because forest ecosystems are dynamic they will continue to produce more vegetation that competes for available sunlight, moisture, and nutrients. As time progresses, without fuels reduction treatment, the conifer stands will develop more dense understories of shade-tolerant, fire-intolerant trees (fuel ladders), dead/down woody debris will continue to accumulate, and there will be increases in mortality, setting the stage for progressively larger catastrophic fire events.

Past actions have led to current conditions. As noted above, past timber harvest and fire suppression activities are past actions that have had cumulative consequences of abnormal fuels accumulation and high fire hazard observed over extensive forested areas today. Past active management has not been able to replace the historic role of fire in maintaining forest stands in a sustainable condition. Past plantation silviculture on Federal lands and harvest practices on private lands historically lacked post-harvest fuels reduction, and have added to the current hazardous fuels conditions. The indirect effects of the no action alternative, in combination with effects of past actions, would represent an adverse cumulative effect of continued fuels buildup and increasing fire hazard.

## Alternative 1 - Proposed Action

### Direct Effects

Alternative 1 proposes to treat 1,618 acres of overstocked forest stands as summarized in the table below. This alternative allows commercial and non-commercial thinning to reduce stocking of overstocked stands within LSR and Riparian Reserve land allocation areas. Timber harvest with associated activity fuel treatments will reduce ground fuel loadings, ladder fuels, and crown bulk densities that will result in lower fire intensities and effects.

**Table 3-3. Types of fuel treatment methods & acres proposed for Alternative 1**

| Site Prep/Fuels Reduction Acres | |
|---|---|
| Tractor Jackpot Pile (TJP)/Burn Piles (BP) | 284 Acres |
| Hand Pile (HP)/Burn Piles (BP) | 220 Acres |
| Biomass or Masticate | 1,070 Acres |
| Masticate | 44 Acres |
| **Total** | **1,618 Acres** |

On the westside of the project area, treatment units have been strategically placed to disrupt the spread of wildfire towards adjacent private lands and the community of Wildwood to the west of the project. Treatment units have also been placed strategically along the eastern project boundary, following the main ridgeline running from north to south. The ridge top units will be thinned and masticated; this project would set the stage for future underburning to maintain desired fuel loading.[64] The construction and/or re-construction of two additional shaded fuelbreaks is also proposed. One fuelbreak is along the northern project boundary, separating the project area from the Chanchelulla Wilderness Area. The other is along the southern project boundary, separating the project area from private lands and State Hwy 36.

Road re-construction and maintenance will be done under this alternative, thus fire suppression vehicles would benefit from improved road conditions. Due to proposed road decommissioning, fire suppression vehicles would utilize alternate routes to access fires in the project area. The effect of road decommissioning on fire suppression equipment arrival time has been analyzed as part of the project-level roads analysis process.[65] Although access to localized areas would be altered, proposed road decommissioning would have minimal effect on future fire suppression.

If Alternative 1 is selected, direction and guidance for land and resource management as specified in the Forest Plan, Forest-wide LSRA, the Shasta-Trinity National Forest Fire Management Plan, the National Fire Plan, and FSM-5150 will all be met.

## Indirect Effects

A fire behavior fuel model 8 was used to predict probable fire effects for Alternative 1, and would represent the desired future condition for the area as stated in the LSRA.[66] A fire behavior fuel model 8 is classified as closed canopy stands of healthy, short-needled conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and some twigs, since little undergrowth is present. Slow burning surface fires with low flame heights are typical, although an occasional 'jackpot' or heavy fuel concentration can cause flare-ups. Total fuel load (dead-down & live) 3 inches in diameter and less is equal to or less than 5 tons per acre. Dead fuel loading of ¼ inch diameter and smaller fuels is in the average range of 1 to 5 tons per acre.

Fire behavior fuel model 8 is used to represent fuel conditions within post-harvest stands after hazard reduction fuels treatments have been implemented. Projected fire effects displayed in table 3-4 represent what effects can be expected from a wildfire start during 90$^{th}$ percentile and above weather conditions.

[64] Underburning would occur with a separate project, future foreseeable Gemmill Prescribed Burn Project.
[65] The project-level RAP is available in the project record
[66] Forest-wide LSR Assessment (USDA-FS, 1999), Chapter 4-15 & 16

**Table 3-4. Fuel model and fire effects for Action Alternative 1**

| Alternative I | Fuel Model | Flame lengths | Rate-of-spread | Percent Mortality | Fire Size in 1 Hour |
|---|---|---|---|---|---|
| Post Treatment | FM 8 | 2.4 feet | 9 chains\hr | 9% | 2 acres |
| Fire size after 2 hours would be approximately 7 acres. | | | | | |
| Fire size after 4 hours would be approximately 28 acres. | | | | | |
| Fire size after 6 hours would be approximately 64 acres. | | | | | |

Future wildfires will have less chance of transitioning into more destructive stand replacement crown fires. Wildfire starts within the project area would be easier to suppress and less costly. Also wildfires starting outside the project area and burning into it would have slower rates of spread, lower flame lengths, and be easier to contain.

Plantation treatments, with associated activity fuel treatments, will assist in their survival during a wildfire event. A wildfire burning into, or leaving these treated plantations will have lower flame lengths, fire intensities, and lower overall fire effects when compared to untreated plantations.

## Alternative 3 – Diameter Limit

### Direct Effects

Alternative 3 proposes to treat 1,462 acres of overstocked forest stands as summarized in the next table. As with Alternative 1, this alternative allows commercial and non-commercial thinning to reduce stocking of overstocked stands within LSR and Riparian Reserve land allocation areas. Timber harvest with associated activity fuel treatments will reduce ground fuel loadings and small to medium ladder fuels that will help to lower fire intensities and effects; the ability to modify crown bulk densities will be restricted, depending upon initial stand diameter distributions and spacing of size classes, so if a fire were to crown out it would more likely persist as a crown fire.

**Table 3-5. Types of fuel treatment methods and acres proposed for Alternative 3**

| Site Prep/Fuels Reduction Acres | |
|---|---|
| Tractor Jackpot Pile (TJP)/Burn Piles (BP) | 284 Acres |
| Hand Pile (HP)/Burn Piles (BP) | 64 Acres |
| Biomass or Masticate | 1,070 Acres |
| Masticate | 44 Acres |
| **Total** | **1,462 Acres** |

Alternative 3 will treat 156 acres less than Alternative 1, by eliminating 139 acres of helicopter yarding and 17 acres of cable yarding, and only remove trees 18 inches and less in DBH. [67] This alternative retains most of the strategically placed units and fuelbreaks as described under Alternative 1, but does not allow sufficient biomass removal to create and/or maintain fuelbreaks effectively. In leaving more residual trees (all trees 18" DBH and above), it may not be possible to thin the fuelbreaks to 40% crown closure. This will lower the overall effectiveness of the fuelbreaks, especially when it comes to stopping crown fires. Proposed road reconstruction, maintenance, and

[67] Diameter at breast height (DBH)

decommissioning will be done under this alternative and the effects would be identical as discussed for Alternative 1.

If Alternative 3 is selected, direction and guidance for land and resource management as specified in the Forest Plan, the Shasta-Trinity National Forest Fire Management Plan, the National Fire Plan, and FSM-5150 will all be met. This alternative **will not meet** desirable fire conditions as described in the Forest Wide LSR Assessment.

### Indirect Effects

Fire behavior fuel model 9 is used to represent fuel conditions within post-harvest stands after hazard reduction fuel treatments have been implemented under Alternative 3. Projected fire effects displayed in Table 3-6 represent what effects can be expected from a wildfire start during 90$^{th}$ percentile and above weather conditions. In a fire behavior fuel model 9 fires run through surface litter faster than a model 8 and have longer flame height. Concentrations of dead/down woody material will contribute to possible torching out of trees, spotting, and crowning, overall fire effects are well above a fuel model 8, but less than a fuel model 10.

**Table 3-6. Fuel model and fire effects for Action Alternative 3**

| Alternative 3 | Fuel Model | Flame lengths | Rate-of-spread | Percent Mortality | Fire Size in 1 Hour |
|---|---|---|---|---|---|
| Post Treatment | FM 9 | 7.1 | 45 chains\hr | 15% | 46 acres |
| Fire size after 2 hours would be approximately 185 acres. | | | | | |
| Fire size after 4 hours would be approximately 740 acres. | | | | | |
| Fire size after 6 hours would be approximately 1,666 acres. | | | | | |

Wildfires will have less chance of transitioning into crown fires than with Alternative 2. Wildfire starts within the project area would be easier to suppress and less costly than with Alternative 2. Also wildfires starting outside the project area and burning into it would have slower rates-of-spread, lower flame lengths, and be easier to contain than with Alternative 2. However, all these aspects of future wildfire behavior and likely consequences would be intermediate between the no action alternative and the proposed action alternative.

Alternative 3 would improve Fire Condition Class for the area, but not meet the desirable fire conditions stated in the LSRA.[68] LSR 331 would receive some fire protection by this alternative, and risk to loss from a wildfire will be lower than existing conditions.

## Cumulative Effects – Alternatives 1 and 3

### Bounding Statement

The cumulative effects assessment area is bounded in space by the Gemmill project area because this is the complete area potentially exposed to direct effects from proposed fuels treatment activities. Private

[68] Forest-wide LSR Assessment (USDA-FS, 1999), Chapter 4-15 & 16

lands are not included in the assessment area, but are discussed where relevant to indirect effects, risk management, and fuels/vegetation management objectives.

The cumulative effects assessment is further bounded in time by the limits of past, present, and reasonably foreseeable future actions, in general a 10 year horizon into the future. This is an appropriate timeframe because future conditions beyond that can not be known, and will be changing with vegetative regrowth and stand development into the future.

## Past Actions

Past actions that have been implemented in the area were primarily for timber harvest, with associated site prep and/or activity fuel treatments. Most past actions relevant in characterizing existing timber and fuels conditions occurred prior to the Northwest Forest Plan in 1994, which along with the Forest Plan, designated LSR to be managed for the maintenance and improvement of late-successional habitat. See Appendix E (Cumulative Actions Table) Table E-1 for a detailed list of projects and activities. Timber Sale units were typically clearcut, broadcast burned for site preparation, and then planted. Young plantations to approximately 10 years old lacked surface fuels and vegetative continuity, so they provided beneficial conditions to fuels management. As these trees aged and grew taller, their extruding limbs extended further out from the trunk, resulting in closing space between trees and thus becoming a continuous fuel bed; annual needle drop also restored continuous fine surface fuels. It is highly probable that a wildfire start within these plantations would result in complete mortality. These plantations can also act as a ladder fuel component to the surrounding forest. Therefore, the fuels benefits of these past actions do not persist today; just the opposite, they represent flammable stands with continuous fuel ladders that are highly susceptible to stand replacement fire.

The Midas Blow-Down area borders the northeast corner of the project. Midas consists of over 100 acres of trees blown down several years ago. A timber sale was proposed to remove much of the blown down merchantable conifer trees, but the project never reached implementation. The blown down trees are still present, representing a significant fire hazard to the project area and surrounding areas.

Past projects on adjacent private lands consist primarily of timber harvest on forest lands and human development type projects on residential lands, with a limited amount of mining and grazing. In the past, timber harvest on private lands included minimal, if any, activity fuel treatment. Fires originating on private lands, especially those having high fuel loadings, represent a significant threat to the LSR and the Wildwood WUI.

## Foreseeable Future Actions

Reasonably foreseeable projects within the area includes the Gemmill LSR Prescribed Burn Project, consisting of approximately 326 acres of under burning and 110 acres of brush field burning, totaling approximately 436 acres. The primary objectives of the burning are to provide maintenance for and widen the existing ridgetop fuelbreak, to reduce hazardous fuel conditions, and to stimulate new growth to enhance wildlife browse.

There are no specific projects foreseen on adjacent private lands, but it is reasonable to presume in general that timber harvest on forest lands, development projects on residential lands, and limited mining

and grazing activities will continue to occur. Private harvest practices involving minimal activity fuels treatment is expected to continue. Fires originating on private lands will continue to present a significant threat to the LSR and the Wildwood WUI.

### Cumulative Effects for Alternatives 1 and 3

Direct and indirect effects of the proposed action are not considered adverse from a fire and fuels management perspective, but rather beneficial in reducing excess biomass. Treatments to thin stands and reduce hazardous fuels conditions have direct and indirect effects which improve the Fire Condition Class for the area, and substantially reduce predicted fire behavior and effects, particularly during severe fire weather. Treatment units are placed strategically within the LSR to provide benefits toward the fire resilience of the LSR as a whole.

Past actions had initial fuels reduction benefits that are now gone; plantations are currently part of the fuel hazard problem. Therefore, past actions do not add to cumulative beneficial effects of current and future actions. Effects of foreseeable future actions would add to this benefit, in reducing surface fuels over additional areas. If Alternative 1 is implemented, it will provide pre-treatment to some of the units proposed in the burn project, enabling better results and wider weather windows for prescribed burning. While this is desirable, the burn project is not dependent upon the Gemmill Thin Project for implementation.

The effects of this action, in combination with past and foreseeable future actions, will result in a net beneficial effect in the reduction of hazardous fuels conditions. The project increases the probability of achieving the desired future condition for the area which includes fire resilient stands, protection and perpetuation of LSR habitat into the future in the face of increasing wildfire risk, and decreased fuel loading within the Wildwood WUI for CAR protection. Cumulative effects from a fire and fuels standpoint are beneficial. This action alternative provides the most beneficial effects compared with other alternatives.

### Comparison of Cumulative Effects for Alternatives 1 and 3

Action alternatives are similar, but not the same, in cumulative effects. Again, cumulative effects from a fire and fuels management standpoint are the beneficial direct and indirect effects of current and foreseeable future actions, specifically biomass removal and the moderation of expected fire behavior and effects. Alternative 1 provides the most beneficial cumulative effects; Alternative 3 provides a lesser degree of beneficial cumulative effects. Either action alternative is highly preferred to the no action alternative, which has adverse cumulative effects with continued fuels buildup and increasing fuels hazard and fire risk.

Alternative 1 creates the desired conditions for fire resilient stands- removal of surface and ladder fuels and thinning of overstory crowns to prevent as much as possible a wildfire from crowning out and persisting as a crown fire, effective even in severe fire weather. Given that only strategic portions of the LSR are being treated, it seems appropriate from a protection standpoint to treat those activity areas with the more aggressive Alternative 1. This alternative creates effective pre-treatment for foreseeable prescribed burn activities, so cumulative effects are the most beneficial.

Alternative 3 creates these desired conditions to a lesser degree. Surface fuels and small to medium ladder fuels would be removed. By retaining all trees 18 inches DBH and greater, large ladder fuels would be retained, and the ability to thin the overstory crown is restricted. The difference is sufficient to change the fire behavior fuel model from 8 to 9. This alternative would provide effective protection in more moderate fire weather, but in severe fire weather flame lengths are sufficient to ignite some of the larger ladder fuels in 18-24 inch DBH trees, and risk transition to overstory crowns. This alternative creates sufficient pre-treatment for foreseeable prescribed burn activities, but with persistent ladder fuels and continuous crowns, prescription parameters would be much more restrictive and weather windows narrower. Getting burns accomplished and prescriptions achieved would thus be somewhat more difficult.

Depending upon stand-specific diameter distributions, the alternatives could look quite similar on the ground, or could look very different, with continuous interspersed overstory crowns with Alternative 3. Cumulative effects would be similar, but Alternative 1 would assure the best fuels arrangements and fire resilient stand conditions in all stands treated.

Neither action alternative can assure the absence of a stand replacement crown fire in extreme, wind-driven wildfire events. Both action alternatives are temporary in the long-term; reintroduction of fire is ultimately necessary to maintain the stands in a sustainable condition. Either action alternative is a necessary first step in creating stand conditions where fire could be reintroduced without unacceptable risk. Thus, cumulative effects of these actions in combination with foreseeable future actions are key to the long-term success of individual fuels reduction projects. In terms of utilizing fire for future fuels reduction in the LSR, Alternative 1 carries less risk of escape and/or threat to firefighter safety when compared to Alternative 3. Alternative 1 would more likely assure stand survival after wildfire under severe fire weather. Therefore, Alternative 1 has the most beneficial cumulative effects, and is the proposed action alternative.

## Introduction – Wildlife

The Gemmill Wildlife Biological Evaluation (BE) and Biological Assessment (BA) provide further background and detailed information that supports the discussions in the analysis described below. These documents are provided in Appendix G and H of this EIS.

### The Northern Spotted Owl as a Representative Species for Late-successional Wildlife Habitat Analysis

To avoid redundant discussions of both existing habitat conditions and project effects, the northern spotted owl (*Strix occidentalis caurina*) is used as a representative for other species associated with late-successional conifer forest habitat as well as for species associated with snags, logs and hardwoods. Because this project takes place primarily within late-successional habitat, using the spotted owl as a representative species for this project-level effects analysis is both logical and credible for the rationale presented below:

- The northern spotted owl is strongly associated with late-successional (especially old growth) conifer forest habitat that includes snags/logs and hardwoods as important components.[69] Owls use snags for nesting sites and both snags and logs provide habitat for prey species. Hardwoods provide structural diversity and cooler roosting sites important to owls for thermoregulation in the heat of the summer.
- Spotted owl habitat characteristics and components are virtually identical to those species associated with late-successional habitat addressed in the Wildlife BE for this project.
- Spotted owls forage, nest and successfully reproduce in the project vicinity.

## Geographic Boundaries – largest to smallest

Effects to northern spotted owl habitat and late-successional habitat are analyzed on multiple spatial levels, depending upon which activity and associated impacts are being evaluated. The following categories used for analysis bounding are derived from the best available evaluation techniques from sources within the scientific community and consultation with federal and state agencies.

- The term project area refers to the specific areas that would be directly impacted by the proposed actions (e.g., thinning units, fuelbreak units, plantations).
- Bounding for the primary area analyzed for this project is the 16,858-acre spotted owl Action Area, also referred to within this discussion as project area vicinity, and is established using a 1.3 mile buffer around all areas containing suitable nesting or roosting habitat proposed for treatment. This is an appropriate unit for measure because this is what the U.S. Fish and Wildlife Service (USFWS) has estimated the median annual home range size for the northern spotted owl in California to be, based on available radio telemetry.[70]
  - Because the precise configuration of a spotted owl home range is rarely known, the estimated home range is represented by a 1.3-mile circle (3,340 acres) centered upon an owl activity center (e.g., nest site). Suitable habitat within a home range would likely be utilized to some extent by territorial owls. Therefore, habitat affected by the project would likely fall within the home ranges of any owls nesting in the owl Action Area.
  - **Five** individual **owl home ranges** for owl activity centers within the project area vicinity, located by surveys or included in our records, are analyzed.
- **Owl territories** are the areas delineated around an owl activity center using a 0.7-mile radius circle around the area most heavily used (territory or 'core area') by owls during the nesting season. These areas assist the Forest Service and USFWS during project-level consultation over possible and likely impacts to individual owl pairs.
  - **Five** individual **owl territories** for owl activity centers, located by surveys or included in our records, are analyzed.
- The **19,283** acre **fisher analysis area** is the area analyzed for potential impacts to Pacific fisher related to this project.

[69] Thomas et al. (1990); USFWS (1990)
[70] Thomas et al. (1990)

## Timeframe

Effects to late-successional habitat are analyzed at a number of timeframes. A reduction of canopy closure in order to meet the purpose and need of this project is unavoidable. Proposed treatments would result in maintaining a moderate/dense canopy closure. In most of the mature stands we expect little recovery in overall canopy closure after the thinning but younger inclusions totaling roughly 300 acres would respond to the thinning and are likely to grow into suitable owl habitat conditions in about 10 to 15 years.

To evaluate the efficacy of the alternatives to develop late-successional habitat over time, stand development was modeled for a 50-year period.[71] We also modeled the effects of fire to canopy closure in treated and untreated stands out 50 years.

## Habitat Definitions

- ***Late-Successional Forest*** - Forest seral stages that include both old growth and mature age classes that are defined below. There is a clear distinction between habitat provided by old growth stands when compared to mature stands:
  - ***Old Growth*** - A forest stand usually at least 180-220 years old with moderate to high canopy closure; a multilayered, multispecies canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood; numerous snags; and heavy accumulations of wood, including large logs on the ground. Old growth stands provide **high** quality nesting/roosting habitat for the northern spotted owl.
  - ***Mature Stand*** - A mappable (>10 acres) stand of trees for which the annual rate of growth has peaked; generally greater than 80 years old but not yet old growth. Mature stands generally contain trees with a smaller average diameter, less age class variation, and less structural complexity than old growth stands of the same forest type**.** Dense and moderately dense mature conifer stands provide **moderate** quality nesting/roosting and foraging habitat respectively for the northern spotted owl. Mature forest with less than moderate canopy closure does not necessarily provide habitat for species such as the northern spotted owl but often provides connectivity between owl nesting/roosting/foraging habitat.

[71] Forest Vegetation Simulator and Fire/Fuels extension were used to evaluate likely effects of the project on forest structure; these models are explained in more detail in Appendix J (Modeling) of this DEIS.

# Affected Environment – Wildlife

## Desired Condition

The project area is located within a Northwest Forest Plan (NWFP) LSR and Endangered Species Act-designated northern spotted owl Critical Habitat unit (CHU 36). As such, stands in the project area are managed to provide habitat for late-successional associated species including the spotted owl.

Because not all forested stands within LSR are currently functioning to their fullest potential as late-successional habitat, the NWFP recognizes the role of silviculture in maintaining or increasing desirable late-successional habitat components. How these key habitat components are incorporated into the project design for both action alternatives will be described in further detail within the following analysis.

The Gemmill Thin Project interdisciplinary team specifically designed this project to maintain, protect and develop the following key late-successional habitat attributes and components. These attributes and components include: 1) large trees 2) large snags 3) coarse woody-debris 4) dense canopy closure 5) multiple-canopy layers 6) large diameter hardwoods.

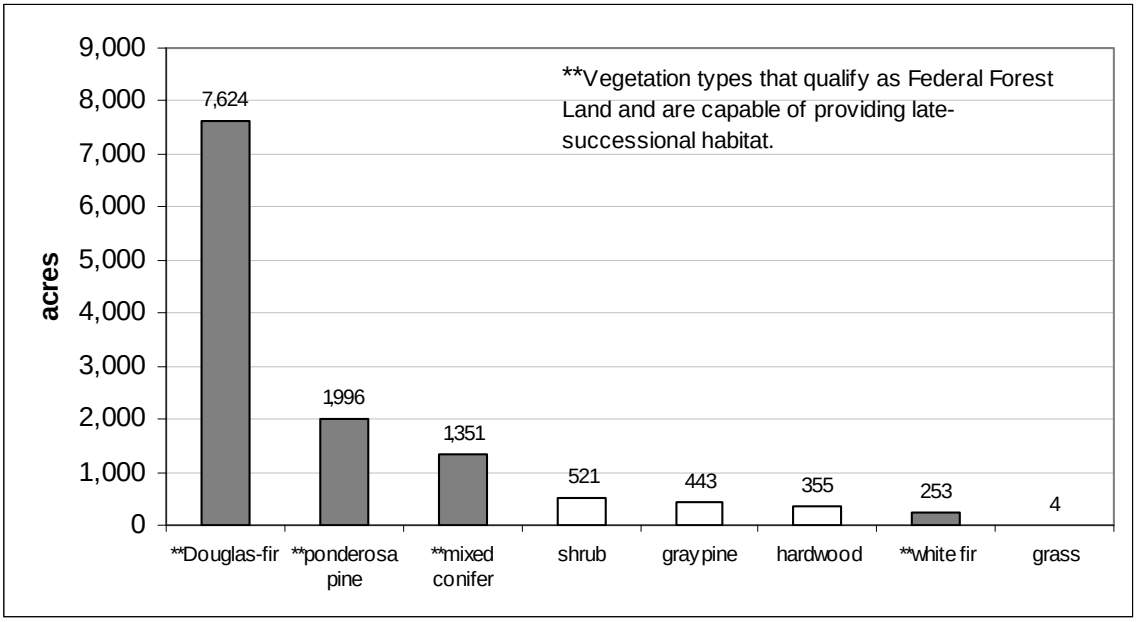



**Figure 3-4. Major vegetation types on National Forest land in the spotted owl Action Area. Only Douglas-fir, ponderosa pine, mixed conifer and white fir qualify as Federal Forest Land and are capable of providing late-successional habitat for species such as the northern spotted owl.**

## Current Habitat Conditions

This section discusses the amount and configuration of late-successional habitat in the owl Action Area. The old growth subset is distinguished from mature stands to stress the significance of this higher quality habitat over the more general late-successional habitat. Forest conditions related to the sustainabilty of the largest/oldest trees and fuels conditions related to the sustainability of existing and developing late-successional habitat are also discussed.

The most abundant major vegetation types on National Forest land in the spotted owl Action Area are Douglas-fir followed by ponderosa pine, mixed conifer, shrub, gray pine, hardwood, white fir and a minor amount of grass (Figure 3-4). Other vegetation types occur in the area that are too small to have been mapped (generally less than 10 contiguous acres). Of these types, only Douglas-fir, ponderosa pine, mixed conifer and white fir qualify as Federal Forest Land[72] and are capable of providing late-successional habitat.

Of the approximately 11,224 acres of Federal Forest Land in the Action Area, about 7,679 acres currently provide spotted owl nesting/roosting/foraging (NRF) habitat and habitat for other species associated with late-successional conifer forests. Approximately 1,688 acres is old growth which provides the highest quality owl habitat. No owl habitat appears to be fragmented (isolated) to a degree where it is not available to owls or other species associated with late-successional forests. Based upon habitat mapping, field reviews and aerial photography, suitable owl NRF habitat in the Action Area lies in a fairly contiguous pattern with the connectivity habitat on National Forest land and private property. Connectivity habitat is defined as conifer stands of at least 11 inches DBH and at least 40% canopy closure (also known as '11-40' conditions).[73]

Connectivity habitat comprises more than 81% (10,224 acres) of the 12,558 acres of National Forest land in the spotted owl Action Area and is relatively contiguous. Thomas et al. (1990) established the level of adequate connectivity habitat at 50% of a given landscape. The 4,310 acres of private land in the Action Area is comprised largely of connectivity habitat, generally of marginal quality.

## Fuel Conditions

Much of the late-successional forest in the Action Area is at risk of being lost to fire, putting adjacent existing and developing old growth habitat at risk. Current surface fuel loading in these stands is a concern. Long-term field experience supported by computer modeling using data collected in the project area indicate that the fuel levels in the project area will dramatically increase with time.[74] While dead woody material (fuel), such as logs and snags, are key components of old growth habitat, when it accumulates to unnatural levels other key habitat components, such as canopy cover, are put at risk due to the increasing probability that stand-replacing wildfire will occur.

As explained in *Chapter 3 Fuels*, the natural fire regime in the project area prior to European settlement acted to limit the buildup of dead woody material and smaller diameter trees that form fuel ladders into the upper canopy. Historic wildfires tended to remove smaller diameter trees (developing ladder fuels) while leaving important old growth habitat components such as large trees, logs and snags. The more intensive timber harvest practices that occurred on Federal lands around 1950 through 1980 often included removal of the largest trees and/or regeneration harvest that lacked post-harvest fuels

[72] Federal Forest Land is defined as public land capable of becoming at least 10 percent stocked with forest trees, and has not been developed for non-timber use. It is used for analysis of the Forest-wide standard and guideline that provides for retention of old growth fragments where little remains (15% S&G). The project-specific analysis of Federal Forest Land in the project area, including consistency with the 15% S&G, is detailed on page 34 of the Wildlife BA in Appendix G.
[73] Thomas et al. (1990)
[74] See FVS modeling results for effects of no action.

reduction treatments. These activities, along with the near total suppression of wildfires, shaped the current forest structure and wildfire behavior. Projected surface fuels coupled with existing fuel conditions indicate that within about 10 to 15 years a fire start in these stands would be catastrophic. Fire would likely climb into the canopy and result in the loss of important habitat components, such as large trees and the associated dense canopy cover, such that these stands would no longer function as spotted owl nesting/roosting habitat. Of equal or greater concern is that once fire in these stands reaches the upper canopy, the adjacent old growth is at a much greater risk of being lost to fire even though these stands would normally be relatively resistant to loss from ground fire.

In addition, past fire suppression is putting the persistence of the largest/oldest trees in the project area at risk due to competition for limited site resources in overcrowded stand conditions. Extensive field reviews show that the majority of the largest/oldest trees are already beginning to display obvious signs of distress such as fungal/insect damage. Fading/yellowish foliage and existing hardwoods are in a highly suppressed and weakened condition due to shading from shade-tolerant conifer species (i.e., white fir) that are growing due to fire suppression.

## Species Occurrence and Habitat Accounts

This section describes the occurrence of Endangered Species Act-listed (ESA-listed), Forest Service Sensitive, and Survey and Manage Species in the Action Area based upon surveys, inferences of occurrence made from current habitat conditions, and species' known or expected ranges. The Wildlife BA and BE in Appendix G and H include more detailed discussions for each species, along with pertinent literature citations.

### ESA-listed species

The Shasta-Trinity National Forest accessed the list of Federal Endangered, Threatened, or Proposed species from the USFWS web site dated November 20, 2007 (http://www.fws.gov/arcata/specieslist) where species occurrence is listed by county. The list includes the following species that may occur in the county where the proposed project would occur:

- Endangered
  - None
- Threatened
  - Marbled murrelet (*Brachyramphus marmoratus*)
  - California red-legged frog (*Rana aurora draytoni*)
  - Northern spotted owl (*Strix occidentalis caurina*)
- Proposed
  - None

#### ESA-listed species *not* carried forward for further analysis

The following list includes species where no further analysis is required for this project, the rationale for which is included in the Wildlife BA (Appendix G). The pages in the Wildlife BA where species

occurrences are discussed are included with the heading for each species listed below. A more detailed discussion, along with pertinent literature citations not included here, can be found in the Wildlife BA.

- Marbled Murrelet (Wildlife BA pages 8 and 28)
- California Red-Legged Frog (Wildlife BA pages 8-9, 28)

#### Northern Spotted Owl (Wildlife BA pages 9 and 10)

Surveys conducted from 2005 through 2008 confirmed that three spotted owl pairs occur in the Action Area (two pair seen nesting and one pair seen with young out of the nest). Our records also include two additional 'historic' activity centers last confirmed in 1992 and 1994 based upon seeing or hearing a pair in close proximity, but reproduction or nesting was not confirmed. Recent survey efforts indicate that these 'historic' activity centers are likely no longer active even though they are carried forward in the analysis. Owl surveys will continue for the duration of project implementation within the appropriate timeframes.

### Forest Service Sensitive Species

The Regional Forester issued the most recent Sensitive Species list for each of the National Forests in Region 5 in April of 2004. For a complete list of all wildlife species listed for the Shasta-Trinity National Forest see the Wildlife Biological Evaluation (BE) for the Gemmill Thin project (Appendix H).

The Pacific fisher, American marten, northern goshawk, pallid bat and Townsend's big-eared bat are carried forward throughout the analysis based upon the likelihood of occurrence due to the species' ranges and existing habitat conditions described below. Like the northern spotted owl, Pacific fisher, marten, and goshawk are associated with late-successional conifer habitat (especially the old growth subset**).** As stated above, the northern spotted owl will be used in the following analysis as a representative species for effects related to late-successional and old growth habitat.

#### Forest Service Sensitive Species *not* carried forward for further analysis

The following list includes species where no further analysis is required for this project, the rationale for which is included in the Wildlife BE (Appendix H). A more detailed discussion, along with pertinent literature citations not included here, can be found in the Wildlife BE.
The pages in the Wildlife BE where species occurrences are discussed are included in parentheses for each species listed below.

- American Marten (*Martes americana*) (pages H-14 - H-15)
- California Wolverine (*Gulo gulo luteus*) (pages H-2 - H-3)
- Western Red Bat (*Lasiurus blossevillii*) (page H-3)
- Bald Eagle (*Haliaeetus leucocephalus*) (page H-3)
- Willow Flycatcher (*Empidonax traillii*) (page H-4)
- Northwestern Pond Turtle (*Clemmys marmorata marmorata*) (page H-4)
- Cascade Frog (*Rana cascadae*) (page H-4)
- Foothill Yellow-legged Frog (*Rana boylii*) (page H-4)
- Southern Torrent Salamander (*Rhyacotriton variegatus*) (page H-4)

- Shasta Salamander (*Hydromantes shastae*) (page H-5)
- California floater, *topaz juga*, montane peaclam, nugget pebble snail, Shasta sideband snail, Wintu sideband snail, Shasta chaparral snail, Tehama chaparral snail, Pressley hesperian snail or Shasta hesperian snail (page H-5)

### Forest Service Sensitive Species carried forward for further analysis

The following list includes those species that warrant further discussion within this analysis based on occurrence or presence of suitable habitat within the project area. The pages in the Wildlife BE where species occurrences are discussed in more detail are included with the heading for each species listed below.

- Northern goshawk (*Accipiter gentilis*)
- Pallid bat (*Antrozous pallidus*)
- Townsend's big-eared bat (*Corynorhinus townsendii*)
- Pacific fisher (*Martes pennanti pacifica*)

### Pacific Fisher (Wildlife BE pages 11-14, 18, 33-34)

The USFWS finds the status of the Pacific Fisher as being warranted for federal listing but precluded by pending proposals for other species with higher listing priorities.[75] Because of this unique status, the fisher was analyzed at a species-specific, slightly larger area than the spotted owl Action Area in order to aid in possible future consultation or status reviews with the USFWS. Our records include seven past sightings of individual fishers in the project area vicinity. The combination of sighting reports, monitoring results, and study findings demonstrate fisher are widely distributed across a variety of habitat types throughout the STNF. Fishers are expected to occur, in low densities, in the area even though recent baited camera stations failed to detect fishers in the area and modeling predicts a generally low probability of fisher detection in the area.

The characteristics of sites used for resting and denning are the best-known elements of habitat selection by fisher.[76] Numerous studies have documented that resting/denning fishers in the western United States utilize stands with certain forest characteristics such as **large trees**, **large snags**, **coarse woody-debris**, **dense canopy closure**, **multiple-canopy layers**, **large diameter hardwoods**, and **steep slopes near water**.[77] Trees must be large and old enough to bear the type of stresses that initiate cavities. These characteristics are virtually identical to those associated with late-successional (especially the old growth subset) and spotted owl habitat. In the Gemmill Project area vicinity, fisher resting/denning habitat structure is typically best created, stabilized, and maintained within late-successional forests. As with northern spotted owl habitat, the major structural components of resting/denning habitat are typically found in greater density and larger sizes in the old growth subset of late-successional forest.

[75] USFWS (2004)
[76] USFWS (2004)
[77] Powell and Zielinski (1994); Seglund (1995); Aubry et al. (2002); Carroll et al. (1999); Mazzoni (2002); Self and Kerns (2001); Truex et al. (1998)

The fisher analysis area (FAA) encompasses 19,582 acres and is analyzed for potential impacts to the Pacific fisher specific to this project. The FAA was established using the same general technique and principles used to depict the spotted owl Action Area. It is designed to focus on female fishers because female survival has been shown to be the most important single demographic parameter determining fisher population stability.[78] Although there is quite a bit of variation in fisher home range size in different studies, we have selected to use figures based on studies conducted in proximity to the project site and in similar habitat conditions.[79] Yeager conducted fisher studies on the STNF and calculated female fisher home range size to average about 5,800 acres. Suitable habitat within a female's home range would likely be utilized to some extent within any given year and significant impacts to habitat (both positive and negative) would likely affect (positively or negatively) any current or potential future female fishers raising young in the FAA. We used a 1.7 mile radius circle (5,800 acres as per Yeager's studies) to approximate an average female fisher home range in the project area vicinity. The FAA was created by mapping a 1.7-mile buffer around all areas proposed for treatment that may impact fisher habitat. This method likely overestimates the number of female home ranges impacted (16,868/5,800 = about 3) since it assumes homogeneous suitable habitat and full occupancy, but we believe that the FAA gives a reasonable approximation for an analysis of effects.

### Northern Goshawk (Wildlife BE pages 16-17, 19)

This assessment of goshawk habitat is based upon the late-successional habitat definitions presented in the Gemmill Wildlife BA (Appendix G) cross-referenced to the habitat capability models included in Appendix G of the Forest Plan and uses the LMP-90 database coupled with field reviews of the project area vicinity to confirm habitat capability.

On the west side of the Shasta-Trinity National Forest, goshawks are typically associated with late-successional and old growth conifer habitat.[80] Stand-level habitat characteristics are the same as those discussed previously for fisher resting/denning habitat. The Action Area includes 1,688 acres of high capability habitat (254 acres in the project area), 9,991 acres of moderate capability habitat (5,991 acres National Forest land plus roughly 4,000 acres on private property) (955 acres in the project area) and 4,796 acres of low capability habitat (405 acres in the project area). Goshawk habitat capability in the analysis area is undoubtedly substantially lower because this analysis does not account for slope steepness. The Forest Plan model includes slope percent; gentle slopes are preferred by the goshawk; the watershed includes many areas dominated by steep terrain.

Goshawk surveys were conducted in 2007 and 2008 in the project area vicinity, and were focused on areas with historic goshawk nesting or sighting data as well as areas with the most suitable habitat. In 2007, two general goshawk activity centers were located that implied a close proximity of nest sites. In 2008, an active goshawk nest was located in the Hall City drainage in the center of the project area, on the edge of unit 23. This unit will not be entered during the goshawk breeding season if year of action surveys

[78] Truex et al. (1998), Lamberson et al. (2000)
[79] Yeager (2005)
[80] USDA (1998)

indicate nesting activity is occurring. In addition, Limited Operating Periods (LOPs) will be in effect for ¼ mile surrounding the nest site (see discussion below on pg.53 on direct effects of the project for goshawks). **Pallid Bat (Wildlife BE pages 15, 18-19, 24)**

The pallid bat has a wide distribution throughout the western United States, and can be abundant in many arid, low elevation regions. They roost in deep crevices in rock faces, caves, mines, and bridges. Suitable caves, mine entrances and rock habitats occur scattered throughout the project area vicinity and throughout the entire STNF.

Pallid bats occur and reproduce in the project area vicinity. The Forest Service Pacific Southwest Research Station conducted strategic bat surveys across the South Fork Management Unit during the summers of 2003-2004, including a concentrated survey effort near Hall City and Wilson Creeks in the project area vicinity. Two juvenile and one pregnant female were captured.

### Townsend's Big-eared Bat (Wildlife BE pages 16, 18-19, 24)

This species has a large geographic range and occupies a variety of habitats ranging from coniferous forests and woodlands, to deciduous riparian woodlands, semi-desert and montane shrublands. The distribution of this bat tends to be determined by and strongly correlated with the availability of caves or cave-like roosting habitat such as old mines.[81] The size of an area outside of a roost structure required by this species depends on availability of water, abundance of insect prey, time of year, reproductive status of the bats, and the size of colony. This species forages in more cluttered habitats, avoiding more open areas while foraging opportunistically within concentrations of insects, relying heavily on riparian areas, wetlands, forest edges or ridges.[82] Foraging habitat occurs across the STNF and within the project area. Roosting habitat, in the form of Hall City Caves and numerous mine adits, occurs within the project area and surrounding vicinity.

Pacific Southwest Research Station conducted strategic bat surveys across the South Fork Management Unit, including a concentrated survey effort near Hall City and Wilson Creeks in the project area vicinity. Big-eared bats were detected during their survey, but not directly within the project area. A known maternity roost site lies roughly 10 miles to the northwest of the project area. Several aspects of the biology of this species make it a particularly difficult to survey. It is a slow flying, highly maneuverable bat that is adept at avoiding mist-nets and its echolocation call is relatively quiet, such that acoustic surveys often fail to detect the bat when it is present. An assumption of presence is made, specifically for Hall City caves and other mine adits in the project area due to their high suitability for roosting and the previous detection of big-eared bats in the general vicinity.

## Survey and Manage (S&M) Species

In 2003, surveys were completed in the project area and vicinity that followed the *Survey Protocol for Terrestrial Mollusk Species from the Northwest Forest Plan Draft Version 2.0*.[83] These surveys revealed no S&M species requiring special management consideration or protection as per the *Record of Decision*

[81] Gruver & Keinath (2006), Zeiner (1990); Arizona Game and Fish Department (1993)
[82] Fellers and Pierson (2002)
[83] Furnish et al. (1997)

*and Standards and Guidelines for Amendments to Survey and Manage, Protection Buffer, and other Mitigation Measure Standards and Guidelines* (2001) and subsequent *Annual Species Reviews* (June 14, 2002; March 14, 2003 and December 12, 2003) except for two terrestrial snails: *Vespericola pressleyi* and *Helminthoglypta talmadgei*. The *Vespericola* sp. is associated with permanently wet areas (Furnish et al. 1997) and no such areas lie within or immediately adjacent to areas proposed for treatment. The *Helminthoglypta* sp. requires protection of known sites (no pre-project surveys are required) and no known sites of this species occur in the project area vicinity. The project area lies outside the known or expected ranges the Shasta salamander as well as S&M freshwater mollusk species.[84] Because they are not likely to be impacted by the project, S&M species are not discussed further in this document.

## Environmental Consequences – Wildlife

Chapter 2 of this EIS contains a summary table (Table 2-3) comparing Alternatives 1 and 3 in detail. In terms of effects to spotted owl habitat, the difference between these alternatives is the total number of acres that would be thinned and the subsequent difference in short-term and long-term effects. These effects and the expected impacts to habitat due to fire are discussed below. Other acre-related differences cannot be quantified, such as the actual number of individual large/old trees and hardwoods that would remain and continue to experience stress and perhaps mortality due to continued competition for limited site resources with Alternative 3 as compared to the proposed action. Gathering individual tree data that would be needed to quantify the differences between the two action alternatives would not be practicable. The acres for both the action alternatives are included in the text, tables and graphs where they differ.

### Alternative 2

#### Direct Effects

Direct effects are effects to individual animals through harm, mortality, displacement or disturbance at the time of an action. Direct effects can range from minor disturbances that have negligible effects to wildlife to effects that are more intense or long-lasting and may lead to failed reproductive efforts.

There would be no direct effects to any of the species associated with the old growth or late-successional habitat discussed above from the no action alternative because no actions would take place that would cause harm, mortality, displacement or disturbance that may lead to failed reproductive efforts.

#### Indirect Effects

As discussed below, projected stand canopy closure within this period in the thinning units is similar, with or without the thinning, because of tree mortality. The largest/oldest conifers and understory hardwoods would continue to weaken due to competition for limited site resources. Smaller diameter snags/logs would also increase, and contribute to surface fuel build-up, see discussion below on *FVS and Fuels Modeling*.

There would be no effect to existing canopy closure in the short-term; the existing dense understory would remain and all sizes of snags/logs would remain. The largest/oldest conifers and understory

[84] Frest and Johannes (1999)

hardwoods would remain in competition for limited site resources. However, the untreated stands would remain vulnerable to fire events that would reduce them below suitable owl habitat conditions within the 10-15 year timeframe, as discussed in the *Fuel Conditions* section above, in the FVS/FFE modeling below and in *Chapter 3 Fuels*.

Without treatment, overstocked stands will not stay healthy or meet the need for more old growth habitat in the LSR. No increase in suitable owl connectivity or foraging habitat would occur from thinning dense pine plantations. Most of the existing plantations scattered throughout the LSR have never been thinned so they, too, are overcrowded and are hindered in their development of future old growth habitat characteristics.

### Fuels and fire effects

Modeling results (FVS/FFE) as described below are the most effective analysis tool for describing the direct and indirect effects of implementing the no action alternative as well as the proposed action alternatives.

## Alternatives 1 and 3

### Direct Effects

Direct effects are effects to individual animals through harm, mortality, displacement or disturbance at the time of an action. Direct effects can range from minor disturbances that have negligible effects to wildlife to effects that are more intense or long-lasting and may lead to failed reproductive efforts.

Because the project was designed to avoid direct effects to northern spotted owls and goshawks through use of surveys and Limited Operating Periods (LOP), some protection from disturbance will be afforded to other late-successional associated species during these periods. However, since LOPs are designed to protect only owls and goshawks during the nesting their season, they do not assure that direct effects to other species will be avoided. Therefore, direct effects to each Forest Service Sensitive species that may potentially occupy the project area are disclosed individually.

#### Northern Spotted Owl

We do not expect to harm or displace owls or cause owls to abandon an active nest site.

Limited Operating Periods (LOPs) would be implemented to avoid direct adverse impacts to the northern spotted owl. From February 1 through July 10, all noise- and smoke-generating activities will be prohibited within ¼ mile of suitable nesting/roosting habitat. In addition, all vegetation removal/cutting/burning will be prohibited through September 15 within suitable nesting/roosting habitat.

These LOPs would minimize direct effects to the spotted owl by avoiding disturbances during critical periods of the breeding season or when young owls are not mobile enough to readily move away from a disturbance. Due to our continuing surveys in the project area, we know the vicinity of active nest sites and no actions are proposed within nest groves.

The recent final report for the Effects of Noise Disturbance on Northern Spotted Owl Reproductive Success[85] is pertinent to the Gemmill Project because it is based upon data collected in a long-term study area that includes portions of the Shasta-Trinity National Forest in vegetation types similar to those in this project and addresses issues associated with this project. This study indicates that noise disturbance (no LOPs) from management actions does not appear to have significant short-term effects on owl reproduction. Only when disturbance is ongoing and long-term (greater than 3 years) was a significant negative effect on numbers of fledglings produced evident. This report indicates that the long-term effects to owl reproduction are more likely associated with long-term loss of habitat rather than the noise disturbance.

### Pacific Fisher (Wildlife BE pages 11-14, 18, 21, and 33-34)

When assessing project level effects to fisher populations, the USFWS regards the retention of key habitat elements such as large downed logs, large snags that provide cavities for denning and a higher canopy closure that provides protection from the heat and drying effects of the sun, as being the most important factors used to maintain habitat suitability. It is the specific removal of these elements that cause the degradation of a given habitat type. The continuing loss of these important habitat structural elements as well as the continuing loss and fragmentation of suitable habitat constitute the primary threats to fisher populations.[86] Because the goal of the Gemmill Thin project is the improvement and protection of late-successional habitat for the species that rely on it, the project was designed specifically to retain these key habitat elements, improve habitat structure and contribute to connectivity between areas of suitable habitat. While it is possible that individual fishers may be impacted by short-term disturbance during project implementation, the disturbance would be short-lived and of a small scale and would not exacerbate the significant threats to viability (discussed above) identified by the USFWS.

### Northern Goshawk

A Limited Operating Period (LOP) from Feb. 1 to Aug. 15 for ¼ mile around known nest sites will alleviate potential impacts to goshawks from human disturbance during project implementation. The pair of goshawks occupying the Hall's City Creek drainage may be disturbed during project implementation, although the unit containing the current nest will not be entered during breeding season if year of action surveys determine that nesting activity is occurring. In addition, the implementation of a ¼-mile LOP surrounding the nest site during nesting season should also help to minimize the impacts to this pair. Nests have not been located for the two potential pair in the Landis Gulch area and the Chanchelulla Gulch area but since these goshawks were aggressively defending territories in areas located over 1.2 miles away from harvest units, disturbance to breeding activities of these birds is not expected.

In addition, year of action surveys will be conducted within the project area. Results from these surveys will guide the implementation of LOPs that will protect nesting goshawks during project implementation for the duration of the goshawk nesting season.[87]

[85] Damiani et al. (2007)
[86] USFWS (2006)
[87] See *Chapter 2 Resource Protection Measures*

### Townsend's Big-Eared Bat (Wildlife BE pages 15, 18, 24, and 33)

This bat species may use Hall City cave located near the southeast side of the project area as well as two abandoned mine adits within the project area as roost sites.

The *Technical Conservation Assessment for Townsend's Big-eared Bats*[88] identifies several key conservation elements and provides management guidelines aimed at protecting these elements. Within this assessment, the disturbance and destruction of roosts is identified as responsible for the local and range-wide declines of Townsend's big-eared bat. Among the guidelines were standards for management of caves and mines. Protection of known roosts and identification and protection of additional roosts were identified as core conservation actions for this, and several other species of bat.

Protection of roosting bats requires minimizing or eliminating human disturbance at roosts and ensuring that surface disturbing activities are done at appropriate times and at appropriate distances from roosts.[89] Disturbance of roosting bats at specific times and of a long duration can be especially detrimental to the fitness of the bats. Continued disturbance at roost entrances can cause bats to become hesitant to exit or can lead to unnecessary expenditure of vital energy reserves.[90] Delayed emergence from roost sites for bats with high energetic demands, that will have not had food or water for14 to 16 hours, can have detrimental effects. Disturbance of maternity roosts, where large colonies of pregnant females or females and their young roost, may result in total roost abandonment and mothers that may leave non-volant young behind.

Disturbance buffers will be implemented with the project as a means for protecting known and potential roost sites and reducing impacts from human disturbance during project implementation. Within these 250-foot buffers around caves and abandoned mine adits, no harvest or harvest activities will take place.

Although the project avoids impacts to caves, mines and rock outcrop areas, and these areas are over 250 feet from any unit boundary, it is possible that individuals may be disturbed due to noise during project implementation. Studies of the habitat requirements of this bat have indicated that although the bats may leave a particular roost site if sufficiently disturbed, they will generally return to the site if the disturbance is short-term and short duration and the microclimate within and around the roost site has not been altered.[91] It is unknown whether maternity roosts are present in the project vicinity, but providing protection buffers to known sites where potential maternity roosts may exist would avoid impacts to reproduction.

No activities would take place at any time within 250 feet from known roost sites, nor would any of the proposed actions alter the environment around cave or abandoned mine entrances (and therefore the microclimate within). Temporary, occasional disturbance may occur, but should not affect breeding or rearing activities.

[88] Gruver & Keinath (2006)
[89] Gruver & Keinath (2006)
[90] Fellers & Pierson (2002), Gruver & Keinath (2006)
[91] Pierson (1999), Arizona Game and Fish (2002)

### Pallid Bat (Wildlife BE pages 14, 18, 24, and 33)

Pallid bats occur in the project area vicinity and may roost in caves, abandoned mines and mine adits, deep rock crevices, and tree cavities scattered throughout the area. Disturbance buffers, where no harvest or harvest activities will take place, of 250 feet for caves and mine adits will reduce impacts to roost sites during project implementation. Even though the proposed actions avoid direct impacts to caves, mines, rock outcrop areas, and large snags/trees (i.e., that most commonly would have larger cavities that could accommodate larger numbers of bats); individuals may be disturbed and vacate the vicinity due to noise during project implementation. Temporary, occasional disturbance may occur, but should not affect breeding or rearing activities. Effects to this species are expected to be similar to those described above for Townsend's big-eared bat.

## Indirect Effects

Indirect effects are those that may impact wildlife species into the future due to an alteration of habitat conditions. As discussed earlier in the introduction, the northern spotted owl and its habitat is used as a representative for other species associated with late-successional forests (especially the old growth subset). Indirect effects are discussed in relation to the proposed treatments' effects to late-successional and old growth habitat and habitat components. Existing and projected fire/fuels conditions, as evaluated using FVS/FFE modeling, are also discussed in relation to the ability of the treated areas to provide late-successional habitat when fire events are considered.

### Pallid Bat (Wildlife BE pages 14, 18, 24, and 33)
### Townsend's Big-Eared Bat (Wildlife BE pages 15, 18, 24, and 33)

Indirect effects from the proposed actions are expected to be similar enough in nature for these two species that they will be discussed together for the purposes of this analysis. Indirect effects to these species' habitat would not be represented by using the northern spotted owl habitat analysis because these two species of bats are not necessarily tied to late-successional forest habitat, and will therefore be discussed separately.

Protection of roosting habitat requires ensuring that the microclimate within the roost is not altered. The most significant characteristic of a given roost site for a bat is the microclimate within, and significant changes to it may cause complete abandonment of the site. Air flow plays a considerable role in maintaining the temperature and humidity levels within a cave or cave-like structure. Disruption of the environment immediately outside of a roost site, for example removal of large trees at a cave entrance, will alter the airflow and potentially the microclimate inside.

Retaining the site specific microclimate is of the greatest significance to a maternity roost where pregnant females or females and their young rely on these highly specific areas during the summer months.

No activities would take place at any time within 250 feet from known roost sites, nor would any of the proposed actions alter the environment around cave or abandoned mine entrances/adits, thereby retaining the microclimate within. There would be no impact to cave or mine roosting habitat from the proposed activities.

## Indirect Effects - Using the Northern spotted owl as a representative species for species associated with key habitat components of late-successional forests

It is important to note that the proposed timber harvest does not involve a sanitation prescription whereby trees that display defect, disease or decay are removed. Trees that are considered "cull" or "standing cull" are **not** targeted for removal, therefore those trees that are most likely to become snags and downed logs in the future will be retained

The Gemmill Thin Project interdisciplinary team (IDT) specifically designed this project to maintain, protect and develop the following key late-successional habitat attributes and components: 1) **large trees**, 2) **large snags**, 3) **coarse woody-debris**, 4) **dense canopy closure**, 5) **multiple-canopy layers**, 6) **large diameter hardwoods**. Note that these attributes also apply to other species associated with late-successional habitat (especially old growth).

Described below is how these key habitat components are incorporated into the project design for both action alternatives:

1. **Large Trees**: The thinning from below, dead fuel removal, and fuelbreak maintenance prescriptions were specifically designed to retain the largest/oldest trees. Prescriptions in Alternative 1 would thin within close proximity of existing predominant trees (the largest/oldest) to increase available site resources so these important trees can persist longer. Due to the 18"DBH limitation for tree removal, Alternative 3 would not include this treatment. The small (¼ to ½-acre) landings would be strategically located to avoid impacting large trees (including hardwoods) and snags. Proposed thinning in plantations with both alternatives would accelerate the growth and development of the remaining trees.
2. **Large Snags**: Smaller snags do not have the potential to include branches or cavities large enough to provide owl nest sites or fisher resting or denning sites. Thinning from below and dead fuel reduction prescriptions would retain all existing large snags (≥19" DBH). Proposed plantation thinning would accelerate the growth of larger conifers and ultimately large snags into the future.
3. **Coarse Woody Material (Logs)**: Thinning from below and dead fuel reduction prescriptions would retain all existing large logs (≥19" diameter at the large end); plantation thinning would accelerate the growth of larger conifers and ultimately large logs into the future.
4. **Dense Canopy Closure**: The IDT developed the thinning from below prescriptions as a balance between the maintenance of canopy and a reduction in existing and future fuels to prevent loss of habitat due to wildfire. The resulting post-treatment stand-level canopy closure of about 75% (factoring approximately 15% hardwood contribution) is well above the mean canopy closure of 60% reported by the U.S. Fish and Wildlife Service for suitable owl habitat. Resulting canopy closure would also align with the descriptions for fisher rest sites studied in the southern Sierra Nevada and northern California, by Self and Kerns (2001), Zielinski et al. (2004), and Mazzoni (2002). The fuelbreak prescriptions would reduce canopy to about 40%. However, these areas do not likely provide suitable owl nesting/roosting or fisher denning/resting habitat because of their ridgetop location and the past removal of key components such as large decadent trees, large

snags and large logs. The plantation thinning would accelerate the development of a dense canopy comprised of large conifers into the future.

5. **Multiple Canopy Layers**: Thinning from below prescriptions would retain all the largest/oldest trees in the upper canopy, all viable hardwoods in the lower canopy, as well as a variety of conifer sizes in the mid-canopy to maintain multiple canopy layers. Within the plantations, hardwoods would be maintained at the same spacing guidelines as for conifers to assure this understory component is carried into the future.
6. **Large Hardwoods**: All project activities are designed to retain all viable hardwoods.

### Short-term Effects to Spotted Owl Habitat

The 10 to 15 year timeframe post-project is considered 'short-term' because after this time we expect owl habitat conditions to improve.

Landing construction would remove a maximum of about 15 acres of NRF habitat in both alternatives. However, within the short-term timeframe, stands that are currently unsuitable owl habitat (in the form of overstocked young stands and plantations) would develop into suitable habitat and compensate for acres lost to landing construction.

About 1,209 acres (Alternative 1) or 1,064 acres (Alternative 3) of existing NRF habitat would experience a reduction in canopy closure due to the project, including a reduction in small snags/logs, and a simplification in canopy layering. We expect these areas to continue to function at pretreatment levels because key habitat components, described above, would be maintained and the residual canopy closure would be well above established suitability thresholds for the northern spotted owl, goshawk and Pacific fisher.

Tables 3-7a and 3-7b present the amount of each habitat type that would be affected by the project. Effects are segregated by the intensity of the impact within the Action Area and the territories and home ranges of the owl activity centers that would be affected.

**Tables 3-7a and 3-7b. *Short-term effects*** (acres) to spotted owl nesting/roosting (NR) and foraging (F) habitat within the owl Action Area (top of 4a) as well as the individual known spotted owl territories (4a) and home ranges (4b) . Note that the differences between Alternatives 1 and 3 show up only in the Action Area and home range of Activity Center TR098. Old growth is displayed separately from overall nesting/roosting habitat to emphasize its ecological significance**

| **Table 3-7a Entire Owl Action Area and Owl Territories** | | **Old Growth** (high quality NR) | | **Dense Mature** (mod. quality NR) | | **Mod. Dense Mature** (foraging) | | **Total NRF** | |
|---|---|---|---|---|---|---|---|---|---|
| **Activity Center ID** | **Effects to Habitat** | **Existing Available Habitat** | **Acres Affected** | **Existing Available Habitat** | **Acres Affected** | **Existing Available Habitat** | **Acres Affected** | **Existing Available Habitat** | **Acres Affected** |
| **Entire Owl Action Area** | Removed | **1,688** | 3 | **3,908** | 9 | **2,083** | 3 | **7,679** | 15 |
| | Canopy/snag/log | | Alt. 1 254<br>Alt. 3 202 | | Alt. 1 656<br>Alt. 3 573 | | Alt. 1 299<br>Alt. 3 289 | | Alt. 1 1,209<br>Alt. 3 1,064 |
| | **Total** | | **Alt. 1 257**<br>**Alt. 3 205** | | **Alt. 1 665**<br>**Alt. 3 582)** | | **Alt. 1 302**<br>**Alt. 3 292** | | **Alt. 1 1,224**<br>**Alt. 3 1,079** |
| **TR094** | Removed | **63** | 0 | **428** | 0 | **144** | 0 | **635** | 0 |
| | Canopy/snag/log | | 0 | | 0 | | 16 | | 16 |
| | **Total** | | **0** | | **0** | | **16** | | **16** |
| **TR098** | Removed | **348** | 3 | **382** | 4 | **74** | 2 | **804** | 9 |
| | Canopy/snag/log | | 140 | | 230 | | 49 | | 419 |
| | **Total** | | **143** | | **234** | | **51** | | **428** |
| **TR228** | Removed | **142** | 0 | **211** | 0 | **118** | 0 | **471** | 0 |
| | Canopy/snag/log | | 0 | | 0 | | 0 | | 0 |
| | **Total** | | **0** | | **0** | | **0** | | **0** |
| **TR320** | Removed | **183** | 0 | **454** | 0 | **63** | 0 | **700** | 0 |
| | Canopy/snag/log | | 0 | | 0 | | 7 | | 7 |
| | **Total** | | **0** | | **0** | | **7** | | **7** |
| **TR351** | Removed | **374** | 0 | **342** | 0 | **99** | 0 | **815** | 0 |
| | Canopy/snag/log | | 0 | | 0 | | 0 | | 0 |
| | **Total** | | **0** | | **0** | | **0** | | **0** |

| **Table 3-7b Owl Home Ranges** | | **Old Growth** (high quality NR) | | **Dense Mature** (mod. quality NR) | | **Mod. Dense Mature** (foraging) | | **Total NRF** | |
|---|---|---|---|---|---|---|---|---|---|
| **Activity Center ID** | **Effects to Habitat** | **Existing Available Habitat** | **Acres Affected** | **Existing Available Habitat** | **Acres Affected** | **Existing Available Habitat** | **Acres Affected** | **Existing Available Habitat** | **Acres Affected** |
| **TR094** | Removed | **260** | 0 | **1,173** | 0 | **485** | 1 | **1,918** | 1 |
| | Canopy/snag/log | | 4 | | 23 | | 59 | | 86 |
| | **Total** | | **4** | | **23** | | **60** | | **87** |
| **TR098** | Removed | **530** | 3 | **828** | 9 | **268** | 2 | **1,631** | 14 |
| | Canopy/snag/log | | 195 | | Alt. 1 503<br>Alt 3 493 | | 114 | | Alt. 1 812<br>Alt. 3 688 |
| | **Total** | | **198** | | **Alt. 1 512**<br>**Alt. 3 502** | | **116** | | **Alt. 1 826**<br>**Alt. 3 (702)** |
| **TR228** | Removed | **345** | 0 | **324** | 0 | **294** | 0 | **963** | 0 |
| | Canopy/snag/log | | 3 | | 4 | | 0 | | 7 |
| | **Total** | | **3** | | **4** | | 0 | | **7** |
| **TR320** | Removed | **525** | 0 | **1,074** | 0 | **323** | 0 | **1,922** | 0 |
| | Canopy/snag/log | | 0 | | 0 | | 39 | | 39 |
| | **Total** | | **0** | | **3** | | **39** | | **39** |
| **TR351** | Removed | **570** | 0 | **1,282** | 0 | **640** | 0 | **2,462** | 0 |
| | Canopy/snag/log | | 0 | | 0 | | 51 | | 51 |
| | **Total** | | **0** | | **0** | | **51** | | **51** |

**Removed indicates habitat lost due to landing construction. Canopy/snag/log indicates a reduction in canopy closure and small snags & logs due to thinning, fuel reduction or fuelbreak maintenance prescriptions but existing habitat suitability would remain.

Although Alternatives 1 and 3 would remove up to a maximum of about 15 acres of connectivity habitat due to landing construction, connectivity habitat would remain at well above the 50% threshold[92] in the Action Area. The size (up to 100 feet wide) and location of the proposed landings would not isolate existing owl habitat. Owls or other species crossing these open areas would never be more than 50 feet from forest cover. Additionally, the proposed plantation thinning would accelerate the development of about 43 acres of connectivity habitat in approximately 10 years. Without thinning, these plantations would remain so dense that owls would not be able to freely fly through them for 35+ years.

#### Long-term effects to spotted owl habitat

Alternative 1 and 3 would have similar effects to owl habitat in the long-term. While we do not expect a dramatic increase in growth with thinning in existing owl NR habitat, this is not the case with thinning within younger inclusions of existing foraging habitat, connectivity habitat or capable owl habitat. These younger inclusions would respond to the thinning more vigorously and, given the retention of other key habitat components, they would grow into moderate quality nesting/roosting habitat (dense mature forest) or foraging habitat conditions in about 10 to 15 years. There would be a net increase in moderate quality NR habitat of 370 acres for Alternative 1 and 353 acres for Alternative 3. There would also be a net decrease in owl foraging habitat due to thinned existing foraging habitat growing into moderate NR habitat conditions of 54 acres for Alternative 1 and 37 acres for Alternative 3.

Overall owl NRF would increase by 313 acres for both Alternatives 1 and 3, but Alternative 1 better serves the needs of the owl and other late-successional related species because more of the increase is in moderate quality NR habitat as opposed to lesser quality foraging habitat. For more details on this analysis, see Table G-5 in Appendix G (Wildlife Biological Assessment).

### Modeling - Fuels and Fire Effects

Up to this point, the analysis has focused on the effects to owl habitat without quantifying the interrelated issues of tree mortality, fuels and fire. This section integrates wildlife considerations with the information presented in *Chapter 3 Fuels* and models the proposed thinning compared with no treatment as it relates to fuel build-up and the resulting effects during a future fire event. The effect to canopy closure is stressed because canopy closure is an important component of owl habitat that will be impacted by the project. The project maintains other key habitat attributes such as the largest/oldest trees, large snags/logs and viable hardwoods, but a reduction in overall canopy closure is unavoidable to meet the purpose and need of this project. The results presented below are projected at the stand level using computer software designed to assist in land management of fire-adapted ecosystems. The difference between alternatives is reflected in the number of acres that would be treated with each alternative.

### FVS forest stand modeling

The analysis used forest stand data collected in the Gemmill Thin project area to run the **Forest Vegetation Simulator** model (FVS) along with the **Fire and Fuels Extension to the Forest Vegetation Simulator** (FFE-FVS). FVS (stand level) is an individual tree, distance independent growth and yield

[92] Thomas et al. (1990)

model. It simulates growth and yield for most major forest tree species, forest type, and stand conditions. FVS can simulate the effects of a wide range of silvicultural treatments. We used the 'ICASCA' variant of FVS for the specific geographic area that includes the project area. FFE-FVS links FVS with models of fire behavior, fire effects, fuel loading, and snag dynamics. Model outputs include predictions of potential fire behavior and effects and estimates of snag levels and fuel loading over time. Because FFE is linked to the FVS growth model, it helped us assess both the short and long-term effects of our proposed thinning and fuels treatments. More detailed information about FVS can be found at the following website: http://www.fs.fed.us/fmsc/fvs/index.php.

## FVS model limitations

During the modeling process, the IDT recognized a number of inherent limitations related to our expected stand response to thinning and late-successional habitat conditions and components.

### Maintaining the largest/oldest trees

The model assumes an even distribution of the trees we propose for removal. Therefore, when we modeled thinning from an existing canopy closure (or basal area) down to a target canopy closure the model assumes the "cut trees" are relatively evenly distributed through the stand. This assumption is essentially true in the mature stands that are much more homogeneous than the older stands (or older portions of mature stands). In the mature stand treatments the model predicts logical results reasonably consistent with our past experience with similar thinning treatments. Conversely, the prescription related to the older more heterogeneous portions of the stands is more nuanced in that we identify trees for removal on both a relatively evenly distributed canopy closure (basal area) basis as well as on a much more scattered, very site specific basis dictated by individual tree's proximity to, and competition with, very large/old trees. Consequently, in the older stands the model seems to give credible results for growth, fuels, and fire behavior but shows little or no effects to the mortality rate for the largest/oldest trees in the stands. Because the model is not sensitive to this prescription that specifically targets thinning competing trees around the largest trees, the model's assumed even distribution of "cut trees" misses this nuance. Extensive field reviews of the stands shows that many of these large/old trees are already beginning to display obvious signs of distress such as fungal/insect damage and fading/yellowish foliage. Removing smaller trees that are competing with the largest trees for limited water, sunlight, and nutrients is likely to result in increased growth and protection of the largest trees.

### Hardwoods

The relatively small diameter of the existing hardwoods in the lower levels of the stand structure (i.e., stratum 3) results in this important stand component being missed by the modeling. The prescription targets all viable hardwoods for retention, but this is missed by the model results for predicting canopy closure recovery after thinning. Our extensive field reviews of the project area indicate that the hardwood component would add another 10 to 20 percent canopy closure (average roughly 15%) to model results which only account for conifer trees.

We assume the model's predicted results to canopy closure after fire events are still valid because hardwoods represent a vulnerable component in the lower understory that would be lost regardless. We also assume that the predicted mortality of the smaller size class trees with no treatment includes hardwoods.

### Low density conifer size classes

Because of their low density our sampling failed to pick up conifers within the 18 through 26 inch DBH size classes within mature stands and 16 through 20 inch DBH size classes within the older stands. Intensive field reviews of the project area revealed that these size classes do occur, but at very low density. We did not consider this to be a limiting factor in the usefulness of the modeling. The only time these trees would be considered for removal is in the rare occasion when they occur in direct competition with much larger predominant (legacy) conifers or they occur in temporary landings and are less than 24 inches DBH. Additionally, our data collection did not account for conifers below roughly 8 inches DBH. Field reviews indicate that this heavily suppressed sapling component occurs at a density of well over 200 trees per acre.

**Figure 3-5. Existing conditions showing heavily suppressed sapling component at high densities**

### Fuel Build-Up (No Fire)

Based upon intense field reviews and long-term experience, we see an existing excessive fuel load in the stands proposed for thinning and anticipate this to worsen with time as competition for limited site

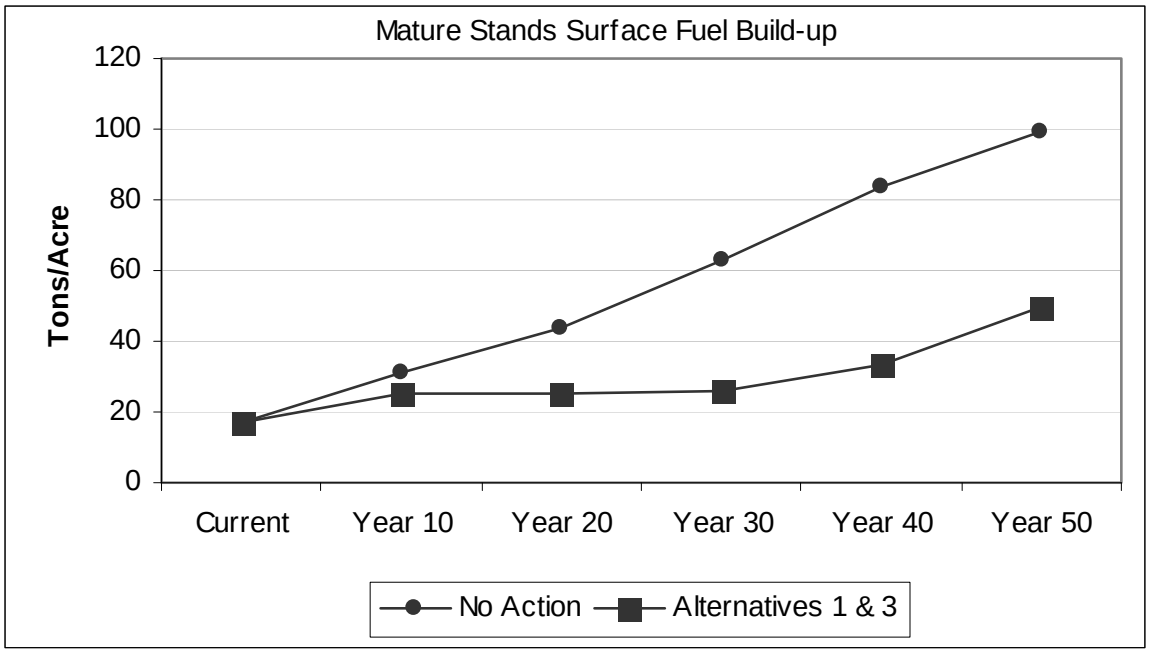
resources leads to tree mortality. Our modeling indicates that without treatment dying trees will increase surface fuels from an existing 17 tons per acre to about 100 tons per acre in mature stands and from an existing 44 tons per acre to about 57 tons per acre in the older stands. Proposed thinning would result in reduced fuel build-up at least 50 years into the future (Figure 3-6). This accumulation of coarse woody material could be viewed as a positive trend for old growth habitat. However, the projected mortality leading to this accumulation of material involves primarily smaller understory trees (i.e., those targeted for thinning) that would not provide large snags/logs associated with old growth habitat. Additionally, the tree mortality with no thinning would have a negative impact on canopy closure, another important component of old growth habitat.

### Canopy Closure (No Fire)

Intense field reviews, long-term experience and modeling indicate that even without treatment, canopy closure will drop over time as competition for limited site resources leads to tree mortality. Within about 15 years in mature stands and about 10 years in older stands projected mortality in the untreated scenario will reduce canopy closure to or below the projected canopy closure that would result from the proposed thinning (Figure 3-7). Modeling projects higher canopy closures in the treated stands than in untreated stands from about 20 years on, especially in the mature stands. This indicates that if trees are not removed, they will naturally fall out of the stands through mortality. Allowing the mortality to thin the stands increases surface fuel build-up and maintain dense fuel ladders up into the overstory.

### What Happens with Fire

The proposed thinning treatments will dramatically reduce the loss of overstory conifers (canopy closure) due to future late summer fire, when compared with no action (Figure 3-8). Currently, a fire in untreated stands would reduce canopy closure well below owl NR suitability and below even connectivity habitat conditions in roughly 5 years (mature stands) to 25 years (older stands) of continuing fuel build-up. Conversely, because of the reductions of existing/future fuels coupled with the increased vigor of the remaining trees, fire after the thinning treatments would not reduce canopy below owl NR habitat conditions even after 45 years of fuel build up. Canopy closure would remain at NR habitat conditions for the same time period.



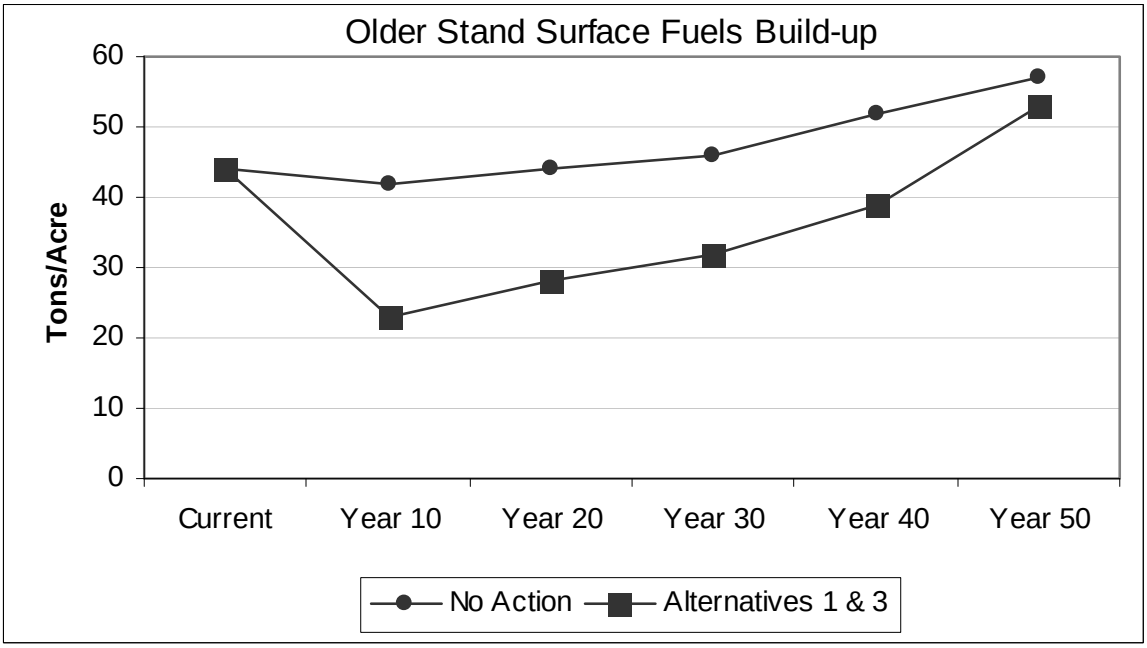
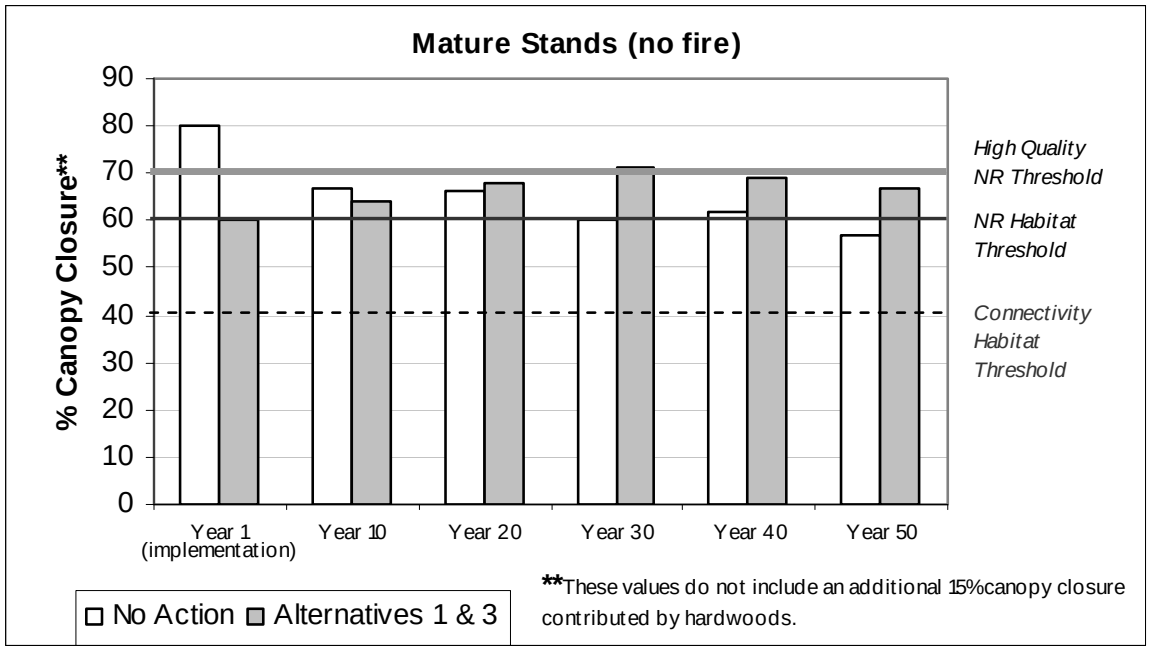




**Figure 3-6. The proposed thinning treatments within dense forest stands would reduce fuel build-up into the future. Existing large snags and logs as well as large overstory conifers will be retained to provide owl and fisher nesting and denning sites and large snags and logs into the future**



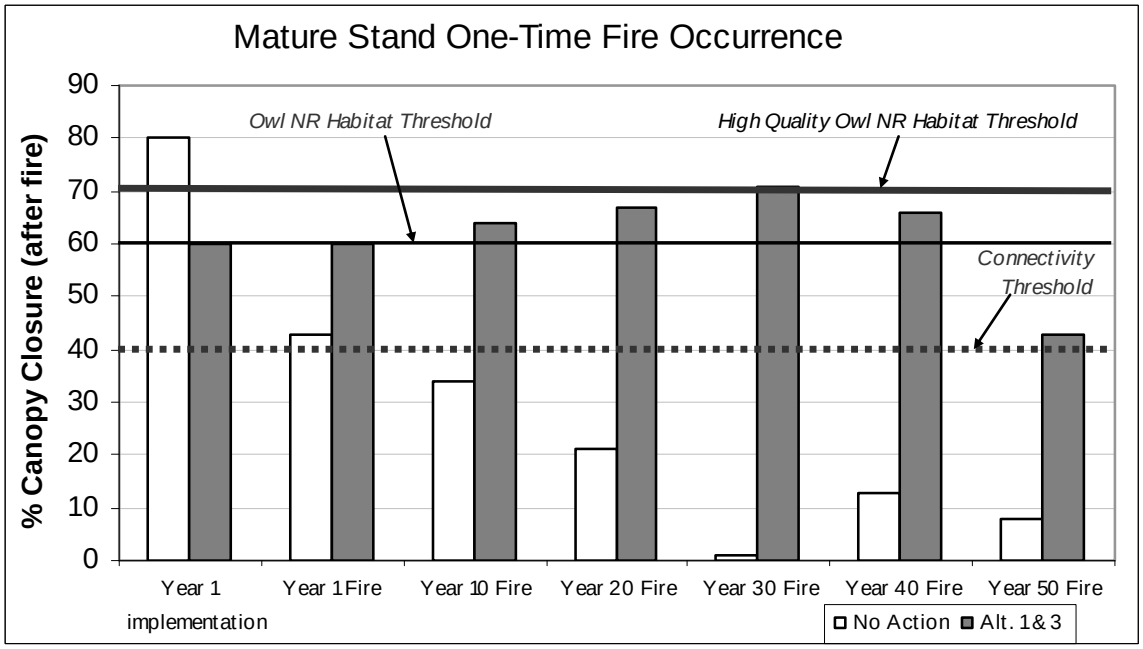
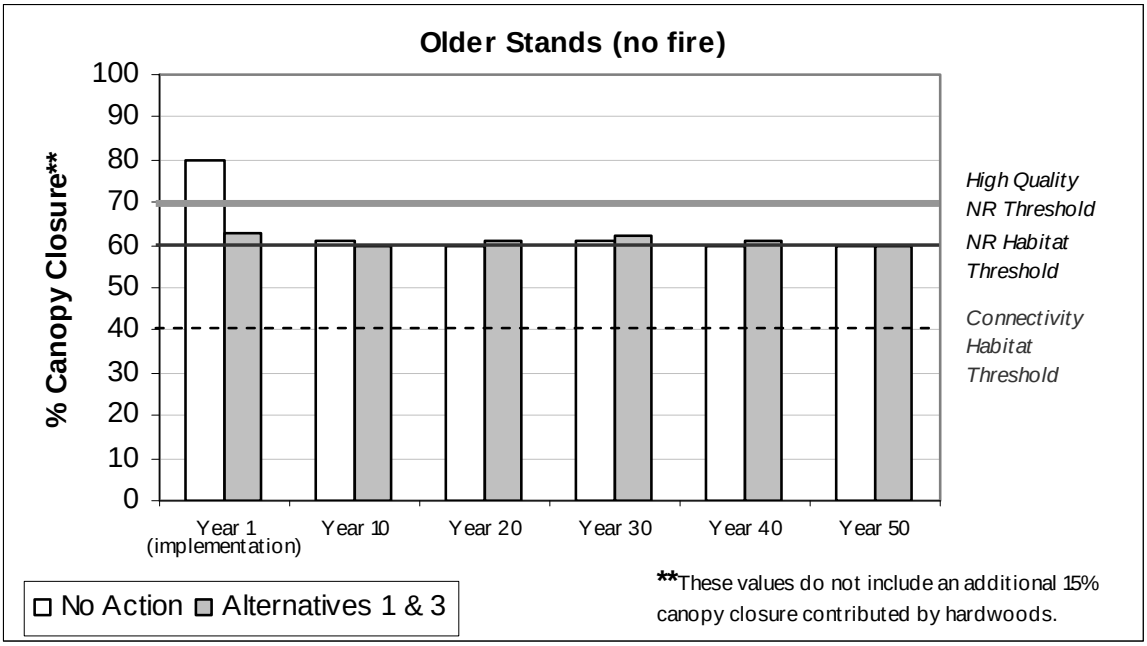




**Figure 3-7. The proposed thinning treatments within dense forest stands maintain a moderate to dense canopy closure. Note that this modeling does not include an additional 15% canopy closure contributed by hardwoods that would be retained. Moderate to high canopy closure is a key habitat component for species associated with old growth conifer forests such as the northern spotted owl and Pacific fisher. Large overstory conifers will be retained to provide owl and fisher nesting and denning sites and large snags and logs into the future**



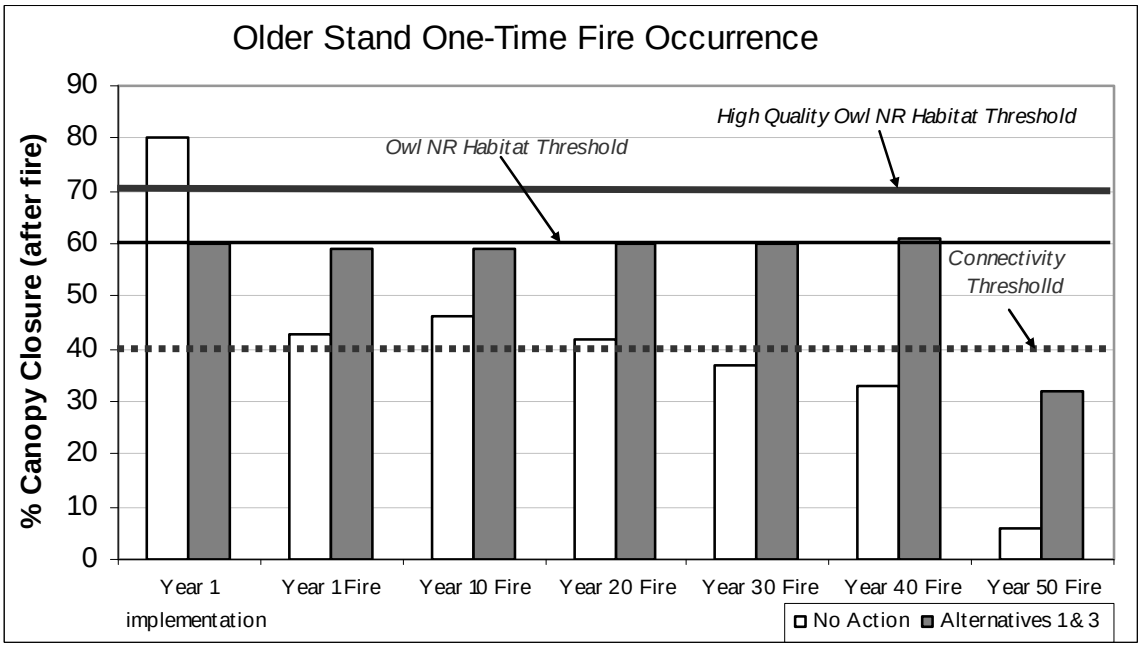




**Figure 3-8. The proposed thinning treatments within dense forest stands will dramatically reduce the loss of overstory conifers (canopy cover) due to fire into the future. Moderate to high canopy closure is a key habitat component for species associated with old growth conifer forests such as the northern spotted owl and Pacific fisher. Large overstory conifers are those trees that will provide owl and fisher nesting and denning sites and large snags and logs into the future. Late summer fire was modeled because this is the driest time of the year and the period when most catastrophic wildfires occur in the project area vicinity**

**A synopsis of these modeling results shows that:**

- While our proposed thinning treatments would reduce canopy closure, the same level of canopy reduction would be quickly exceeded if we did nothing.
- By thinning the stands, smaller diameter snags/logs would be reduced with a concurrent reduction of existing and future fuel. With no action, these smaller diameter trees would not provide large snags or logs in the future because they are likely to die as a result of continued competition and/or disease/insect outbreaks exacerbated by overstocked conditions.
- The reduction in fuels and the concurrent increase in the vigor of the remaining trees would allow the treated stands to better survive late-summer fire events and provide owl habitat into the future. Without thinning, the stands would not provide owl habitat after a late-summer fire.

## Cumulative Effects for Alternatives 1 and 3

### Bounding

Bounding for the cumulative effects analysis for the fisher was the **19,582-**acre fisher analysis area (FAA), as described in detail in the Gemmill BE (Appendix H) and earlier in this analysis. This is the appropriate unit of measure because it is designed to focus on female fishers and female survival has been shown to be the most important single demographic parameter determining fisher population stability.[93] Bounding for the cumulative effects analysis for the spotted owl and the remainder of the species in this analysis (other than the fisher) is at the spotted owl Action Area level and is established using a 1.3 mile buffer around all areas proposed for treatment. This is an appropriate unit of measure because this is what the USFWS has estimated the median annual home range size for the northern spotted owl in California to be, based on available radio telemetry. Because this analysis uses the spotted owl as a representative species for late-successional and old growth associated species, and because owl home range size is large enough to encompass the home ranges for the species other than the fisher in this analysis, the analysis is appropriately bounded by using the owl home range Action Area method.

Bounding for an effects analysis for bat species, specifically Townsend's big-eared and pallid bats, depends on a wide variety of factors besides the specific presence of a suitable roost structure. These factors include; availability of water, abundance of insect prey, time of year, reproductive status of the bats, and the size of colony. This species does not construct nests or dens for reproductive purposes and must rely solely on the presence of highly specific structures for reproduction and survival. It is the presence of these structures in a given juxtaposition to sources of water and food that provide the bounding of their home range. Home range size and composition is highly variable once the specific parameters are met for suitability.

Using the spotted owl Action Area to provide the bounding for this analysis is appropriate because the environmental factors that constitute suitable habitat for these bat species are encompassed within the owl Action Area.

[93] Truex et al. (1998), Lamberson et al. (2000)

### Past

The existing conditions related to spotted owl habitat included in this document reflect past actions and events (e.g., fire) that led to those conditions. An inspection of aerial photographs shows that most of the forested land within the Action Area has been harvested for timber. Timber harvesting has had a significant impact on late-successional habitat within the spotted owl Action Area. Timber harvesting on Federal lands has removed roughly 960 acres of suitable spotted owl habitat in the last 20 to 25 years. The 4,310 acres of private property has been heavily harvested and is now dominated by very dense pine and mixed conifer forest that provides only marginal owl connectivity habitat. Much (roughly 75 to 80 percent) of this private property was likely suitable owl habitat prior to harvest. This past loss of habitat played an important role in determining the sense of urgency for the Gemmill Thin Project.

### Future

No Forest Service projects that would negatively impact existing owl or old growth habitat are planned in the Action Area in the foreseeable future. The STNF has completed Categorical Exclusions whereby approximately 870 additional acres of existing plantations will be thinned as funding becomes available (see LSR PCT displayed in Appendix E (Cumulative Actions Table) for a portion of the Action Area). As with the 45 acres of plantations proposed for thinning in the Gemmill Thin Project, the future plantation thinning would accelerate the development of about 870 acres of connectivity habitat in approximately 10 years. Without thinning, these plantations would remain so dense that owls would not be able to freely fly through them for 35+ years.

The STNF is in the early planning stages of developing a prescribed burning project within the Gemmill Thin Project fuelbreak and selected thinning units (see Prescribed Burning displayed in Appendix E (Cumulative Actions Table)). The early planning for this project includes provisions for maintaining the habitat components that would be established by the Gemmill Thin Project (e.g., canopy closure, large trees/log/snags, and viable hardwoods).

The California Department of Forestry and Fire Protection (CDF) web site (http://www.fire.ca.gov/ResourceManagement/THPStatusUpload/THPStatusTable.html) lists no private timber harvest plans in the Action Area. Nonetheless, we assume that intense timber management will continue on this private land into the foreseeable future, discounting these areas as providing suitable owl habitat beyond use as connectivity. Older conifer forest habitat will likely be restricted to the 15,784 acres of Federal Forest Land within the Action Area, adding to the sense of urgency for implementing the Gemmill Thin Project in order to maintain, protect and develop owl habitat. Existing non-conifer areas such as hardwood and shrub dominated habitats and riparian vegetation would likely remain largely intact on both federal and private lands

There are no present or foreseeable actions that would negatively affect spotted owl habitat or species associated with the late-successional habitat within the project area and that would cumulatively warrant a change in either of the Gemmill Thin Project action alternatives. There are no future foreseeable actions within the area bounded by this analysis that would have any additive effects to the Sensitive bats species

in the project area. No actions will contribute to or constitute a threat to the persistence and viability of these bat species.

## Wildlife Management Indicator Assemblages

During the planning of the Gemmill Thin Project, Forest staff prepared a project-level Management Indicator Assemblages (MIA) report to better inform decision-making. In order to prepare this report, biologists used data developed in the Forest-wide Management Indicator Assemblage Habitat Monitoring Report. Both MIA reports (project-level, and Forest-level) are part of the project record and available upon request. This section discloses information from these MIA analyses as it is relevant to the decision about implementing the Gemmill Thin Project.

The project-level analysis reviews the legal requirements for management indicator analysis, as derived from the National Forest Management Act (NFMA) and the Forest Plan, and analyzes likely project effects on management indicator assemblage habitat types. The project-level report determined that the proposed Gemmill Thin Project could potentially affect four assemblage habitats (late-seral, open and early seral, multihabitat and snag and down logs). The other five assemblage habitat types would not be affected. For Alternative 1 and Alternative 3, all of the 1,044 acres of late-seral assemblage habitat found in the project area will remain late-seral assemblage habitat post-project. Equally, 544 acres of openings and early seral assemblage habitat will remain openings and early seral stage habitat. Fifteen acres of hardwood forests and seven acres of chaparral will also remain in these types post-project. Hardwoods and snag and down logs assemblage acreages will not be affected by the project.

'Ingrowth' (the growth of trees from an openings and early seral assemblage type to a late-seral assemblage type) would be insignificant over the time of project implementation. The open and early seral assemblage habitat types (plantations, younger openings and early seral stands) in this project are mostly too young to provide a significant shift in assemblage type distribution through ingrowth, even within the next 10 years.

The Forest-wide Management Indicator Assemblage Habitat Monitoring Report determined that, since 1991, the Forest has seen a net shift of acres from open and early seral management indicator assemblage habitat to the late-seral assemblage habitat type. Although the Forest has lost approximately 53,000 acres of late-seral assemblage habitat to wildfire and harvest since 1991, ingrowth (the natural process of forest tree growth) has resulted in a gross accrual of approximately 252,000 acres of late-seral assemblage habitat, resulting in a net accrual of about 199,000 acres of late-seral assemblage habitat into the smaller size classes of this category. Note that this accrual is in the smaller size classes and does not represent an accrual of old growth habitat, which is also occurring but at a slower rate. Although the proposed thinning will directly affect these stands, it will not shift a significant amount of habitat from one assemblage type to the other, nor will it alter or significantly contribute to existing Forest-wide trends.

## Residential and Migratory Birds

During project planning, the Forest biologist completed a project-level Residential and Migratory Bird report. This report was developed complimentary to the Forest-level Residential and Migratory Bird Report in order to ensure decision makers are provided with status evaluations of residential and migratory birds within the project area. These evaluations ensure that decision makers consider migratory birds in their project planning and can reasonably mitigate for anticipated negative effects. The report includes residential birds in the analysis in order to provide a more comprehensive profile of possible project effects for decision makers.

The Gemmill Thin Project lies within the Sierra Nevada bio-strata as developed by the Breeding Bird Survey (BBS). Portions of four BBS biostrata overlay the Shasta-Trinity National Forest. The Sierra Nevada bio-strata covers portions of the west side of the Forest, extends north of the Shasta Lake area to extend southward along the Sierra Nevada mountain range. Tables 3-8 and 3-9 indicate those avian species that occur on the Shasta-Trinity National Forest and those that occur within the Sierra Nevada bio-strata that have seen a statistically credible increase or decrease in their population trend between 1966 and 2005. Table 3-8 indicates the survey wide trends of those species found on the Forest (meaning it includes the entire range of the species in North America) and Table 3-9 indicates those species found within the Sierra Nevada bio-strata that are experiencing a credible population increase or decline during the same period.

The largest number of statistically credible declines is seen in the openings and early seral assemblage habitat. This parallels the Forest-level analysis that indicates we are slowly accruing more late-seral assemblage habitat than we are losing, and that we are slowly losing opening and early seral assemblage habitat. This is consistent with the down-turn in timber harvest levels and a shift to harvesting younger stands, which occurred after implementation of the Northwest Forest Plan. Increasing wildfire incidence, especially of large and stand-replacing wildfires, could change this relationship in the future.

We will continue to monitor population trends of native species. At the current time based on the best available data, the proposed actions are not likely to contribute to, or alter significantly or measurably, the population trends of the residential and migratory birds that occur in the area.

**Table 3-8.** Credible and Statistically Significant Trends in birds that occur in forested areas on the Shasta-Trinity NF – Survey-wide 1966 to 2005. **Bold** indicates species declining in both range-wide surveys and within the bio-strata. *Italics* indicate those species increasing survey wide and decreasing within the Sierra Nevada bio-strata.

| **Management Indicator Assemblage Habitats** | **Increasing Trend survey wide** | **Decreasing trend survey wide** |
|---|---|---|
| Late Seral | Cassin's Vireo<br>Red-Breasted Nuthatch | Olive-sided flycatcher<br>**Mountain chickadee**<br>Evening grosbeak |
| Openings and Early Seral | Turkey vulture<br>Western Kingbird<br>American Crow<br>Common Raven<br>*American robin*<br>Cedar waxwing | Ring-necked Pheasant<br>Rufous Hummingbird<br>Pinyon Jay<br>Horned lark<br>European starling<br>Orange-crowned warbler<br>Vesper sparrow<br>Grasshopper sparrow<br>**Dark-eyed junco**<br>Western meadowlark<br>Brewer's blackbird<br>**Purple finch**<br>**Cassin's finch**<br>Pine siskin |
| Snags and down logs | Black-capped chickadee<br>Red-Breasted Nuthatch<br>Mountain bluebird | None |
| Hardwoods | *Warbling vireo* | **Band-tailed pigeon** |

**Table 3-9.** Credible and Statistically Significant Trends in birds that occur in forested areas on the Shasta-Trinity NF – Sierra Nevada, 1966 to 2005

| **Assemblages** | **Increasing trend Sierra Nevada** | **Decreasing trend Sierra Nevada** |
|---|---|---|
| Late Seral | White-headed woodpecker | Steller's jay<br>**Mountain chickadee** |
| Openings and Early Seral | None | *American robin*<br>Nashville warbler<br>**Dark-eyed junco**<br>**Purple finch**<br>**Cassin's finch** |
| Snags and down logs | White-headed woodpecker | Golden-crowned Kinglet |
| Aquatic | None | None |
| Hardwoods | None | **Band-tailed pigeon**<br>*Warbling vireo* |

The Responsible Official has reviewed the information on residential and migratory bird trends and has fully considered it during the planning phase of this project. Given that the project will not significantly alter the proportions of assemblage type habitat found in the area or on the Forest, it is

unlikely to alter the current population trends of these species. Appropriate mitigations, such as snag and large down wood retention, were considered as part of the planning and development of the project and incorporated within the project design.

## Affected Environment – Vegetation

### Upland Vegetation

The most abundant and contiguous vegetation type in the project area is Douglas fir mixed conifer. These Douglas fir dominated mixed conifer stands occur over about 70% of the watershed in early to late seral stages. Other tree species common in the mixed conifer type include white fir, ponderosa pine, sugar pine and incense cedar. Hardwoods include black oak, madrone, and giant chinquapin; and bigleaf maple occurs with Douglas fir in the lower reaches of perennial streams in the project area. The mixed conifer type can be subdivided into mixed conifer/riparian and mesic, mixed conifer/dry and mixed conifer-canyon live oak. The mixed conifer/riparian-mesic type is generally located within the Hall City Creek, Wilson Creek, and Chanchelulla Creek near stream areas, and is most common on east and north slopes. The mixed conifer dry associations are relatively common, and occur in more upland areas on ridges, on west and south slopes of lesser site productivity. The mixed conifer-canyon live oak associations are relatively uncommon, and occur in more upland areas on ridges, and on west and south slopes with more xeric/skeletal soil conditions.

White fir is generally located above 2,800 feet in elevation, and occurs as dense stands with little understory. A moist white fir type is associated with stream courses such as the headwaters near Chanchelulla Creek. Moister white fir types have huckleberry oak as an indicator species, and are found on northwest slopes. The mesic white fir type is found between 3000 and 4000 feet. Jeffrey pine dominates in areas with ultramafic soil and serpentine outcrops. Jeffrey pine stands may also include small amounts of ponderosa pine, Douglas-fir, incense cedar, sugar pine and gray pine. Gray pine represents some of the least productive and most environmentally-sensitive sites in the watershed. Small patches of gray pine are located in lesser productive sites on southerly slopes above Wilson Creek. Canyon live oak is characteristically an abundant component in gray pine stands.
Non-forested sites include shrub dominated and herb dominated areas. The shrub dominated sites are common on the southerly slopes of Wilson Point. The herb dominated community occurs as small meadows throughout the watershed, notably identified by the middle reaches of Hall City Creek.

### Riparian Vegetation

Riparian vegetation composition within the watershed is influenced by channel aspect, gradient, geomorphology, and hydrologic regime, as reflected by stream order. Riparian communities in the project area range from white alder/Indian rhubarb-sedge (*Alnus rhombifolia/Darmera peltata-Carex nudata*) along much of Hall City Creek, to pacific yew (*Taxus brevifolia*), bigleaf maple and white alder with California hazel (*Corylus cornuta var. californica*), dogwood (*Cornus sessilis*) and/or spikenard (*Aralia*

*californica*) in the constrained, higher order tributaries. Bigleaf maple and/or California hazel occur in some drier first and second order channels.

Many riparian areas host relatively high numbers of large trees as compared with the adjacent uplands, presumably due to a favorable topographic position and environment (more moisture and more favorable soils). Plant communities well adapted to moist conditions and saturated soils associated with frequent flooding or a high water table occur in near stream areas. Additionally, opportunistic 'pioneer' species may colonize riparian areas after disturbance (natural or human-caused).

Riparian vegetation in the project area ranges from being absent (in dry ephemeral and intermittent channels), to consisting of perennial riparian species such as bigleaf maple (*Acer macrophyllum*), white alder (*Alnus rhombifolia*), and Pacific yew (*Taxus brevifolia*) in moist aras such as along first order perennial streams. Along intermittent channels, sclerophyllous species, including prince's pine (*Chimaphila umbellata*) and dwarf Oregon grape (*Berberis aquifolium*) frequently co-occur with the more water-loving species. Big leaf maple is ubiquitous, occurring in both perennial and intermittent channels, but white alder, mountain dogwood (*Cornus nuttallii*) and Pacific yew appear to be limited to channels where water availability is greater year-around. Alder occurs most frequently on active channel shelves and floodplains where frequent flooding and high light levels permit establishment. Pacific yew occurs on floodplains, terraces and stream banks at moist locations and is frequently associated with older stands of Douglas-fir and a well established shrub component of dogwood and/or California hazel (*Corylus cornuta*).

## Existing Condition in Project Units

### Mature Stands

About 751 acres of mature stands are proposed for thinning. These are mixed conifer stands, comprised of primarily Douglas-fir and ponderosa pine, with lesser amounts of white fir, incense cedar, and sugar pine in the overstory layers. The understory layers are primarily comprised of white fir and Douglas-fir, with common hardwood associates of Pacific madrone, California black oak, and interior live oak. These stands are generally single-storied and even-aged; they originated in the early 1900s through natural regeneration after being harvested to support local mining operations in the area. These stands have been lightly thinned or have had sanitation/salvage logging in the past. They are mostly overstocked, with loss of vigor, and increasing susceptibility to insect and disease. Untreated overstocked stands are susceptible to insect attack, especially during prolonged periods of low precipitation. At the level of stocking found in these forest stands, projected mortality may be as high as 40-70 trees per acre over the next ten years. Most mortality would occur in suppressed understory trees that would naturally be removed during thinning or fire, although overstory (dominant) trees may succumb to mortality within the near future with no action.[94] Current basal area ranges from approximately 200-350 ft.$^2$/acre, canopy cover ranges from approximately 50 to 90%, and stand density index (SDI) ranges from approximately 200 to 450.

[94] See FVS/FFE modeling discussion below and in *Chapter 3 Wildlife*

### Old Growth Stands

About 528 acres of proposed thinning is within stands that currently have desirable late successional and old growth attributes, such as large older trees, decadence, and vertical structure (multiple canopy layers). In general these stands are 100-150 years old with an overstory canopy of large, older predominant trees (250 years or older) of Douglas-fir, ponderosa pine, and some sugar pine. These predominant trees are generally 36 inches DBH or larger. The project would retain and protect these highly desirable trees, which provide habitat for old growth dependant wildlife species. Past management practices, and the successful suppression of wildfire over the past 100 years, has lead to understory canopy layers that are densely-stocked and slow-growing. These lower layers of canopy are similar in size and age to mature stand conditions described above, however with a higher incidence of white fir as the primary tree species. The objective of proposed thinning in these stands is to retain and protect the large, older trees, to provide for development of future large old trees, and to reduce existing fuel ladders so that the risk of future stand-replacing wildfire is lowered. Current basal area ranges from approximately 150-350 $ft.^2$/acre, canopy cover ranges from approximately 50 to 90%, and stand density index (SDI) ranges from approximately 200 to 400.

## Environmental Consequences – Vegetation

As discussed previously in *Chapter 3- Wildlife*, the interdisciplinary team utilized computer vegetation and fire modeling as part of this effects analysis (FVS/FFE). [95] The following discussion refers to the FVS/FFE modeling results to disclose potential effects of the project on stand health and forest structure. Data collected from stands within the project area was utilized for modeling and the FVS/FFE runs are representative of proposed treatments (and no action). As with any modeling, numbers indicated are approximations. Trends and relative changes are the more important analytical considerations. [96]

### Alternative 2 – No Action

### Direct and Indirect Effects

#### Thinning in Mature and Old Growth Stands

If no action is selected the identified opportunity to improve stand vigor, as well as improve stand resistance to insect/disease and wildfire impacts would not be realized as proposed with the action alternatives. Increased competition for sunlight, nutrients, and soil would reduce overall stand vigor, increase susceptibility to primary and secondary insect and disease effects, and increase stand mortality (especially for the larger, older trees). Stand vertical structural diversity would not be maintained or improved. Understory stand components, including hardwood species, would not remain a viable stand component, due to increasing overstory competition. The opportunity for treated stands to respond to release, and respond to future release, would not be realized. There would be an increased risk of widespread insect attack in the project area – specifically from the fir-engraver beetle, western pine beetle

[95] Forest Vegetation Simulator Growth and Yield Model, Version 1.18, USDA Forest Service, February 2005.
[96] Ritchie, Martin W. (1999)

and turpentine beetle. In general, trees that die as a result of stand densities would contribute to increasing fuel-loading over time.

**Table 3-10. Alternative 2: Mature Stands**

| Year | Stand Density Index | Canopy Closure | Basal Area/Acre (Sq Feet) | Trees Per Acre | Average Diameter Breast Height (Inches) | Average Tree Height (Feet) | Fuel Load (Tons/Acre) |
|---|---|---|---|---|---|---|---|
| **Current Status** | 466 | 70 | 280 | 316 | 11.2 | 85 | 17 |
| **10 Years After "No Action"** | 441 | 67 | 286 | 215 | 15.1 | 120 | 31 |
| **50 Years After "No Action"** | 349 | 57 | 268 | 85 | 25.0 | 135 | 99 |

As shown in Table 3-10, increases in average DBH and tree height are tempered by drastically increasing fuel loading with decreases in canopy closure and overall stand density (SDI and trees per acre) due to natural mortality. If Alternative 2 is selected large, older trees would continue to be at increasing risk of mortality due to fuels accumulation and encroaching smaller trees. Along with the probability of stand-replacing wildfire, inter-tree competition for available site resources would continue to increase in the project area. Older overstory trees would continue to die at an accelerated rate, particularly during drought cycles, and the stagnated, shade-tolerant understory will not provide similar replacement trees.

**Table 3-11. Alternative 2: Old Growth Stands**

| Year | Stand Density Index | Canopy Closure | Basal Area/Acre (Sq Feet) | Trees Per Acre | Average Diameter Breast Height (Inches) | Average Tree Height (Feet) | Fuel Load (Tons/Acre) |
|---|---|---|---|---|---|---|---|
| **Current Status** | 363 | 63 | 250 | 140 | 18.1 | 105 | 44 |
| **10 Years After "No Action"** | 396 | 61 | 263 | 178 | 16.5 | 108 | 42 |
| **50 Years After "No Action"** | 395 | 60 | 291 | 117 | 21.3 | 129 | 57 |

### Thinning in Plantations

Table 3-12 displays model results for plantations with no action. Although average DBH and tree height increase over time, fuel loading is drastically increased.

**Table 3-12. Alternative 2, No Action: Plantations**

| Year | Stand Density Index | Canopy Closure | Basal Area/Acre (Sq Feet) | Trees Per Acre | Average Diameter Breast Height (Inches) | Average Tree Height (Feet) | Fuel Load (Tons/Acre) |
|---|---|---|---|---|---|---|---|
| **Current Status** | 170 | 53 | 70 | 516 | 4.9 | 26 | 12 |
| **10 Years After "No Action"** | 404 | 74 | 212 | 470 | 8.9 | 48 | 17 |
| **50 Years After "No Action"** | 374 | 64 | 277 | 113 | 20.7 | 109 | 129 |

### Thinning in Shaded Fuelbreaks

With no action, vegetation will continue to grow (increasing live and dead fuels) and the existing project area fuelbreak would continue to become less functional in stopping the spread of wildfire. Since understory vegetation, and ground and ladder fuels would not be reduced there is reduced likelihood that the fuelbreak could be safely used by wildfire suppression crews. Table 3-13 shows modeled results for the shaded fuelbreak.

**Table 3-13. Alternative 2: Shaded Fuelbreaks**

| Year | Stand Density Index | Canopy Closure | Basal Area/Acre (Sq Feet) | Trees Per Acre | Average Diameter Breast Height (Inches) | Average Tree Height (Feet) | Fuel Load (Tons/Acre) |
|---|---|---|---|---|---|---|---|
| **Current Status** | 428 | 71 | 318 | 118 | 22.0 | 93 | 30 |
| **10 Years After "No Action"** | 382 | 63 | 295 | 89 | 24.4 | 107 | 41 |
| **50 Years After "No Action"** | 347 | 47 | 302 | 50 | 33.1 | 137 | 96 |

## Alternative 1 – Proposed Action

The Forest Service has considerable experience with the silvicultural practice of thinning within the Coastal Mixed Conifer type, and it is generally found to increase growth in residual stands. Tree diameter increment (growth) is correlated to tree density. The effects of this project are not uncertain, and do not involve unique or unknown risk; this project is similar to many tree thinning projects that have occurred elsewhere on the Shasta-Trinity National Forest and in northern California.

### Direct and Indirect Effects

#### Thinning in Mature and Old Growth Stands

The project proposes thinning from below in 1,279 acres of mixed conifer stands. Approximately 528 of these acres contain older stands classified as old growth, and the rest are classified as mature (80-100 years old). Proposed thinning would reduce basal area in mature stands to approximately 140-180 square feet per acre, and stand density index (SDI) to approximately 300. In old growth stands, post-project basal area will be around 200 square feet per acre. SDI provides a measure of conifer stand stocking levels, and an indicator of general stand health and risk. For the California mixed conifer type, common to the

Gemmill Thin project area, the Maximum Density is 750 (Reineke, 1933), and the recommended management zone is defined as 300-450 (Powell, 1999).

The opportunity to improve stand vigor, and resistance to insect/disease impacts would be realized within these stands. Decreased competition for sunlight, nutrients, and soil moisture by a reduction in crown closure from an estimated 60-90% to an estimated 60% would improve stand vigor, reduce stand mortality, and reduce susceptibility to primary and secondary insect and disease effects. Stand vertical structural diversity would be maintained or improved. Understory stand components, including hardwood species, would remain a viable stand component, with reduced overstory crown competition. The opportunity for treated stands to respond to release, and respond to future release, would be realized. Thinning at this level reduces competition for limited moisture and improves the ability of trees to withstand future drought conditions, especially for drought-sensitive species such as white fir. There would be a low risk of widespread insect attack in the project area, specifically from the fir-engraver beetle, western pine beetle and turpentine beetle. In general, trees that would have died and contributed to fuel-loading over time would be removed as commodity.

**Table 3-14. Alternative 1: Thinning of Mature Stands**

| **Year** | **Stand Density Index** | **Canopy Closure** | **Basal Area/Acre** (Sq Feet) | **Trees Per Acre** | **Average Diameter Breast Height** (Inches) | **Average Tree Height** (Feet) | **Fuel Load** (Tons/Acre) |
|---|---|---|---|---|---|---|---|
| **Current Status** | 466 | 70 | 280 | 316 | 11.2 | 85 | 17 |
| **10 Years After Thinning** | 396 | 64 | 268 | 166 | 17.2 | 125 | 25 |

Large, older trees would be at reduced risk from encroachment of competing trees for available site resources, particularly during drought cycles (Smith et al., 2003).

**Table 3-15. Alternative 1: Thinning of Old Growth Stands**

| **Year** | **Stand Density Index** | **Canopy Closure** | **Basal Area/Acre** (Sq Feet) | **Trees Per Acre** | **Average Diameter Breast Height** (Inches) | **Average Tree Height** (Feet) | **Fuel Load** (Tons/Acre) |
|---|---|---|---|---|---|---|---|
| **Current Status** | 363 | 63 | 250 | 140 | 18.1 | 105 | 44 |
| **10 Years After Thinning** | 368 | 60 | 262 | 125 | 19.6 | 140 | 23 |
| **50 Years After Thinning** | 370 | 60 | 292 | 82 | 25.6 | 145 | 53 |

## Thinning in Plantations

Approximately 30-year old plantations, on an estimated 44 acres, would be thinned. The opportunity to improve stand vigor, resistance to insect/disease impacts, and growth would be realized within these stands. Decreased competition for sunlight, nutrients, and soil moisture by a reduction in trees per acre

from an estimated 500 to an estimated 130 trees per acre would improve stand vigor, reduce stand mortality, and reduce susceptibility to primary and secondary insect and disease effects.

**Table 3-16. Alternative 1, Proposed Action: Plantations**

| Year | Stand Density Index | Canopy Closure | Basal Area/Acre (Sq Feet) | Trees Per Acre | Average Diameter Breast Height (Inches) | Average Tree Height (Feet) | Fuel Load (Tons/Acre) |
|---|---|---|---|---|---|---|---|
| **Current Status** | 170 | 53 | 70 | 516 | 4.9 | 26 | 12 |
| **10 Years After Thinning** | 183 | 39 | 98 | 198 | 8.2 | 40 | 12 |
| **50 Years After Thinning** | 374 | 65 | 275 | 107 | 20.2 | 110 | 33 |

### Thinning in Shaded Fuelbreaks

Mature mixed conifer and ponderosa pine stands on an estimated 268 acres within an existing ridge-top fuelbreak would be thinned to restore fuelbreak function.

**Table 3-17. Alternative 1, Proposed Action: Shaded Fuelbreaks**

| Year | Stand Density Index | Canopy Closure | Basal Area/Acre (Sq Feet) | Trees Per Acre | Average Diameter Breast Height (Inches) | Average Tree Height (Feet) | Fuel Load (Tons/Acre) |
|---|---|---|---|---|---|---|---|
| **Current Status** | 428 | 71 | 318 | 118 | 22.0 | 93 | 30 |
| **10 Years After Thinning** | 265 | 44 | 215 | 54 | 26.9 | 109 | 19 |
| **50 Years After Thinning** | 348 | 54 | 304 | 47 | 34.4 | 133 | 30 |

## Alternative 3

### Direct and Indirect Effects

With Alternative 3 large, older trees would continue to be at increased risk due to encroachment of competing trees for available site resources, particularly during drought cycles. This is because trees within the 18 to 26 inches DBH size range would not be removed where they are currently competing with the largest trees. The opportunity to improve stand vigor, and resistance to insect/disease impacts would be mostly realized within these stands, though not as well as with implementation of Alternative 1. There would be an estimated 160 fewer acres treated than under Alternative 1 because of operability considerations. Individual tree selections would retain additional competitors and fire/fuels ladders adjacent to larger, older trees than would occur with implementation of Alternative 1. Alternative 1 is more responsive to protections provided to older, larger trees. There would be lessened response and development of future recruitment trees over time than would occur under implementation of Alternative 1.

Achievement of fuelbreak stand structural objectives may not be fully achievable with implementation of Alternative 3. This is because of the retention of all trees of 18 inches or greater DBH, regardless of crown position or spacing, or risk of mortality.

**Table 3-18. Alternative 3, Diameter Limit: Late Successional/Old Growth**

| Year | Stand Density Index | Canopy Closure | Basal Area/Acre (Sq Feet) | Trees Per Acre | Average Diameter Breast Height (Inches) | Average Tree Height (Feet) | Fuel Load (Tons/Acre) |
|---|---|---|---|---|---|---|---|
| **Current Status** | 363 | 63 | 250 | 140 | 18.1 | 105 | 44 |
| **10 Years After Thinning** | 368 | 60 | 262 | 125 | 19.6 | 140 | 23 |
| **50 Years After Thinning** | 370 | 60 | 292 | 82 | 25.6 | 145 | 53 |

**Table 3-19. Alternative 3, Diameter Limit: Thinning of Young Growth**

| Year | Stand Density Index | Canopy Closure | Basal Area/Acre (Sq Feet) | Trees Per Acre | Average Diameter Breast Height (Inches) | Average Tree Height (Feet) | Fuel Load (Tons/Acre) |
|---|---|---|---|---|---|---|---|
| **Current Status** | 466 | 70 | 280 | 316 | 11.2 | 85 | 17 |
| **10 Years After Thinning** | 396 | 64 | 268 | 166 | 17.2 | 125 | 25 |
| **50 Years After Thinning** | 473 | 67 | 365 | 116 | 24.0 | 140 | 50 |

**Table 3-20. Alternative 3, Diameter Limit: Thinning of Plantations**

| Year | Stand Density Index | Canopy Closure | Basal Area/Acre (Sq Feet) | Trees Per Acre | Average Diameter Breast Height (Inches) | Average Tree Height (Feet) | Fuel Load (Tons/Acre) |
|---|---|---|---|---|---|---|---|
| **Current Status** | 170 | 53 | 70 | 516 | 4.9 | 26 | 12 |
| **10 Years After Thinning** | 183 | 39 | 98 | 198 | 8.2 | 40 | 12 |
| **50 Years After Thinning** | 374 | 65 | 275 | 107 | 20.2 | 110 | 33 |

**Table 3-21. Alternative 3, Diameter Limit: Shaded Fuelbreaks**

| Year | Stand Density Index | Canopy Closure | Basal Area/Acre (Sq Feet) | Trees Per Acre | Average Diameter Breast Height (Inches) | Average Tree Height (Feet) | Fuel Load (Tons/Acre) |
|---|---|---|---|---|---|---|---|
| **Current Status** | 428 | 71 | 318 | 118 | 22.0 | 93 | 30 |
| **10 Years After Thinning** | 265 | 44 | 215 | 54 | 26.9 | 109 | 19 |
| **50 Years After Thinning** | 348 | 54 | 304 | 47 | 34.4 | 133 | 30 |

## Cumulative Effects – Alternatives 1 and 3

### Bounding Statement

The cumulative effects assessment area for vegetation management considerations is bound by the Gemmill Thin project area. Private lands are not included in the assessment area, but are discussed where relevant to potential effects, risk management, and vegetation management objectives. The cumulative effects assessment is bound in time by the expected duration of effects from past, present, and reasonably foreseeable future actions, in general a 10 year horizon into the future.

### Past Actions

Past actions that have been implemented in the area were primarily for timber harvest, with associated site prep and/or activity fuel treatments. Most past actions relevant in characterizing existing vegetation conditions occurred prior to the Northwest Forest Plan in 1994, which along with the Forest Plan, designated LSR to be managed for the maintenance and improvement of late-successional habitat. See Appendix E (Cumulative Actions Table) Table E-1 for a detailed list of projects and activities. Timber sale units were typically clearcut, broadcast burned or tractor piled for site preparation, and then planted. Plantations regenerated in the mid 1980s are now well-stocked to overstocked, and are in need of stocking control.

Past projects on adjacent private lands consist primarily of timber harvest on forest lands and human development type projects on residential lands, with a limited amount of mining and grazing. In the past, timber harvest on private lands included minimal, if any, activity fuels treatment.

### Foreseeable Future Actions

Reasonably foreseeable projects within the area include the Gemmill LSR Prescribed Burn Project (See Appendix E). The primary objectives of the burning are to provide maintenance for and widen the existing ridgetop fuelbreak, to reduce hazardous fuel conditions, and to stimulate new growth to enhance wildlife browse. There are no specific projects foreseen on adjacent private lands, but it is reasonable to presume in general that timber harvest on forest lands, development projects on residential lands, and limited mining and grazing activities would continue to occur. Private timber harvest practices are expected to continue.

### Cumulative Effects for Alternatives 1 and 3

Direct and indirect effects of the action alternatives are not considered adverse from a vegetation management perspective, but rather beneficial in reducing excess stocking and fire risk. The proposed treatments have direct and indirect effects which generally improve stand growth response and resilience to insect and disease stresses, and reduces the potential for mortality overall. The effects of this action, in combination with past and foreseeable future actions, would result in a net beneficial improvement in growth and resilience in the project area and will move the area toward the desired future conditions. Cumulative effects of this project, from a vegetation management standpoint, are beneficial.

### Comparison of Cumulative Effects for all Alternatives

The action alternatives are similar, but not the same, in cumulative effects. Alternative 1 provides the most beneficial cumulative effects; Alternative 3 provides a lesser degree of beneficial cumulative effects. Either action alternative is highly preferred to the no action alternative, which has adverse cumulative effects with continued vegetation overstocking and increasing insect and disease stresses and potential for mortality.

Alternative 1 creates the desired conditions for more resilient stands- treatments to thin stands have direct and indirect effects which generally improve stand growth response, and resilience to insect and disease stresses and potential for mortality. Proposed thinning would reduce competition for limited moisture and improves the ability of residual stands to withstand future drought conditions. There would be a lowered risk of widespread insect attack in the project area, specifically from the fir-engraver beetle, western pine beetle and turpentine beetle. In general, trees that would have died and contributed to fuel-loading over time would be removed as commodity.

Alternative 3 creates these desired conditions to a lesser degree. Fewer overstocked acres would be treated with implementation of Alternative 3. There would be an estimated 160 fewer acres treated than under Alternative 1 because of operability considerations. Individual tree selections would retain additional competitors and fire/fuels ladders adjacent to larger, older trees than would occur with implementation of Alternative 1. Alternative 1 is more responsive to protections provided to older, larger trees. There would be lessened response and development of future recruitment trees over time than would occur under implementation of Alternative 1. Large, older trees would continue to be at increased risk due to encroachment of competing trees for available site resources, particularly during drought cycles.

## Affected Environment – Botany

The bounding for this effects analysis is the Upper Hayfork 5th Field Watershed, unless otherwise described. This is the most reasonable spatial boundary for analysis because this level watershed determines the scope of the subsurface hydrology, which is one of the driving factors in plant community composition. Habitat ranges primarily from early successional conifer plantations to late successional Douglas-fir or mixed conifer forest. Less than 10% of the area is occupied by non-conifer habitat types; primarily montane shrubs, chaparral, and oak woodlands. Elevations range from 3,200 to 5,400 feet.

### Categories of Plants Analyzed

The following analysis discusses potential impacts from the proposed alternatives to several categories of rare plants that occur on the STNF for which current management direction mandates conservation. An analysis of the impacts to and from noxious weeds will also be addressed, as per direction from FS Manual 2080, amendment No. 2000-95-5, and effective 11-29-95.

- ***Endangered and Threatened species*** are those listed under the Federal Endangered Species Act of 1973. There are no Endangered or Threatened plants known to occur on the STNF; nor are there any species proposed for listing.

- ***Sensitive species*** are those vascular plant, bryophyte, lichen, and fungi species eligible for listing under the Endangered Species Act, or whose viability is of concern. Guidelines for the protection of these species are defined in Shasta-Trinity National Forest Forest Plan. The Biological Evaluation (BE) for Sensitive Plant Species and Supplementary Botany Report (April 2006) was prepared to review the proposed Gemmill Thin Project to determine whether the proposed actions would result in a trend toward Federal listing any of the species designated on the June 10, 1998 Region 5 Sensitive plant list and the 2001 Survey and Manage ROD. From this evaluation, it was determined that from the Forest Service Region 5 Sensitive plant list, only the *Sensitive fungi species may be affected and thus warrant further discussion within this analysis.*
- ***Forest Plan Endemic species*** are rare species confined wholly or mostly to the Shasta-Trinity National Forest. These are afforded the same protection as Sensitive species by mandate of the Forest Plan. These species are addressed in the project-level Biological Evaluation (BE) for Sensitive Plant Species and Supplementary Botany Report (April 2006).
- ***Survey and Manage species*** are also on the Forest Service Region 5 Sensitive plant list with the exception of *Tetraphis geniculata, Schistostegia pennata, Eucephalis vialis,* and *Leptogium cyanescens;* which will be discussed below. Effects to species that are also Sensitive species were analyzed in the Biological Evaluation (BE) for Sensitive Plant Species and Supplementary Botany Report (April 2006).
- ***Noxious Weeds*** are analyzed whenever any ground disturbing action is proposed. The analysis evaluates the risk of introducing or spreading noxious weeds due to the proposed action. For projects that have a moderate to high risk of introducing or spreading noxious weeds, the decision document must identify noxious weed control measures that will be undertaken during project implementation.

## Threatened and Endangered Species

There are no federally listed Endangered, Threatened, or Proposed plant species or critical habitat in or around the project area. Therefore, there will be no further discussion of this plant category in this analysis.

## Sensitive Species

No populations of any Sensitive plants were found during field surveys in 2002 and 2005. Field surveys were not performed for Sensitive fungi species, therefore occupancy in suitable habitat is assumed. 335 acres of late-successional conifer forest are found in project units closest to Hall City Creek. Late-successional conifer forest provides habitat for eight Sensitive plant or fungi species: bug-on-a-stick (*Buxbaumia viridis*), Brownie lady's-slipper (*Cypripedium fasciculatum*), mountain lady's-slipper (*Cypripedium montanum*), branched collybia (C*ollybia racemosa*), olive phaeocollybia (*Phaeocollybia olivacea*), Pacific fuzzwort (*Ptilidium californicum*), English Peak greenbriar (*Smilax jamesii*), and orange-peel fungus (*Sowerbyella rhenana*).

Several Sensitive plant species occupy serpentine soils that are found commonly on the South Fork Management Unit. Field visits identified a single serpentine outcrop of about 3-5 acres in the southeast

corner of the project area. This site is outside of any treatment areas. There is no suitable habitat in project units for Sensitive plant species that require serpentine soils.

Perennial riparian areas are present in the project area, with the largest streams being Hall City and Wilson Creeks. While Sensitive plants and fungi that require riparian habitats could potentially occupy intermittent stream areas, they are much more likely to be found in perennial riparian habitats. Project units exclude perennial riparian areas, eliminating the potential for effects to Sensitive plants or fungi occupying these habitats.

Chaparral and oak woodlands are concentrated in the central part of the project area, along the south-facing slope south of Wilson Point. These areas provide suitable habitat for Tracy's wooly-stars *(Eriastrum tracyi)*, a Sensitive species. Where there are exposed soils or roadcuts, there is suitable habitat for copper moss (*Mielochheferia elongata)*, another Sensitive species. Although included in the project area, chaparral and oak woodlands are not within treatment units and therefore Tracy's wooly-stars and copper moss will not be affected by the project.

No populations of bug-on-a-stick, Brownie lady's-slipper, mountain lady's-slipper, Tracy's wooly-stars, copper moss, Pacific fuzzwort, Canyon Creek stonecrop, and English Peak greenbriar are known from the project area. Due to lack of populations, there would be no direct or indirect effects to these species, and therefore no cumulative effects. Because of the lack of potential impacts, these species will not be analyzed further.

### Forest Plan Endemic Plant Species

There are no known populations of the three Forest Plan Endemic species and no suitable habitat for any of them in the project area. Because of the lack of populations and habitat, there would be no direct or indirect effects to these species, and therefore no cumulative effects. Because of the lack of potential impacts, these species will not be analyzed further.

### Survey and Manage Plants

Based on habitat, there is potential for four Survey and Manage species to be present within the project area: bug-on-a-stick, mountain lady's-slipper, Brownie lady's-slipper, and Pacific fuzzwort. However, no populations of these species were found during field surveys, and there are no known populations in the project area. All species occupy habitat that is late-successional in general, although mountain lady's-slipper has been found in mid-successional conifer forest with late-successional remnants. Field surveys for *Leptogium cyanescens* were not performed because the habitat it requires, shady perennial riparian zones with good hardwood diversity, is being excluded from any treatments and the species would not be affected by the proposed action.

There would be no impacts to Survey and Manage species from the action alternatives because of the lack of individuals in the project area. Because there would be no direct or indirect impacts, there would be no cumulative impacts to these species as a result of the project. The Gemmill Thin Project is in compliance with the 2001 Survey and Manage ROD.

### Noxious Weeds

A high priority weed species is one that is of local management concern because of its currently limited distribution on the Shasta-Trinity National Forest, highly invasive nature, and demonstrated potential to displace large geographic areas of native plant communities. Funding does not allow for treatment of all non-native species, so emphasis is given primarily to high priority weed species. High priority weed species for the west side of the Shasta-Trinity National Forest are species that have a documented presence on the Forest and include any knapweed species (*Centaurea* other than *C. solstitialis*), dyers woad (*Isatis tinctorius*), brooms (*Cytisus* spp., *Genista* spp., *Spartium* spp.), Canada thistle (*Cirsium arvense*), and fennel (*Foeniculum vulgare*).

Information on weed presence and abundance was documented with field surveys. No noxious weeds of significance (high invasiveness) were found within the project area. The highest concentration of noxious weeds is along roadsides, in non-forested openings, and within plantations that have not reached a closed tree canopy.

## Environmental Consequences – Botany

Field surveys in all project units were performed in 2002 and 2005 for Sensitive plants, Survey and Manage plants, and Forest Plan Endemic species. Despite the presence of suitable habitat, no individuals of any Sensitive, Survey and Manage, or Forest Plan Endemic plants were found. Field surveys for Sensitive fungi must be performed during late fall or winter when soils are cool and moist. Because of the inability to access most potential fungi habitat in the project area during the appropriate survey season (due to snow), it was decided to not perform surveys and assume occupancy by branched collybia, olive phaeocollybia, and orange-peel fungus.

Because **sensitive fungi** and **noxious weeds** are the only botanical groups potentially affected by the project, these are the only groups that will be discussed in detail within the following botanical effects analysis.

### Direct and Indirect Effects of Alternative 2

#### Sensitive Fungi

There would be no direct effects from the No Action alternative because no activity would occur. With no action, current tree and shrub density levels that have higher fuel loadings and higher fire hazard would be maintained and increase over time. Not implementing the proposed action may increase the probability that the project area would experience high-intensity wildfire, which could result in adverse impacts to habitat for branched collybia, olive phaeocollybia, and orange-peel fungus.

Indirect impacts of higher-intensity wildfire in habitat for Sensitive fungi species include loss of organic matter for moisture retention and nutrients, soil sterilization and temperatures high enough to kill underground reproductive tissues, death of soil microorganisms essential to growth and reproduction of these species, and loss of soil and its nutrients through erosion. These are the same impacts that would occur in any wildfire. High intensity wildfire is expected to increase the degree of these impacts on plant species.

Habitat for branched collybia, olive phaeocollybia, and orange-peel fungus occurs in the project area in mature or late successional mixed conifer forested areas. These plant communities have evolved in a fire-dependent ecosystem,[97] so the three fungi species may be expected to be able to survive or respond positively to low or moderate-intensity fire. High-intensity wildfires were not typical in the Klamath Mountains of California historically and many native plant species are not resilient to its impacts. There is a higher chance of death of native species individuals or populations from lethal soil temperatures that can kill underground reproductive structures. Indirectly, severe modifications in the forest canopy due to high-intensity wildfire could be great enough to eliminate habitat characteristics, such as shade, that are necessary for native and rare plant species to survive after wildfire.

### Noxious Weeds

The No Action alternative would result in no net increase in suitable habitat for noxious weeds from project related activities. Suitable habitat for weeds decreases with an increase in canopy closure. Lack of disturbance and maintenance of the canopy would continue to discourage the establishment of weeds, allowing native species to occupy the majority of habitat in the project area. Other important factors that contribute to introduction and establishment of weeds, such as off-road vehicle use, transport on vehicles traveling through the project area, spread of existing roadside noxious weeds, and potential wildfires would continue.

Aside from contributing to increases in fuel loading, there would be no direct or indirect effects and therefore no cumulative effects, from selecting the No Action alternative.

## Direct and Indirect Effects of Alternatives 1 and 3

Alternatives 1 and 3 are described and compared in detail in Chapter 2 of this EIS. Because the project was designed to minimize or eliminate potential adverse effects, very few impacts to botanical species are expected from either alternative. Actions proposed in Alternatives 1 and 3 are similar in nature, therefore it is practical to group the discussion of potential impacts from both alternatives together.

Several protection measures have been incorporated into the project to minimize impacts to natural resources within the project area. Protective measures such as excluding perennial riparian areas and serpentine soils from activities, retaining 50% soil organic material during ground disturbing activities, and limiting periods of operability to avoid soil compaction during wet weather all reduce impacts so that both action alternatives will have very similar, minimal effects to Sensitive plants and fungi.

Temporal and spatial bounding for this effects analysis occurs at two different levels, depending upon which botanical group is addressed. Spatial bounding for Sensitive fungi occurs at the 5$^{th}$ field watershed level because this watershed level determines the scope of the subsurface hydrology, which is one of the driving factors in plant community composition. Temporal bounding for Sensitive fungi is approximately 10 to 50 years, which is considered the approximate recovery period that would be expected for forest canopies to reach pre-project levels.

[97] Sawyer and Thornburgh (1977)

Spatial bounding for noxious weeds is different than for Sensitive fungi because suitable habitat for weeds is potentially created due to management actions (i.e. skid trail development, road reconstruction, landing construction/decommissioning, etc.) whereas fungi habitat that may be affected by the project occurs prior to the action. The analysis area for noxious weeds is spatially bounded by the major highways and forest roads that surround the project area. Although major highways are a somewhat unusual basis for bounding, they identify the main vectors that are responsible for transporting and introducing noxious weeds into the project area. Temporal bounding for the noxious weeds analysis is the amount of time required for native plant communities to become stabilized post-project so that they can again resist invasive weed introduction and establishment (approximately 10-25 years).

### Sensitive Fungi

Although suitable habitat is present in the project area within units containing mid-to-late successional or late-successional conifer or mixed conifer/hardwood forest types, no surveys were performed for branched collybia, olive phaeocollybia, and orange-peel fungus for reasons described above. Due to a lack of field surveys and presence of suitable habitat, occupancy by these three species is assumed. Although little or no scientific research has been completed on the impacts of similar vegetation management on the three Sensitive fungi species, impacts to these species would be similar to those of common forest fungi. Results of research studies on impacts to these species are available to varying degree and cited here where applicable.

Assuming occupancy of the three species in suitable habitat, impacts may occur to fungi under both action alternatives. The only direct impact would be disruption of mycelial networks where/when soils are disturbed by machinery used in thinning, road construction, and machine piling.

In Alternative 3, no trees greater than 18 inches DBH would be harvested. Thinning treatments in both action alternatives retain post-project residual canopy closure at no less than 60% on average. Where canopy cover is currently less than 60%, no overstory trees would be removed under either alternative. It is unlikely that suitable habitat for Sensitive fungi is present in areas with less than 60% canopy closure because of the open exposure. Relative to suitable habitat, both action alternatives are the same in their impacts on potential populations of Sensitive fungi.

Fuelbreak prescriptions will result in residual canopy closure around 40%, and treatments will occur in some areas of suitable habitat for Sensitive fungi. There is no difference in fuelbreak treatments between the two proposed action alternatives. To reduce fuel hazards and stocking density, the smallest trees would be removed first until the desired canopy closure is obtained. Although fewer trees and less biomass are being removed under Alternative 3, tractors used to reduce understory fuels will traverse over the same ground, resulting in approximately equal amounts of soil disturbance between the two alternatives.

Indirect impacts to Sensitive fungi from lowering canopy cover below 50% can be longer lasting to fungi than direct impacts from ground disturbance. Removal of mature overstory trees would disrupt host tree connections for olive phaeocollybia. As trees are thinned, increased sunlight to the forest floor would dry out the soil and organic layer more quickly, reducing available moisture necessary for fungi growth

and reproduction and slowing organic matter decomposition rates. Potential effects are expected to last until canopies begin to recover to pre-project levels, approximately 10 to 50 years depending on individual site conditions.

## Effects of Thinning

Thinning from below would retain the largest trees to provide shade for ground-floor moisture retention that would contribute to organic matter accumulation. Organic matter accumulation provides a substrate for branched collybia and orange-peel fungus, and a source of fungal species biomass for reinoculation of disturbed soils in the project area. Retention of the largest trees will likely ensure retention of an adequate number of host trees for olive phaeocollybia.

There is no information available on the exact amount of time branched collybia, olive phaeocollybia, and orange-peel fungus require to recover from minor, moderate or heavy impacts. Retention of habitat elements such as organic matter, shade, and host trees would ensure that at least a minimum of each of these elements is available after treatments for potential populations of the three species to recover.

### Harvesting Methods

Cable systems would be used to remove timber on 125 acres with Alternative 3 and 142 acres with Alternative 1. Cable systems are much less invasive into the soil, and damage is mostly restricted to surface soil gouging from dragging logs to decks. Although superficial soil compaction is expected to occur in cable units from endlining logs to landings, this would not be heavy enough to adversely affect Sensitive fungi species.

Helicopter systems would be used to remove timber on 139 acres out of a total of 1,547 acres proposed for harvest under Alternative 1. With Alternative 3, these acres will not be treated, due to operability constraints. Helicopter yarding causes little or no impact on soil and would result in no impacts to potential Sensitive fungi populations.

Tractors would be used to harvest timber on 1,266 acres under both Alternatives 1 and 3. Approximately 311 of those acres have suitable habitat for Sensitive fungi. Tractors can impact fungi populations through soil compaction and disruption of the organic matter layer, where most of the fungal mass is present on the forest floor. When tractors operate on wet soils they can cause soil compaction. All tractor work under both action alternatives would occur during the period of operability, as described in *Chapter 2 – resource protection measures*. The period of operability occurs when soils are below maximum soil moisture content and restricting activities to dry conditions ensures that soil porosity would not be reduced more than the Region 5 standard of 10% (FSH 2509.18). Working within the period of operability would ensure no Sensitive fungi habitat is lost from tractor activities.

311 acres within project units provide habitat for branched collybia, olive phaeocollybia, and orange-peel fungus. Mitigations to retain soil organic matter in treated stands (FSH 2509.18) would result in retention of at least 50% of organic matter on a site. This would not minimize or eliminate disruption of the organic layer, but would retain organic matter that would be available for reinoculation of future organic matter as it accumulates. Retention of 60% overstory cover would encourage maintenance of necessary, minimum humidity levels and organic matter in duff and soil.

## Effects of Post-Harvest Fuel Treatments

Pile burning would occur on 504 acres in Alternative 1, and 348 acres in Alternative 3. Pile burning results in localized areas of high soil heating under the piles. To minimize potential effects, machine-made piles would be no greater than 8' X 12' in diameter on average and handpiles would not exceed 4' X 6' on average. High soil temperatures are thought to be restricted to the top 2 inches of soil, while fungal and plant root biomass can reach much lower depths.[98] With a total of up to 9 acres of burned pile area, loss of surface fungi habitat would extend over 2% of treated acres and less than 0.04% of available suitable habitat for Sensitive fungi within the 5th field watershed. Recovery and reintroduction of any populations of branched collybia, olive phaeocollybia or orange-peel fungus is expected from residual fungal biomass in the areas surrounding burn piles.

Tractors would be used to pile slash on 284 acres for both alternatives, most within units that have suitable habitat for Sensitive fungi. Implementation of resource protection measures ensure that soil compaction is below levels that would adversely affect Sensitive fungi; however organic matter layers would be disrupted. Retention of at least 50% of organic matter at each site would accelerate recovery time for fungi species. Machine piling treatments would impact suitable habitat on 284 acres, or 1% of habitat within the 5th field watershed.

## Effects of Road Re-construction and Decommissioning

There are no differences in miles of road, landing, or rock pit work between the action alternatives. No new road construction would occur under any alternative.

Approximately 25.3 miles of existing roads would be reconstructed and 31 landings would be reconstructed or created (on previously disturbed soils). Approximately 10.5 miles of existing roads or trails would be decommissioned after project activities by ripping and outsloping. Because all of these areas are currently heavily compacted, there is no suitable habitat for branched collybia, olive phaeocollybia or orange-peel fungus, and therefore no impacts to these species from road and landing-related activities. Decommissioning roads, landings, and trails accelerates recovery of potential suitable habitat for Sensitive fungi when done by ripping, which reduces compaction and increases soil porosity.[99]

Temporary road construction would occur in areas that have not been previously disturbed, and areas affected are outside of suitable habitat for Sensitive fungi. Temporary road construction would heavily disturb about 1.6 acres, or less than 1% of the treatment acres, all within late-successional conifer stands. These acres would be ripped and closed after treatment activities, reducing soil compaction. Because roads are proposed for areas outside of suitable habitat, there would be no impact on Sensitive fungi. The Midas rock pit, and adjacent land surrounding the pit, provides no habitat for Sensitive fungi. Expansion of this pit would have no impacts on any Sensitive fungi species.

## Noxious Weeds

Noxious weed habitat is created when soil is disturbed by removing competing vegetation, exposing bare soil, and accelerating water loss. Noxious weeds have developed strategies that allow them to outcompete

[98] Smith et al. (2004)
[99] Froelich et al. (1985)

native species by germinating and occupying land faster than native species and under environmental conditions that aren't as well tolerated by native species. Major components of the proposed actions, including mastication, helicopter and cable yarding, and biomass chipping, would result in very little soil disturbance or creation of suitable habitat for noxious weeds. These activities take place on or above the soil surface and are not very invasive into the soil.

Notable soil disturbance would occur through skid trail development, road and landing construction and decommissioning, pile burning, and machine piling. This would create and increase habitat for noxious weeds, particularly annual grasses in all places where these activities occur. Annual grasses are small in stature, but are flammable in moderate to heavy densities. They can carry fire in habitats that historically were occupied by native perennial grasses and shrubs that may have been less likely to carry fire quickly. Several historically disturbed sites throughout the project area are densely covered by annual grasses; providing a localized example of potential to occupy new sites. Creation of suitable habitat would increase the potential for chance introductions of new noxious weed species from outside areas.

Increased soil disturbance will occur for both alternatives in designated skid trails because tractors try to restrict their movement through units to these areas. Skid trails will provide new suitable habitat for noxious weeds after completion of project activities. The STNF Forest Plan restricts skid trail construction to no more than 15% of land harvested with uneven-age systems. No measurable differences would be discerned between skid trail usage in either Alternative 1 or 3. Assuming 15% of tractor-harvested acres would be in skid trails, skid trail development would create suitable habitat for noxious weeds on approximately 190 acres.

Alternatives 1 and 3 will have the same road reconstruction, temporary road construction, landing construction, and road and landing decommissioning activities. These would result in heavy soil disturbance twice during project implementation. New road construction and reconstruction would facilitate weed introduction, creating bare soil in the project area. Decommissioning roads and landings creates loose, bare mineral soil that is excellent habitat for noxious weeds. Habitat would be available until the disturbed site is occupied by native species, within 3-20 years depending on the site and its ability to recover with native plant species.

Machine piling would occur on 284 acres within the project area for both action alternatives. Machine piling would result in the greatest amount of soil disturbance and creation of suitable habitat for noxious weeds. Dozer blades with teeth would dig into the surface 6-12 inches of soil, exposing bare mineral soil that is suitable for weed introduction and establishment. Retention of 60% canopy cover in general will maintain shade that may discourage some noxious weed introduction, and accelerate native plant revegetation in some of the treatment units. There is no difference between Alternatives 1 and 3 in terms of noxious weed effects.

## Cumulative Effects for Alternatives 1 and 3

## Past, Present, and Reasonably Foreseeable Future Activities

### Sensitive Fungi

Bounding for this cumulative effects analysis occurs at the 5th field watershed level because this level watershed determines the scope of the subsurface hydrology, which is one of the driving factors in plant community composition.

The Cumulative Actions Table of this EIS (Appendix E, Table E-1) identifies known actions that have occurred in the watershed and describes reasonably foreseeable future actions. Only some of the past actions have contributed to modification of suitable habitat for Sensitive fungi. Actions that are relevant are those that occurred in habitats that currently do not provide suitable habitat for Sensitive fungi but are thought to have provided habitat prior to the action, based on residual habitat types and knowledge of past treatment prescriptions. Existing habitat conditions reflect the results of the past actions and events and contribute to the cumulative impacts.

There have been 4,927 acres of timber harvest in the Upper Hayfork 5th field watershed within the past 80 years, including 2,179 acres of commercial thinning and 2,748 acres of regeneration harvest (clearcut). Past regeneration timber harvest has resulted in a loss of 15% of the suitable fungi habitat within the watershed; and commercial thinning may have resulted in loss of 4%. Wildfires have resulted in a loss of 0.6% of the suitable fungi habitat within the watershed.

The Upper Dubakella Project is likely to be implemented in the Upper Hayfork watershed within the next five years. 1,025 acres would be treated to reduce fuels and improve forest health, with overstory removal treatments on 300 acres that would impact Sensitive fungi habitat. In the Upper Dubakella Project, machine piling and pile burning is scheduled to occur within 161 of the 300 acres of suitable habitat for Sensitive fungi habitat. These treatments would result in a loss of 1.6% of the suitable habitat in the watershed (300 acres).

Table 3-22 summarizes relevant past and future activities in the Upper Hayfork watershed that have resulted in negative changes to habitat for branched collybia, olive phaeocollybia, and orange-peel fungus. Impacts from past timber harvests, machine piling, and pile burning have occurred on 3,891 acres within the Upper Hayfork watershed. These have contributed to modification or loss of 21% of the suitable habitat within the watershed.

Alternative 1 would contribute to impacts (degradation of habitat, impacts to individuals) on 520 acres. Taken together, past, future, and proposed actions result in degradation or loss of habitat (or loss of individuals) for 4,411 acres, or 23.4% of the suitable fungi habitat within the watershed, with 2.4% of the impacts coming from the proposed actions. Alternative 3 would contribute to impacts (degradation of habitat, impacts to individuals) on 348 acres. Taken together, past, future, and proposed actions result in degradation or loss of habitat (or loss of individuals) for 4,063 acres, or 23.3% of the suitable fungi habitat within the watershed, with 2.2% of the impacts coming from the proposed actions.

The following table summarizes past, future foreseeable, and proposed actions pertinent to a cumulative effects analysis of Sensitive fungi (individuals and habitat). All future actions planned within

a given area may not be listed below, as some actions may not be deemed pertinent to an analysis of fungi habitat.

**Table 3-22. Cumulative Actions Summary - Summary of Actions Affecting Suitable Habitat for Sensitive Fungi within the Upper Hayfork Watershed, Including Past, Future, and Proposed Actions**

| Action | Total Acres | | Acres with Potential Negative Effect | Explanation of Effects |
|---|---|---|---|---|
| **Past** | | | | |
| Timber Harvest-Regeneration Cut to 1926 | 2,748 | | 2,748 | reduction of overstory to 0%, disruption of organic matter layer |
| Timber Harvest-Commercial Thinning to 1986 | 2179 | | 726 | reduction of overstory below 50%, disruption of organic matter layer |
| Wildfire | 352 | | 117 | reduction of overstory below 50%, loss of organic matter layer |
| **Future** | | | | |
| Upper Dubakella Timber Sale, including imbedded machine piling and pile burning | 1,025 | | 300 | reduction of overstory to 60%, disruption of organic matter layer, isolated lethal soil temperatures |
| **Total Past and Future Action Impacts** | | | **3,891** | |
| **Proposed Action** | **Alt. 1** | **Alt. 3** | | |
| Thinning From Below | 1,547 | 1,391 | 0 | 60% overstory to remain |
| Cable Harvest Systems | 142 | 125 | 0 | Little forest floor contact |
| Helicopter Harvest Systems | 139 | 0 | 0 | Little forest floor contact |
| Tractor Harvest Systems | 1,266 | 1,266 | 311 | Disruption of organic matter layer<br>No compaction effects to fungi |
| Machine and Hand Pile Burning | 504 | 348 | 9 | Isolated lethal soil temperatures |
| Machine Piling | 284 | 284 | 200 | Disruption of organic matter layer<br>No compaction effects |
| **Total Proposed Action Impacts** | | | **520** | |
| **Past, Future, Proposed Action Combined** | | | **4,411** | |

The Aquatic Conservation Strategy (ACS) Objective #8 requires maintenance and restoration of species composition and structural diversity of plant communities in riparian areas and wetlands to provide several hydrologic functions, including nutrient filtering, limiting surface erosion, and sustaining physical complexity and stability.[100] ACS Objective #9 requires maintaining and restoring habitat to support well-distributed populations of native plant, invertebrate and riparian-dependent species. Both objectives direct the STNF to minimize disturbance and disruption of belowground fungal networks in riparian areas, where fungi are most likely to grow on the STNF.

In total, both action alternatives, analyzed together with past actions in the affected watershed, may impact individuals but are not expected to exceed viability thresholds for branched collybia, olive phaeocollybia, and orange-peel fungus, or have any significant effects on persistence of these species.

[100] See EIS Appendix F for summary of the project-level ACS analysis

## Noxious Weeds

The cumulative effects analysis area for noxious weeds is spatially bounded as follows: south to Highway 36, north to Highway 3 South, east to Forest Road 31N02, and west to Wildwood Road. Since identification of all activities that have occurred along the entire length of these highways would not contribute well to a discussion of cumulative effects, a listing of past and future activities will be restricted to the geographic area identified above. The spatial cumulative effects analysis area for noxious weeds encompasses a geographic area of 66,000 acres.

The cumulative effects analysis area is bounded in time by the amount of time required for native plant communities to become stabilized enough to once again resist invasive weed introduction and establishment; which is approximately 10-25 years. The date of the first introduction of noxious weeds into the Gemmill Thin project area is unknown.

There have been 1,694 acres of past timber harvest within the Upper Hayfork watershed after 1980, when the chance of introducing noxious weeds from outside areas was greater because of lack of awareness about weed introductions. Commercial thinning and clearcuts caused soil disturbance that created suitable habitat for noxious weeds, especially on gentler slopes where tractors were used for yarding and site preparation for tree planting. Because the extent of machine piling treatments in these projects is unknown, it is assumed 50% of acres had slopes gentle enough to use tractors for brush disposal (847 acres). Limited tractor passes combined with overstory canopies of 60% or greater discouraged introduction or establishment of weeds outside of skid trails. Along skid trails on 20% of unit acres with slopes less than 35%, disturbance was higher and may have resulted in development of up to 169 acres of habitat for noxious weeds. The Upper Dubakella Project may create habitat for noxious weeds over 1,025 acres.

A single fire of about 352 acres occurred within the cumulative impacts analysis area in 1991. Within this fire area is a population of spotted knapweed (*Centaurea maculosa*) about ½ acre in size. This is a very high priority weed for the STNF and has been treated by manual removal for the past 2 years. Because this population is being actively removed prior to seed set, there is little chance it would spread along the Wildwood Road into the project area. There is an isolated population of dyers woad (*Isatis tinctorius*), a high priority weed for the STNF, along the East Fork Road (County Road 343) near the Wildwood Road. This population has received only intermittent treatment due to lack of funding. Most travelers taking the East Fork Road do not also travel to the Gemmill Project area, although local travel between the two sites is possible. Because there is only limited travel between those two sites, it is unlikely dyers woad would be spread from the East Fork Road to the Gemmill Thin project area. The project is not expected to impact the spread of these known noxious weed populations.

There is a one-acre population of Canada thistle located on private land on Highway 36, near its intersection with the Wildwood Road. This population is along one of the main travel routes that accesses the Gemmill Thin project area, and a high-priority species for treatment on the STNF. Canada thistle is restricted to very wet habitats and flying seeds picked by travelers moving from Highway 36 into the Gemmill Thin project area are unlikely to be deposited in one of the 9 isolated springs or seeps in the project area.

Vehicle traffic within the Gemmill project area is fairly low, with most traffic resulting from recreational off-highway vehicles, fuelwood collection, seasonal hunting, and visitation to Hall City Cave. This reduces the chance of introduction of noxious weeds to the project area from areas outside Trinity County, and spread of weeds already present along roads.

The following table summarizes past, future foreseeable, and proposed actions pertinent to a cumulative effects analysis of noxious weeds. All future actions planned within a given area may not be listed below, as some actions may not be deemed pertinent to this analysis.

**Table 3-23. Cumulative Actions Summary - Summary of Actions Affecting Suitable Habitat for Noxious Weeds within the Upper Hayfork Watershed, Including Past, Future, and Proposed Actions**

| Action | Total Project Acres | | Acres with Potential Negative Effect | Explanation of Effects |
|---|---|---|---|---|
| **Past** | | | | |
| Past timber sales-skid trail development | 4,927 | | 169 | Bare soil exposure, loss of moisture from soil |
| Wildfire | 352 | | 352 | Bare soil exposure |
| Existing weed occupation in Trinity County | | | 13,200 | |
| **Future** | | | | |
| Upper Dubakella Timber Sale-skid trail development, pile burning, and machine piling treatments | 1,026 | | 788 | Bare soil exposure, loss of moisture from soil |
| **Total Past and Future Action Impacts** | | | **14,509** | |
| **Proposed Action** | **Alt. 1** | **Alt. 3** | | |
| Skid Trail Development | 1,547 | 1,391 | 250 | Bare soil exposure, loss of moisture from soil |
| Road and landing (re)construction and decommissioning | 71 | 71 | 71 | Heavy disturbance in the absence of native vegetation, bare soil exposure, loss of moisture from soil |
| Machine and Hand Pile Burning | 504 | 348 | 9 | Bare soil exposure, loss of moisture from soil, lethal soil temperatures for native vegetation |
| Machine Piling | 284 | 284 | 200 | Bare soil exposure, loss of moisture from soil, lethal soil temperatures for native vegetation |
| **Total Proposed Action Impacts** | | | **530** | |
| **Past, Future, Proposed Action Combined** | | | **15,039** | |

Contract Provision C6.36 [Equipment Cleaning 5/01] would be incorporated into the final project contract as an additional mitigation to prevent the spread of noxious weeds.[101] This provision requires the operator to insure his equipment is free of weed seeds or propagules prior to entering the project area.

[101] See *Chapter 2 – Resource Protection Measures*

Decommissioned roads and landings would be seeded with native grass seed mixed with non-persistent cereal grains. Certified weed-free straw would be spread on all decommissioned roads and landings, and heavily disturbed skid trails. Roadsides have long been known to contain high amounts of suitable habitat for noxious weeds because of perpetual disturbance and the high probability of weed introductions from vehicles passing through. With implementation of equipment cleaning, seeding, and mulching measures, weed introduction and spread from the proposed actions is expected to be minor relative to the current level of weeds.

## Affected Environment - Air Quality

The Gemmill Project is located in the North Coast Air Basin and is managed by the North Coast Unified Air Quality Management District, which consists of Del Norte, Humboldt, and Trinity counties.

### Air Quality Standards

Air quality health protective standards are set by the California Air Resources Board (CARB) and the United States Environmental Protection Agency (USEPA). The standards are pollutant-specific and have two components; a pollution concentration value, and a time period of exposure. The standards are designed to be conservative and, as such, are set at levels sufficient to protect a wide segment of the population from health effects.[102] Additional information about the State and Federal Standards can be found on the CARB website at http://www.arb.ca.gov.

Trinity County is identified as attainment for $PM_{10}$ on the USEPA map dated 12/2007.[103] Therefore policy does not require a conformity determination for this project analysis[104]. In Trinity County, particulate matter of concern generally comes from motor vehicles, wood burning stoves, dust from construction and logging operations, wildfires and slash burning. Particulate matter ($PM_{10}$) pollution consists of very small liquid and solid particles floating in the air. Of greatest concern to public health are the particles small enough to be inhaled into the deepest parts of the lung. These particles are less than 10 microns in diameter - about 1/7th the thickness of a human hair - and are known as $PM_{10}$ (See www.arb.ca.gov/html/brochure/pm10.htm for more information). Mitigations for $PM_{10}$ include: 1) dust abatement during logging operations; 2) implementing logging/vegetation management practices that maximize product utilization; 3) burning only under approved burn days determined by the North Coast Air Quality Management District; 4) Allowing for adequate cure time before igniting slash material; and 5) Covering of hand-piled slash for more efficient burning conditions.

[102] North Coast Unified Air Quality Management District - www.ncuaqmd.org.
[103] The Green Book Nonattainment Areas for Criteria Pollutants - www.epa.gov/oar/oaqps/greenbk/mappm10.html
[104] Activities that emit significant levels of criteria pollutants in a non-attainment or maintenance area are subject to the conformity rule. This rule requires the Forest Service or any federal agency to demonstrate that their action will not impede the State Implementation Plans to attain or maintain the ambient air quality standard. http://www.fs.fed.us/air/respon.htm

## Climate

The project area climate is a Mediterranean subtype with warm dry summers and cool moist winters. Elevations range from 3,280 to 5,069 feet above sea-level, having slopes ranging of 5% to 60%. All aspects are represented, with south and west being dominant.

## Wind Patterns

Wind patterns fluctuate on a diurnal and seasonal basis. During summer months winds are generally terrain driven. Mountain-valley diurnal winds characterize the surface flow. The pattern of up slope to up canyon winds during the day and down slope, down canyon winds at night account for the pollution transport between the Sacramento Valley and the foothills and mountains. Thus smoke produced from wildland, or prescribed, fires would most likely enter the valley during night and vent out by day.

## Proximity to Class I Wilderness Areas

The Clean Air Act established three classes of air sheds that have different levels or restrictions on the amount of additional pollution that can be added to the air.[105] Class I Air Sheds have the most stringent restrictions. The Yolla Bolla-Middle Eel Wilderness, approximately 12 air miles south of the project site, is designated as a Class I Air Shed.[106] Visibility in the Class 1 Air Shed would be protected by conducting the prescribed burning when transport winds are not expected to carry emissions toward the Wilderness. Distance, along with limited burning durations, are the factors most limiting to transport of air emissions. The Chanchelulla Wilderness is to the north and directly adjacent the project area. It is not classified as having a Class I Air Shed, thus it doesn't add additional constraints to prescribed fire use.

## Proximity to Communities

The project area is located to the east and directly adjacent to the rural community of Wildwood, California. The community of Platina, California (population 179) is approximately 6 miles to the southeast. The largest community is Hayfork, California (population 2,453) located approximately 9 miles northeast of the project. The project vicinity is primarily forested federal with parcels of private lands intermingled.

[105] The Clean Air Act charges the Forest Service to protect air quality related values in Class I Areas - those wilderness areas in existence as of August 7, 1977 larger than 5,000 acres. This protection is specifically enabled through Prevention of Significant Deterioration (PSD) provisions of the Act. (http://www.fs.fed.us/air/respon.htm)
[106] Lands designated as Class I Areas under the Clean Air Act Amendments of 1977 are afforded the highest level of protection from air pollutants in the nation. These lands consist of national Wilderness areas (managed by Forest Service), parks (National Park Service) and wildlife refuges (U.S. Fish & Wildlife Service) in existence at the time the amendment was passed. All other lands in the nation are designated as Class II. (http://www.fs.fed.us/air/map.htm)

# Environmental Consequences – Air Quality

## Direct and Indirect Effects for Alternative 2

The No Action Alternative (Alternative 2) would not produce particulate matter from prescribed fire; however, the potential for air quality degradation in the event of a wildfire is substantial and would continue to increase with no action. Unlike prescribed fires, wildfires cannot be regulated to minimize impacts from smoke. Air quality can be degraded by smoke from wildfires to the point that human illness may be caused. Smoke from wildfire also causes visual impacts to the surrounding areas, and creates hazardous driving conditions on adjacent State, County, and Forest Service Roads for extended periods of time. Should a large wildfire occur, dust emissions resulting from fire suppression equipment (both on and off roads) could show a marked increase until seasonal rains soak the surface of the burned area. The table below presents an estimate of $PM_{10}$ emissions from a modeled wildfire under current conditions as an example of potential air quality impacts.

**Table 3-24. Wildfire $PM_{10}$ emissions estimated - Alternative 2**

| Wildfire Burn Time | Wildfire Burn Acres | $PM_{10}$ Produced |
|---|---|---|
| 1 hour | 50 acres | 10 tons |
| 2 hours | 202 acres | 41 tons |
| 3 hours | 807 acres | 163 tons |
| 4 hours | 1,815 acres | 366 tons |

## Direct and Indirect Effects for Alternatives 1 and 3

### Vegetation Combustion

The action alternatives would produce smoke from burning activities. Smoke from the project is expected to remain in the area for about one to two days each time burning occurs. The number of prescribed burn days needed depends upon site-specific weather and fuel conditions as well as air quality approval and available personnel. Total duration of burn time would be approximately 34 days based on an average of 15 acres per day. Prescribed burning is likely to span a period of 2-4 months, but because of the weather-related and administrative variables mentioned above, actual burning may occur during discrete time frames over a two year period. Permissive burn days are determined by the North Coast Unified Air Quality Management District, as described in the project fuels report.

Alternative 1 would burn approximately 504 acres of hand and tractor piled slash as part of post-harvest hazardous fuels reduction.

**Table 3-25. Alternative 1 – Action - $PM_{10}$ emissions estimated**

| Treatment Type | Treatment Acres | $PM_{10}$ Produced |
|---|---|---|
| **Burn Machine Piles** | 284 | |
| **Burn Hand Piles** | 220 | |
| **Total** | **504 acres** | **14.5 tons** |

Alternative 3 would burn approximately 384 acres of hand and tractor piled slash.

**Table 3-26. Alternative 3 – Action - $PM_{10}$ emissions estimated**

| Treatment Type | Treatment Acres | $PM_{10}$ Produced |
|---|---|---|
| **Burn Machine Piles** | 284 acres | |
| **Burn Hand Piles** | 64 acres | |
| **Total** | **348 acres** | **12.2 tons** |

Pre-treatment methods will be used to minimize smoke emissions and/or reduce fuel loadings. Pre-treatment methods will include public firewood utilization opportunities, and piling and covering slash to be burned and aging slash before burning. Both action alternatives propose biomass utilization and/or mastication on approximately 1,114 acres, as alternatives to burning. By utilizing excess fuels as biomass or ground cover (through mastication) where feasible and appropriate, the project minimizes potential effects to air quality.

State Highway 36 extends from east-to-west and is directly adjacent the project's southern boundary. Proposed prescribed fire will be managed so that project-related smoke does not impair visibility on this road. County Road 302 runs north to south along the western project boundary, and like Highway 36, visibility on this road cannot be impaired by the project. The project burn boss is required to provide on-site monitoring to ensure smoke does not hamper traffic on these roads during burning operations. Site-specific burn plans will not allow ignitions to take place when north winds are blowing or predicted to blow during scheduled burning. If wind changes occur during burning so that smoke is blown towards the highway, ignitions will halt. Prescribed fires may be extinguished if smoke impacts are likely to hamper visibility on the highway.

Road signs will be posted on Highway 36, County Road 302, and all primary Forest Service roads within the area to notify the public of prescribed burning. State and County Road Departments, the California Highway Patrol, and the Trinity County Sheriff's Office will be contacted and informed of planned prescribed fire use prior to any ignitions.

Prior to burning all burn sites and times will be posted in the Record Searchlight and Trinity Journal newspapers and on bulletin boards in the local communities. From a smoke management perspective public notification will primarily be conducted through the use of the Forest Public Affairs Office and the County public affairs. Public notification will include appropriate signs within the vicinity of the wildland fire use area and public facilities. These notices will include much of the information incorporated in the smoke management plan and will identify methods for reporting public smoke complaints. These notices will also attempt to provide some level of public education with regard to the prescribed burn program.

The small rural community of Wildwood is located less than a mile to the west of the project boundary. As with constraints on public roads, on-site burn monitoring will ensure smoke does not negatively impact this community. The rural community of Platina is approximately 6 air miles southeast of the project site and at a lower elevation. Smoke generated from fuel treatment activities is not expected to impact this community.

### Vehicular Fugitive Dust

Logging operations will produce some dust, primarily from tractor skidding of log bundles and hauling over earth surface roads. When logs are being transported from the sale area all dirt based roads are

required to be watered, by the timber sale purchaser, to abate dust that would be created by the increased road usage. A temporary road surface material especially made for dust reduction may be applied to the roads instead of water. Dust generated and the resultant particulate matter ($PM_{10}$) is directly related to vehicle miles traveled on un-surfaced roads in the project area. It can also be attributed to tractor work on harvest units. A Forest Service Timber Sale Administrator oversees all such operations, ensuring their adherence to contract specified requirements. There might be periods of localized impacts from created dust from logging and recreational activities conducted on both public and private lands within the analysis area. Logging operations are generally done over several years and localized dust from skidding and hauling dissipates rapidly. With the above constraints in place and restrictions on vehicle travel by logging equipment, the project will have little measurable impacts upon the air shed.

## Cumulative Effects for Alternatives 1 and 3

Past, present, and reasonably foreseeable activities were reviewed to determine cumulative effects to air quality due to this project. Because impacts to air quality in regards to smoke from past wildfires and prescribed fire activities are short-lived, past activities do not contribute to cumulative effects. Past activities do influence the amount of available material, which would be available for consumption in the event of a future wildfire.

Presently, and within the future, gaseous pollutants and airborne particulate matter would continue to be present in the area. Primary emissions sources contributing would include wood burning stoves, motor vehicle exhaust, emissions from recreational campfires, emission associated with development of private lands, prescribed fire, fugitive dust, and wildfires within or adjacent to the project area. Burning associated with foreseeable actions (summarized in Appendix E) can be expected, and would have short-term effects.

Future wildfire frequency is expected to continue as it has been observed in the past. The effects from past prescribed and wildfires activities are no longer a concern because smoke impacts are short-term in nature and are only a concern while smoke is being produced and soon thereafter. However, if an unwanted wildfire occurs in the future these effects could lead to negative cumulative effects. These negative cumulative effects are dependant upon the size and intensity of the unwanted wildfire. Visibility impairment and hazardous health impacts, due to sudden and dramatic releases, are likely with a large unwanted wildfire event. These events may temporarily reduce visibility and air quality.

One objective of the project is to prevent the occurrence of large uncontrolled wildfires. The no action alternative (Alternative 2) does not contribute towards this objective. Wildfires present a risk to the public and result in damage to both the environment (e.g., increased erosion, air quality degradation) and property. Vegetation management treatments provide the opportunity to reduce the magnitude of wildfire air quality problems over the long-term.

Anticipated smoke production and emissions from prescribed fire due to implementing one of the action alternatives would be within State and local government guidelines, would be of short duration (a few days). Due to its distant proximity, the project will not adversely affect air quality of the Class I Air Shed to the south. Due to the limited duration of the burning and time of the year that the treatments

would be conducted (late fall or early spring), created smoke is expected to dissipate within a few miles of the site.

Reasonably foreseeable smoke-producing projects within the analysis area include the Gemmill Prescribed Burn Project, which consists of under burning within and adjacent to Gemmill Thin project units. The Upper Dubakella Timber Sale area is approximately 8 air miles to the west of the project and also has some prescribed fire use associated with it. Distance, elevation, and terrain effectively separate these two project sites so that smoke will not combine into a single column. It is highly unlikely that burning will be done on both sites at the same time due to the constraints of staffing with the limited number of appropriate personnel. There is no anticipated large (>10 acres) private burning projects scheduled during the same time periods as those on National Forest lands.

The North Coast Air Quality Management District regulates permissible burn days for prescribed fire use within their district. A Smoke Management Plan (contained in all prescribed burn plans) must be submitted and approved by this district prior to using prescribed fire. Overall cumulative emissions are expected to be similar to the past years and are not expected to exceed Federal or State air quality standards.

The improved wildfire suppression characteristics created by prescribed burning and thinning in Alternatives 1 and 3 should lead to a reduction in size and intensity of future wildfires in the treated areas. In the long-term, the emissions from wildfires within the project area are expected to be reduced.

## Affected Environment – Soils

The Hayfork Creek Watershed is located in the Southern Klamath Mountains Ecological Subsection of the Klamath Mountains Ecological Section of northern California. This subsection comprises an area of the Central Metamorphic Belt of the Klamath Mountains and is dominated by Paleozoic metavolcanic and metasedimentary rocks. The climate is temperate and humid. Mass wasting and fluvial erosion are the main geomorphic processes. Appendix L contains relevant data regarding soils including the major soil map units within the project area, their physical properties, and their ratings for burn damage, compaction, and erosion. This section discloses soils information and effects analyses that are relevant to the decision for the Gemmill Thin Project.

### Soil Cover and Fertility

Fuel cover transects indicate that the dominate soil cover is within the 1 to 3 inch and 3 to 20 inch class of woody material. Duff thickness ranges from 2 to 4 inches. Average tons per acre for mixed conifer stands ranged from 22 to 45, for tree/brush stands from 13 to 21 and brush stands from 5 to 7. Large woody debris (LWD) ranges from 10 to 20 trees per acre for mixed conifer stands, for tree/brush stands it ranged from 3 to 8 trees per acre, and for brush areas 1 to 5 logs per acre of old decayed class 4 and 5. On surveyed units, existing soil cover is high and duff depth is good for fertility and buffering of temperatures**.** On the average LWD is greater than 5 logs per acre in project units, which meets Forest Service Soil Quality Standards (SQS). Soil fertility in the project area is moderately high to moderately low depending upon the parent material formation and available water holding capacity. In most forest

soils the parent material has low fertility with most nutrients being recycled from decomposing roots and surface duff that is incorporated into the soil.

According to Forest Service SQS cover should range from 50 to 70% on project area soils (metamorphic soils), depending on erosion hazard rating for each particular soil. The SQS are meant to be early warning thresholds of impaired soil conditions.

### Erosion Hazard

In order to assess the potential risk of a given soil to erode, an erosion hazard rating (EHR) was developed (R-5 FSH 2505.22). Many interrelated factors are evaluated in an EHR system to determine whether land use activities are likely to cause accelerated erosion. The EHR system is designed to assess the relative risk of accelerated sheet and rill erosion. Little past erosion was detected in the project area, and current EHR levels in the project area are low to moderate (see relevant soils data in Appendix L, Soils Data). Fuel loading is high in the project area and a reduction to 5 to 10 tons/acre is desirable for protection of soil resources from destructive fires.

### Soil Compaction

Compaction ratings for project area soils are listed in Appendix L, soils data. Table 3-27 summarizes that 34% of the project area is in a disturbed state and the rest is undisturbed. The greatest disturbed state is skid-trails showing a decrease of 8.2% in total porosity, which is within the established SQS threshold of 10%. The current level of compaction (8.2%) in the project area is moderate, and not detrimental (over 10%).

**Table 3-27. Average disturbance and porosity (compaction) for project area**

| Disturbance | Percent | Total Porosity Decrease | SQS Threshold |
|---|---|---|---|
| **Undisturbed** | 66 | 0 | 10% |
| **Disturbed** | 17 | 3.4 | 10% |
| **Skid Trails** | 17 | 8.2 | 10% |

## Environmental Consequences – Soils

The effects of each alternative on the soil resource have been assessed using the Region 5 Soil Quality Standards (SQS) and the STNF Forest Plan. Soil quality analysis standards provide threshold values that indicate when changes in soil properties and soil conditions would result in significant change or impairment of the productivity potential, hydrologic function, or buffering capacity of the soil. For soil erosion, compaction and soil fertility the analysis was bounded only to project treatment units. This analysis focused on soil productivity and on-site erosion potential. By adhering to SQS for onsite erosion, compaction, and soil fertility, overall soil productivity is maintained or improved.

Each alternative is assessed using the three evaluation criteria developed from the SQS (erosion, compaction, and fertility). Not all changes caused by management are detrimental to the soil resource. The SQS are meant to be early warning thresholds of impaired soil conditions, and are therefore used for

analysis. A threshold for detrimental disturbance is defined as a change in any monitoring variable sufficient to trigger a 15% reduction in soil productivity from that of the undisturbed condition. Fifteen percent was chosen because this value was determined to be the smallest change that would be statistically significant, not to imply that productivity has declined by 15%. If soil productivity is reduced 15% from undisturbed conditions, the SQS detrimental disturbance threshold has been exceeded.[107]

**Table 3-28. Soil Quality Standards Matrix for Alternatives**

| **Soil Quality Standard** | **Alternative 1** (proposed) | **Alternative 2** (no action) | **Alternative 3** (diameter limit) |
|---|---|---|---|
| Anticipated soil cover | 50 - 70% cover | 90 - 100% cover | 60 - 80% cover |
| **Erosion** (erosion hazard rating) | Moderate | Low | Moderate |
| **Compaction** (acres compacted) | No detrimental compaction anticipated | No detrimental compaction detected | No detrimental compaction anticipated |
| (Miles of roads to be decommissioned) | (10.6 miles treated) | (0 miles treated) | (10.6 miles treated) |
| **Fertility** (tons/acre of slash and duff) | 5-10 tons/acre | 22-45 tons/acre | 7-12 tons/acre |

## Direct and Indirect Effects for Alternative 2

Current soil conditions for the project area are landscapes with areas of moderate past use (Hall City sub-watershed) to areas of low past use (Chanchelulla, Wilson, and Goods sub-watersheds). Soils are mostly metavolcanic and on lower rolling hillslopes dormant landslide deposits. Metavolcanic soils are moderately susceptible to erosion and past use indicates that erosion has been low to moderate. Currently these areas are stabilized and erosion is at low rates for metavolcanic. The dormant landslide deposits have had some erosion due to placer miming and stripping in the Hall City sub-watershed. These areas have been logged in the past thus causing more erosion and compaction. Currently these areas have good cover, erosion is at low levels, and compaction levels have recovered and are below SQS thresholds.

This alternative would not treat the current excessive fuel accumulation, and therefore does not reduce the likelihood of future stand-replacing wildfire. If a stand-replacing fire were to occur in the project area severe erosion would occur on both metavolcanic soils and the fine textured landslide sediments. A stand-replacing fire would remove soil cover and cause organic matter destruction especially in the topsoil. These factors would cause sheet and rill erosion in the productive topsoil at rates as high 74 tons per acre, far exceeding soil formation rates of 1 to 2 tons per acre per year. Because erosion rates would be excessive if a stand-replacing fire occurred, the project was designed to reduce the probability of stand-replacing wildfire and thereby provide protection for soil resources.

[107] Powers et al. (1998)

## Direct and Indirect Effects for Alternative 1

This alternative proposes thinning using track mounted equipment, cable suspension, and helicopter; along with post-harvest and other hazardous fuels reduction. Post-project soil cover will be maintained at 50 to 70%, therefore erosion will be low to moderate and less than 1 ton per acre. Harvesting in areas with soils that have severe compaction hazards will only occur during the driest part of the year, June to October, as described in resource protection measures for units 19 to 33, 35 to 37, and unit 39. Soil effects of post-harvest fuels reduction including mastication, lop and scatter, hand pile, jackpot burn, and tractor pile are summarized in Table 3-29.

Road decommissioning of 10.6 miles would greatly benefit the soils resource in terms of reducing soil compaction and increasing water infiltration. Road decommissioning will consist of pulling culverts, ripping, and mulching on selected roads to reduce erosion, increase infiltration, and speed natural recovery of these roads. Due to incorporation of appropriate resource protection measures (Chapter 2) and Best Management Practices (Appendix M), direct and indirect effects to soils will be minimal from this project.

**Table 3-29. Fuel treatments and their effect on soils**

| Treatment | Effects on Soil |
|---|---|
| **Mastication** | Fuel rearrangement, increased soil cover, temp., moisture & microbe activity, possible short-term C/N imbalance if too much incorporation. |
| **Lop & Scatter** | 3 to 10 in material, provides soil cover, breaks down rapidly into fine litter and slow incorporation. |
| **Hand pile** | Like lop-and-scatter except concentrated, decomposes more slowly, concentrations can burn hot but are only spotty and create mosaic. |
| **Jackpot** | Concentrated areas of fuel consumed can be hot but are limited on the landscape are mosaic and do not increase overland erosion. |
| **Tractor Pile** | Usually large with some topsoil mixed in, some compaction and loss of topsoil if done properly with brush rakes and good operator. |

As a general rule, 4 to 10 tons per acre of woody material of duff would be left with material being 0.25 to 10 inches in size. These size classes are the most important to retain since they contain the bulk of recyclable soil nutrients. Retaining 5 to 10 tons per acre of woody material with this alternative will maintain natural decay processes and soil fertility.

Hand pile burning will be fairly hot in concentrated areas of small extent and will create mosaic patterns in terms of soils effects. Water-repellency is only an issue with high intensity fires, hydrophobic vegetation (i.e. chaparral and *chemise* spp.), and coarse-grained soils. In this project area little coarse-grained soils will be burned, and soil water-repellency is not expected. Mastication will occur on slopes less than 35% and will be used to reduce fuels and provide soil cover. If the masticated chips remain on the soil surface, soil temperature will decrease due to the insulation affect of scattered material and soil moisture will increase. With some soil incorporation into the masticated chips, decomposition will be accelerated and plant uptake of important soils nutrients (N, P, Ca, Mg, S etc.) will be encouraged.[108]

[108] Powers (1983)

## Direct and Indirect Effects for Alternative 3

The effects of Alternative 3 on overall soil erosion and compaction will be similar to Alternative 1 except that stand health would not be effectively treated and soil fertility could be affected with increased root diseases in this area. The diameter limit would result in more relatively small diameter trees remaining in the units post-project. Because there would be more trees remaining there would also be increased levels of soil cover in the form of fallen leaves, duff, and forest litter with Alternative 3. This increased soil cover may provide minor benefits, although both alternatives retain approximately 50% soil cover across the units and would result in soil conditions within the established SQS. Road decommissioning will be the same as Alternative 1, which will have a positive direct and indirect effect by increasing infiltration and reducing road erosion. With less area thinned a large wildfire could burn these areas more severely thus increasing erosion.

## Cumulative Effects for Alternatives 1 and 3

To analyze the cumulative effects on soils, the unit of measure used to quantify the effects are the regional Soil Quality Standards (SQS) developed and adopted in 1995 (see FSH 2509.18, R5 Supplement 2509.18-95-1). These are the appropriate units of measure because they are regional standards that evaluate measurable changes in soil productivity that have been tested and peer reviewed. This cumulative effects analysis quantifies the impact effects as a sum of the direct and indirect impacts of the alternatives considered in addition to the past and foreseeable future actions (which are independent of the alternatives considered). Relevant past and future actions are summarized in Table E-1 in Appendix E (Cumulative Actions Table).

Cumulative effects on the soil ecosystem have two scales. The first deals with the number and types of management activities occurring within an individual stand over time; second, the number and types of management activities and their distribution within the project area and/or watershed over time.

### Geographic Bounding

The cumulative effects analysis for soils was bound by the project units. Soil Quality Standards only apply to the affected soils in regards to project unit area erosion, compaction, and fertility of past, present and future planned activities within the project units.

### Time Frame Bounding

The effect of management on soil recovery is dependent on soil type, climate, moisture, cover and time. By using the Universal Soil Loss Equation (USLE) typical erosion recovery rates are developed that show, for soils with 50 to 70% cover, that recovery is in 3 to 5 years post-project (see Figure 3-9).

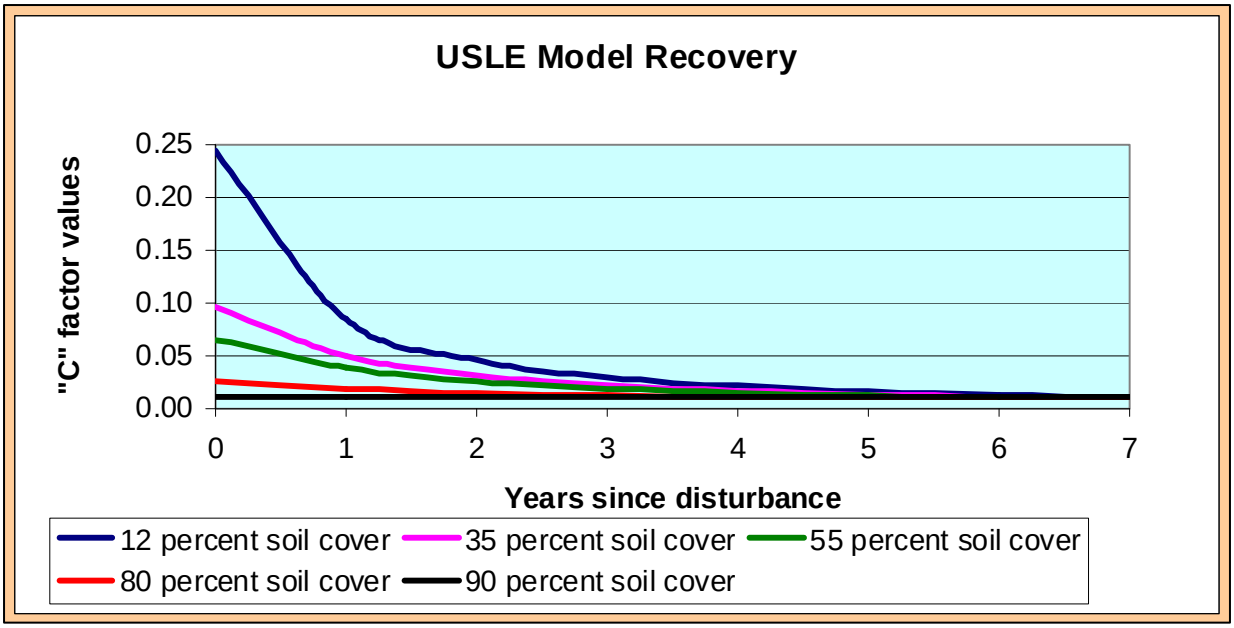



**Figure 3-9. USLE Model Recovery for the Upper Hayfork Creek Cumulative Watershed**

Depending on what effect is measured (erosion or compaction or fertility) will determine recovery rates. Expected recovery rates for this project are displayed in Table 3-30. The table summarizes that there would be some short-term increases in erosion due to the project, but over a 3 to 5 year span those rates drop to background (due to falling leaves, braches, needles, grass and forbs). In regards to compaction, data collected by Shasta-Trinity National Forest and the Pacific Southwest Experimental Station[109] show in soils that have high clay amounts (Holland and Hugo) severe legacy compaction that is over SQS threshold can last up to 40 years. In soils with less clay and more rock fragments this effect is shortened (Marpa and Neuns). With fertility, a slight short-term decrease is due to less duff and dead material but with incorporation this becomes negligible. Also with stand thinning, residual trees are expected to respond with increased growth, root mass, soil organic matter and an overall increase of soil fertility. Project units 19 through 27 are composed of Hugo and Neuns soils, and the remaining units are Marpa and Holland.

**Table 3-30. Recovery rates for the Gemmill Thin Project**

| Recovery Rates for Project Activity (understory thinning) Soils | | | |
|---|---|---|---|
| **Soil Type** | **Erosion** | **Compaction** | **Fertility** |
| Holland | 3-5 years | 30-40 years | 1-2 years |
| Hugo | 3-5 years | 30-40 years | 1-2 years |
| Marpa | 3-5 years | 15-30 years | 1-2 years |
| Neuns | 3-5 years | 5-10 years | 1-2 years |

## Actions Considered

By focusing on the SQS and considering past and future foreseeable activities cumulative effects were evaluated for each alternative within project treatment units (see Table 3-31).

[109] Young et al. (2005)

**Table 3-31. Summary of Impacts and Other Management Actions for Alternative 1**

| Soil Resource | Past | Direct & Indirect | Future | Cumulative |
|---|---|---|---|---|
| **Erosion Hazard** | Low (2-4) | Moderate (5-7) | Low (3-4) | Low (3-4) |
| **Compaction** | Below threshold | 10.6 mi road decommissioned | None | 10.6 miles |
| **Fertility** | Moderate | Moderate | Moderate | Moderate |

Post-project cumulative erosion will be slightly elevated but will go to background levels after 2 to 3 years. This is shown in the recovery line graph (Figure 3-9). The WEPP erosion model was used for detailed analysis in the soils report[110] and shows that onsite erosion rates for the project (0.25 tons per acre) is well below 1 ton per acre; sediment delivery rates are very low (0.18 tons per acre) and are similar to predevelopment levels of (0.09 tons per acre). In comparison, clear-cuts on these soils with similar site conditions are only elevated by 30% (0.65 tons per acre) and severe wildfire often causes erosion rates in excess of 30-70 tons per acre depending on soil type. Landings (each less than ½ acre in size) have erosion rates that are similar to clear-cuts (0.34 tons per acre), and when mulched the rates are negligible (0.02 tons per acre). The same holds true of skid trails that are mulched or slash covered (from 39.9 pre, to 0.64 tons per acre post). All of these units, roads, skid-trails, landings, and prescribed burns have adequate buffers to limit sediment delivery into waterways.

For Alternative 1, implementation of resource protection measures and BMPs ensure that detrimental compaction will not take place, infiltration will not be impeded and overall soil quality will be maintained. Future foreseeable thinning in the analysis area are outside soils bounding area (project units) and would not cause soil-related effects that would be cumulative with the effects of this project.

Future foreseeable prescribed burning in Wilson and Hall City watersheds would be accomplished with a low to moderate burn prescription and would not affect soil fertility significantly. The effects of burning will be limited to low intensity burns that create mosaic landscapes to reduce fuel loads. Light duff consumption and shallow burning penetration has minimal effect on soil organic matter and duff consumption. Burning would be done with the assurance of protecting soil cover, soil organic matter, and consumption of no more that 50 percent of soil duff. Brush fields do contain vegetation that produce water repellency (Chemise, Manzanita, Buckbrush), therefore these areas will only be burned with a light prescription to reduce flashy fuels. Best Management Practices will be incorporated in future Forest Service fuel management activities to insure SQS will be met.

Soil fertility will be increased due to better infiltration and tree growth, which equates to more fine root development and increase of organic matter in the soil. In Mediterranean climates[111] the bulk of soil nutrients reside in the soil and duff, of which is released slowly over time. Root decay has been shown to be one of the main contributors to soil organic matter. Soil organic matter acts as a sink for soil nutrients that are readily available for breakdown by soil microorganisms and incorporation. Maintaining at least

[110] Results of WEPP modeling are summarized in Appendix L.
[111] Mediterranean climate – warm dry summers and cool moist winters.

50% duff and fine slash in an area is crucial to maintaining soil health and fertility. Post harvest fuel treatments will be moderate and soil health will be adequately protected.

## Affected Environment - Land Stability

The Gemmill Thin project area is geologically located within both the Eastern and Western Hayfork subterrane of the Klamath geomorphic province.[112] These two units are in fault contact and are separated by the northwest/southeast trending Wildwood fault.

The Eastern Hayfork subterrane (also known as the Sawyers Bar terrane) is a mélange, which can include mafic volcaniclastic rocks, thin bedded chert, argillite, pillow basalt, tuff, sandstone, limestone and serpentinite/peridotite. The limestone outcrops are especially apparent along the Wildwood fault contact. Hall City cave is located within one of these limestone rock units. The Western Hayfork subterrane predominates within the project area and is mostly composed of volcanogenic rocks ranging from crystal tuff and tuff breccia to coarse breccia but a small metasedimentary unit crops out in the southeast portion of the project area.

The project area is intruded by two plutons: the Goods Creek located in the southern portion of the area composed mainly of medium-grained hornblende-biotite-guartz diorite; and the Wildwood pluton located in the extreme north, composed of medium to coarse-grained biotite-pyroxene diorite. A northeast-southwest running fault separates the Wildwood pluton to the north from the Western Hayfork subterrane to the south.

Several large Pleistocene translational/rotational landslides have been located and mapped between Wilson Creek and Wilson Point along the trend of the Wilson Creek fault. These slides do not appear to be currently active. Both aerial photo interpretation and field inspection of the project area found very limited locations of active or potentially active landsliding. Several small inner gorges are located within the project area mostly along Hall City and Wilson Creek. Valley inner gorges are defined as those slopes adjacent to channel margins having gradients in excess of sixty-five percent. The valley inner gorge is formed through mass wasting triggered by channel downcutting, oversteepening and undercutting. Colluvial hillslopes and hollows are also found throughout the area especially within the Holland, Hugo, Marpa, and Deadwood soil series.

## Environmental Consequences - Land Stability

### Direct and Indirect Effects for Alternative 2

Current management and fuel conditions would continue, no direct or indirect effects are anticipated as indicated by past geomorphic conditions over the past sixty years.

### Direct and Indirect Effects for Alternatives 1 & 3

Direct impacts are usually measured in terms of soil losses at the potential slide source or in the cost of repairing road fill failures, road stabilization or removing landslide material. Indirect effects are caused by

[112] Irwin (1985)

the action and manifest later in time or farther removed in distance, but still reasonably foreseeable. This analysis reviewed not only the chances that a landslide may form at a particular place (unit, proposed road, etc) but also the chance that an action from further upslope may form a landslide downslope or that a landslide from farther upslope may affect an area further downslope. Each project unit was individually field evaluated. All proposed activity areas and road locations demonstrating instability or potential instability were flagged and omitted from treatment areas.

Studies by Megahan (1978) indicate that landslide frequency increases only slightly as overstory crown cover is reduced from 100% to 11%, but for crown cover reduced below 11% a major increase in landsliding occurs. Thinning prescriptions for project harvest units would retain a canopy closure of approximately 60%. No treatment would occur within inner gorge areas, or within approximately 50 feet of the high water mark of any stream channel, avoiding potential debris flow hazard zones.

The project design excludes all unstable or potentially unstable areas through individual unit layout, prescription, and road location modification. No direct or indirect effects to land stability are therefore anticipated from the action alternatives.

### Cumulative Effects for Alternatives 1 and 3

The cumulative effects analysis for land stability considered the effects of the proposed action alternatives along with those of future foreseeable actions (see Appendix E (Cumulative Actions Table – Table E-1) of this EIS). This analysis was bounded by the project area because the direct and indirect effects of the project to land stability would occur at that scale. Since no direct or indirect effects of the project are expected, no cumulative effects are anticipated.

## Affected Environment – Fisheries

The project is within the South Fork Trinity River Basin, Upper Hayfork Creek 5$^{th}$ field watershed. The project area contains four small third-order tributaries to Hayfork Creek; Chanchelulla Gulch, Wilson Creek, Goods Creek, and Hall City Creek. More detailed information on watershed condition within and downstream of the project area follows in *Chapter 3 – Hydrology*.

The South Fork Trinity River Basin (SFTR) is undammed and approximately 970 square miles in size, and is the largest tributary of the Trinity River. The terrain is predominately mountainous and forested. The SFTR has been the subject of several studies following the 1964 flood, which was the largest on record. Following the flood, fish populations declined severely and currently remain below pre-flood levels (PWA, 1994). The continued high rates of erosion and sedimentation are also considered a major contributor to the depressed anadromous fish runs in the river basin (PWA, 1994). The SFTR has one of the highest sediment loads in northern California. The high sediment loads have been attributed to unstable geology, management activities, and storm activity (Raines, 1998).

Upper Hayfork Creek Watershed, where the project is located, currently supports anadromous runs of Klamath Mountain Province (KMP) steelhead trout (*Oncorhynchus mykiss*), Pacific lamprey (*Lampetra tridentate*), and a remnant run of Chinook salmon (*Oncorhynchus tshawytscha*). The current distribution of spring-run Chinook salmon is approximately the boundary between the Middle and Lower Hayfork

Creek 5th field watersheds (see maps in Appendix A). In general, fall-run Chinook salmon utilize lower Hayfork Creek, with concentrated spawning occurring in the first three miles. Upper Hayfork Creek Watershed may have once supported coho salmon *(Oncorhynchus kisutch)*. Reports from early settlement days just speak of salmon with little or no distinction between Chinook and coho salmon. Steelhead are known to spawn in ephemeral and intermittent stream channels in the watershed provided sufficient water is present at the time of spawning (USDA Forest Service, 1998). The STNF conservatively assumes Endangered Species Act designated critical habitat for coho salmon as the range of winter-run KMP steelhead throughout the Forest.

Chanchelulla Gulch, Wilson Creek, Goods Creek, and Hall City Creek are small streams that drain from the project area. These streams provide habitat for steelhead in the lower reaches; Pacific lamprey are found in Wilson and Goods Creek. Non-anadromous fish species occurring in these streams are speckled dace and resident rainbow trout.

## Fishes of Special Interest

### Species Listed Under the Endangered Species Act

The Southern Oregon Northern California Coast (SONCC) coho salmon is listed as Threatened under the Federal Endangered Species Act (62 FR 24588; May 6, 1997) (Table 3-32). Designated critical habitat (64 FR 24049; May 5, 1999) encompasses accessible reaches of all rivers between the Mattole River in California and the Elk River in Oregon, inclusive. A detailed fishery Biological Assessment (BA) has been prepared to review the project proposals in sufficient detail to determine if the actions are likely to adversely affect the threatened species or its designated critical habitat. The BA has been prepared in accordance with legal requirements set forth under section seven of the Endangered Species Act (ESA) (19 U.S.C. 1536 (c)), and follows the standards established in Forest Service Manual direction (FSM 2672.42). The current status and distribution of coho salmon is summarized below.

The historical upper geographical limit of SONCC coho salmon in the South Fork Trinity River (SFTR) is unknown. Coots (1952) reported juvenile coho salmon in Butter (~3 miles upstream of the community of Hyampom), Eltapom and Olsen Creeks (PWA, 1994). In the past, coho salmon inhabited areas of the Middle Hayfork Creek 5th field watershed (USDA Forest Service, 2000). SONCC coho salmon however, are now thought to be extirpated from Upper and Middle 5th field watersheds. At present, the upstream distribution of coho salmon in Hayfork Creek is Corral Creek. SONCC coho salmon distribution information is based on juvenile presence/absence surveys conducted in 2002 by the Forest Service and the California Department of Fish and Game (CDFG). CDFG found juvenile SONCC coho salmon in Butter, Eltapom and Olsen creeks (M. Gilroy, 2002, personal communication). Olsen Creek is a lower tributary to Hayfork Creek. Forest Service crews reported sighting juvenile coho salmon at the mouth of Corral Creek, the next major tributary to Hayfork Creek upstream of Olsen Creek. These observations follow the 2001 adult spawning run which had the widest coho salmon spawning distribution in the Trinity Basin in recorded history.

National Marine Fisheries Service (NMFS) coast-wide status review summarizes available data on the SONCC coho salmon Evolutionary Significant Unit (ESU) abundance information (Weitkamp *et al.*,

1995). The rivers and tributaries in the California portion of this ESU were estimated to have average recent runs of 7,080 natural spawners and 17,156 hatchery returns, with 4,480 identified as native fish occurring in tributaries having little history of supplementation with non-native fish. Information on coho salmon population trends in the Trinity River basin is incomplete, but available information indicates that populations are small to nonexistent in some years. Existing information indicates that coho salmon adults are present in the Trinity River in early September and juvenile coho salmon are present in the main stem Trinity River throughout the year, including summer months, and also inhabit a number of tributaries (NMFS, 1999).

Coho salmon were noted to occur only in small numbers in the Klamath River nearly 70 years ago (Snyder, 1931), but have also been described as historically occurring in abundance within the basin (CDFG, 1994 as cited by NMFS, 1995). Coho salmon comprise the smallest population of the three anadromous salmonid species inhabiting the Trinity River. Because of the decline in distribution prior to the 1980s, together with the possibility of a severe reduction in distribution as indicated by the field surveys and the downward trend of most abundance indicators, it has been determined that coho salmon populations in the California portion of this ESU will likely become endangered in the foreseeable future.

The current distribution of SONCC salmon (occupied critical habitat) is approximately *30 river miles downstream of the project location*.

**Table 3-32. Summary of anadromous fish listing with the project area**

| Fish | FS Sensitive | FS MIS | ESA Listing | Listed Habitat |
|---|---|---|---|---|
| UKTR Chinook salmon | Yes | Yes | Not warranted | EFH |
| KMP steelhead trout | Yes | Yes | Not warranted | None |
| SONCC coho salmon | No | No | Threatened | CH, EFH |

## Forest Service Sensitive Species

The Klamath Mountain Province (KMP) steelhead and Upper Klamath Trinity River (UKTR) Chinook salmon (spring and fall run) are listed as a Forest Service Sensitive species. A detailed Biological Assessment and Evaluation (BA/BE) has been completed to evaluate the effects of the project on Sensitive fish species and their habitat, it is available in the project record. The current status of Sensitive fish species that could be affected by the project is summarized below.

### Steelhead Rainbow Trout

Listed as a candidate for Threatened status under the Federal ESA in 1998, steelhead in the Klamath-Trinity basin have had their range reduced by the construction of major dams on the Klamath, Trinity, and Shasta Rivers, with further declines caused by downstream changes to channels and water temperatures from decreased flows. Poor watershed management (connected with such practices as grazing, logging, and road building) has contributed to declines as well, especially as a result of siltation of holding pools and spawning riffles and increases in water temperatures due to loss of shading. Interactions with hatchery steelhead have contributed to further declines of wild populations, as may have fisheries, including catch of steelhead in gill nets on the high seas.

Summer steelhead populations remain the most imperiled runs in the Klamath River and are holding onto a small number of key populations. In addition to all the usual causes of decline, they are exceptionally vulnerable to poaching when oversummering in pools. As a consequence, during the 1990s there were perhaps 1,000-1,500 adults divided among eight populations - less than 10 percent of their former abundance (Moyle, 2002).

Although winter-run steelhead are not listed under the ESA, their numbers are down from historic levels. Fall-Winter-run steelhead are still widely distributed and fairly common in the basin, although much less abundant than formerly. Local anglers on the South Fork Trinity River reported a substantial decline in the abundance of winter steelhead post 1964 flood. This observation is consistent with findings of Rodgers (1972, 1973, *as cited in* PWA, 1994).


**Figure 3-10. Population Estimates for Winter-Run Steelhead in the Trinity Watershed above Willow Creek**

Figure 3-10 shows the California Department of Fish and Game estimates of adult winter-run steelhead populations for the Trinity River above the Willow Creek weir, including the South Fork Trinity River. The numbers of adult winter-run steelhead in the Trinity River appear to be increasing in the short-term.

NMFS has reviewed the biology and ecology of West Coast Salmon and Steelhead populations and trends; NMFS has also considered available information for potential ESA listing of resident rainbow trout. Preliminary conclusions are that Klamath Mountain Province (KMP) steelhead are not likely to become endangered in the foreseeable future, and that Federal ESA listing is not warranted for the KMP ESU (NMFS, 2003).

### Chinook Salmon

Chinook salmon in the Klamath River Basin upstream of the Trinity River confluence comprises the UKTR ESU. The Forest Service designated river-type ‘spring-run’ Chinook salmon a Sensitive species.

Adult spring Chinook salmon have a unique life history that involves migrating to the upper reaches of the natal stream during spring and summer. Much of the summer is spent holding in pools where they mature sexually. The spawning period usually begins during the latter part of September and continues through October. This life history pattern differs from the fall-run, which enter freshwater with almost mature gametes and spawn soon after during the fall period, usually lower in the watershed than spring-run Chinook salmon. Hyampom located at the confluence of the SFTR and Hayfork Creek is loosely considered the break between the distribution of spring and fall Chinook salmon on the SFTR. However, during years of drought or years having above average precipitation and higher fall flows, there may be considerable overlap in the distribution and use of spawning areas.

Historically, the SFTR had large runs of spring-run salmon (Barnhart 1994). In 1963 it was estimated that 7,000 to 10, 000 spring-run Chinook salmon spawned in the SFTR and its tributaries. In 1964, Lafaunce (1967) estimated the spring-run Chinook population to be 11,600 fish. The number of spring-run Chinook salmon returning the SFTR after the 1964 flood declined significantly.

Fall-run Chinook are known to use the South Fork Trinity River and the lower portion of Hayfork Creek when water flows are high enough to allow fish migration. South Fork fall Chinook are included in population estimates made by the California Department of Fish and Game from their Willow Creek Weir. Fall Chinook escapement in the SFTR basin has not been estimated as consistently as spring Chinook. La Lafaunce (1967) estimated 3,337 fall Chinook in 1964, prior to the flood. No estimates were made again until the 1980s, at which time the escapement was estimated to be as low as 345 in 1990 and as high as 2,640 in 1985. Because the spring Chinook run was more significantly affected than the fall run, indicators for both runs are included to provide a more rounded picture of desired conditions. For example, spring Chinook return to the basin in the spring and hold in the streams over the summer, while fall Chinook run in the fall; over-summer factors may have caused the greater decreases in the spring Chinook population. For fall Chinook, which haven't diminished in numbers in the SFTR basin as dramatically as spring Chinook, 3,000 returning spawners is a reasonable number to indicate population recovery (USEPA, 1998).

Higher spring Chinook escapement in the 1990s (Figure 3-10) may reflect the early stages of population recovery, coincident with apparent movement of sediment downstream, or it may reflect better conditions in those particular years. The current size of the spawning population, while growing, still remains at less than 10% of the run in 1963 and 1964, and less than 20% of the Trinity River Restoration Program goal (4,000 fish). The diminished fish populations in the basin, which began both with the period of increased management and the record flood in the basin, are the strongest indication of impaired habitat conditions, and recovered populations will be the strongest indication of recovered habitat conditions. In the future, if salmonids naturally reproduce at numbers that are close to those observed prior to 1964, it would be reasonable to conclude that habitat conditions are adequately supporting beneficial uses.

NMFS reviewed the biology and ecology of West Coast Salmon and Steelhead populations and trends; preliminary conclusions are that Upper Klamath Trinity River (UKTR) Chinook salmon are not

likely to become endangered in the foreseeable future, and that Federal ESA listing is not warranted with in the UKTR ESU (NMFS, 2003).

### Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation Management Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-297), requires all Federal agencies to consult with NMFS on all actions or proposed actions (permitted, funded, or undertaken by the agency) that may adversely affect Essential Fish Habitat. Essential Fish Habitat (EFH) is defined as those waters and substrate necessary to commercially important fish, including various Pacific salmon species, for spawning, breeding, feeding, and growth to maturity. In addition to their listing under the ESA, coho salmon are also managed by NMFS under the Magnuson-Stevens Fishery Conservation Management Act, which prompts an EFH consultation in addition to an ESA consultation. Similarly, EFH consultation is required for Chinook salmon habitat, even if they are not listed under ESA. EFH consultation is being consolidated with ESA consultation based upon the NMFS finding that the ESA Section seven consultation process used by the Forest Service can be used to satisfy the EFH consultation. In this regard, the project Fisheries BA/BE is the EFH assessment of the action.

### Management Indicator Species

Management Indicator Species (MIS) were chosen in the Forest Plan to represent several fish assemblages.[113] Table 3-33 summarizes the Forest fish MIS.

**Table 3-33. Shasta Trinity National Forest Management Indicator Species fishes**

| Fish Assemblage | Group MIS Representative |
|---|---|
| Anadromous Commercial/Recreational Sportfish | Spring-Run Chinook (South Fork Trinity River only) Winter-Run Steelhead |
| Anadromous Threatened, Endangered & Sensitive Sportfish | Spring-run (summer) Steelhead (South Fork Trinity River only) |
| Inland Coldwater Sportfish | Rainbow Trout |
| Inland Warmwater Sportfish | Largemouth Bass |

All anadromous group MIS representatives will be analyzed for this project, as it is within the range of winter-run steelhead. Inland sport fish groups will not be addressed for this project, as it is not located within the inland portion of the Forest.

## Environmental Consequences – Fisheries

The Gemmill Thin Fisheries Biological Assessment and Evaluation (BA/BE) is an in-depth analysis that evaluates expected effects of the project on fish, fish habitat, coho salmon designated critical habitat, Essential Fish Habitat and Riparian Reserve. The project BA/BE evaluates potential project effects on the factors and indicators determined to be important to anadromous fish habitat.[114] Indicators evaluated include water temperature, turbidity, chemical/nutrient contamination, physical barriers, substrate character, large woody debris, pool frequency/quality, large pools, off-channel habitat, refugia,

[113] See Forest Plan, page 3-11
[114] The Analytical Process for Developing Biological Assessments (USDA et al., 2004) defines specific indicators of fisheries habitat that are used in the Fisheries BA/BE to analyze/disclose effects of the project.

width/depth ratio, streambank condition, floodplain connectivity, changes in peak/base flow, increase in drainage network, road density/location, disturbance history, Riparian Reserve, and disturbance regime. Results of the comprehensive fisheries analyses, as they are relevant to the decision to implement this project, are discussed below.

The alternatives are evaluated for their projected effects (direct, indirect and cumulative) on the following resource areas:

- Fish Habitat and Riparian Reserve
- Fishes of Special Interest

## Alternative 2 – No Action

### Direct and Indirect Effects

#### Fish Habitat and Riparian Reserve

Alternative 2 will have no direct effect on fish habitat or Riparian Reserve.

Alternative 2 will allow natural processes to occur in Riparian Reserve and fish habitat. Some Riparian Reserve timber stands are currently over stocked and in poor health, Alternative 2 will not improve riparian timber stand health. Fish habitat is recovering from historic mining and timber harvest, Alternative 2 will allow passive habitat restoration to continue.

#### Fishes of Special Interest

Alternative 2 will cause no effects to fish habitat or to fish. Improvement to habitat could be expected over time as areas recover from historic disturbance and fish numbers could increase. When combined with foreseeable actions of removing fish migration barriers on Forest and County roads, slight improvements to fish habitat and fish populations may occur over the long-term.

## Alternatives 1 and 3

### Direct and Indirect Effects

#### Fish Habitat and Riparian Reserve

Direct effects to fish habitat may occur at water drafting locations and would be limited to bank trampling, vegetation disturbance, and erosion on one side of the stream for a distance of less than 20 linear feet. Therefore the project may have insignificant negative effects on streambank condition in coho salmon critical habitat at several water drafting and road work sites. Although it would occur in designated critical habitat for coho salmon, drafting is not expected to affect coho salmon because the closest they are known to occur to proposed drafting sites is 30 miles downstream. The action alternatives will directly affect conifer density within the outer 100 feet of Riparian Reserve associated with ephemeral and intermittent streams. No treatment is proposed within Riparian Reserve of fish-bearing or perennial streams. Conifer canopy density will be reduced from 60% to 90% down to 60%, allowing the remaining trees in the stand to develop late successional characteristics.

Several project elements[115] may have insignificant negative effects on water temperature. The additive effects are still expected to be insignificant because decreases in stream shade are too small to be measured and will not result in any measurable increases in solar radiation reaching the stream channel. The project would have insignificant negative effects on turbidity and substrate from several project elements. The additive effects are still expected to be insignificant to fish habitat because effects will be spatially and temporally separated. Any turbidity or sediment that is generated from the project will be distributed over several thousand acres of watershed, this will result in significant dilution of any local effect and because of different drainage patterns and stream lengths, effects will not be concentrated at any single time.

The project may have insignificant negative short-term effects on pool frequency and depth by slightly increasing localized sediment supply due to ground disturbance. The project is also expected to have long-term positive effects to pool frequency through a reduction in sediment supply through better road drainage and surfaces. The project will have insignificant negative short-term effects due to physical disturbance from thinning within outer portions of select Riparian Reserve, and insignificant long-term positive effects on Riparian Reserve tree growth.

### Fishes of Special Interest

The action alternatives have very limited potential to have any direct effects on fish. No management actions are planned within Riparian Reserve of streams that contain fish. The only planned action that may occur within streams that contain fish is water drafting. Implementing NMFS pumping guidelines for flow rates, flow volumes and proper screening is expected to fully protect all fish species; drafting is proposed in areas where coho salmon are not expected to occur. The summary of effects to primary elements of fish habitat is presented here.

Water temperatures within the project area are well within the properly functioning range and are not expected to increase due to the project. Riparian Reserve and stream banks necessary for cover during rearing will not be affected by the project because of the limited streambank disturbance that may occur during the project. The project may lead to slightly increased turbidity during the winter rearing period although increases are not expected to be great enough, or of long enough duration, to affect foraging or growth.

Adult fish migration occurs during high flow events between October and December, several indicators that relate to this activity may be affected by the Gemmill project. Short-term increases in peak flow may result as an effect of compacted and disturbed ground. These increases are modeled to be well within the threshold of concern[116] for these watersheds resulting in no changes that would affect fish migration. Turbidity may have some short-term increase during runoff events that would result in changes to navigation however these short-term changes are not expected to be great enough to hinder the overall migration pattern of any fishes that may be present.

[115] The Fisheries BA/BE separates discrete project activities into “project elements” for purpose of analysis. Project elements include harvest, yarding, fuels treatment, road work, and hauling.
[116] Threshold of concern (TOC) is explained in more detail in *Chapter 3 – Hydrology*.

## Cumulative Effects – Alternatives 1 and 3

To analyze the cumulative effect(s) of the project on Fishes of Special Interest, Fish Habitat and Riparian Reserve, the unit of measure used to quantify the effect(s) is the proper functioning condition based on watershed condition class (WCC). The condition of instream (fish and fish habitat) and near stream (Riparian Reserve) resources is highly dependant on the overall condition of the watershed. The WCC is derived from the water quality cumulative effects model (see hydrology section) and is rated from WCC I to WCC III.

- **WC I** - Watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. The drainage network is generally stable. Physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian systems are predominantly functional in terms of supporting beneficial uses.
- **WC II** - Watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. Portions of the watershed may exhibit an unstable drainage network. Physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian systems are at risk in being able to support beneficial uses.
- **WC III** - Watersheds exhibit low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. A majority of the drainage network may be unstable. Physical, chemical, and biologic conditions suggest that soil, riparian, and aquatic systems do not support beneficial uses.

Data gathered during instream surveys in the project area have validated the WCC as derived from the cumulative watershed effects modeling.

Cumulative effects to Fishes of Special Interest, Fish Habitat and Riparian Reserve are addressed by 8$^{th}$ field subwatershed. The 8$^{th}$ field subwatershed is the most appropriate scale to analyze effects of this project to Fishes of Special Interest, Fish Habitat and Riparian Reserve because smaller field subwatersheds are generally too small to support fish. Larger scale (6$^{th}$ field) subwatersheds would dilute effects enough that impacts from this individual project would likely be unrecognizable. Two subwatersheds are addressed; Hall City Creek and Wilson Creek.

See *Chapter 3 Hydrology* for a discussion of WCC time frames. Effects from permanent features such as roads will persist in perpetuity and effects from activities such as tree thinning may be completely recovered in 15 years or less. The effects to fish habitat often lag behind upland effects due to the length of time that it takes for streams to recover. Changes to fish habitat and the resultant effects to fish are often five to ten years behind those noticed in upland areas.

**Table 3-34. List of watersheds and land use activities analyzed**

| 8th Field HUC | Drainage Area (acres) | Activities Analyzed |
|---|---|---|
| Goods Creek | 1537 | mining, roads, and timber |
| Hall City Creek | 2344 | mining, roads, and timber |
| Wilson Creek | 1812 | mining, roads, and timber |
| Chancheulla Gulch | 1772 | mining, roads, and timber |

Road construction, harvest, yarding, and fuels treatment (Alternatives 1 and 3) will result in insignificant short-term negative effects to peak/base flow through increases in compaction and increasing the drainage network. Short-term increases on the drainage network (negative effect) will occur as a result of temporary roads and road re-construction. Project-specific resource protection measures developed by the interdisciplinary team (see Chapter 2) are likely to limit the negative impacts to a level that cannot be meaningfully measured.

Road reconstruction and road rehabilitation will result in insignificant short-term and long-term beneficial effects on peak/base flows and drainage network by decompacting problem areas and removing roads that interfere with the drainage network.

**Table 3-35. Summary of Cumulative Watershed Effects Analysis for Alternatives 1 and 3**

| 8th Field HUC Watershed Name | WCC (existing) | Short-term (1 years) WCC (Alt 1&3) | Long-term (10 years) WCC (Alt 1&3) |
|---|---|---|---|
| Goods Creek | II | III | III |
| Hall City Creek | II | II | II |
| Wilson Creek | I | II | I |
| Chancheulla Gulch | I | I | I |

Modeling of the post project subwatershed condition (Table 3-35) shows a short-term change from the current conditions in two of the subwatersheds. Over the long-term, the Goods Creek subwatershed shows some degradation (increased fine sediment levels) primarily as a result of private timber harvest; all other subwatersheds show recovery to existing condition.

Alternatives 1 and 3 will maintain the current WCC in three of the four subwatersheds and thus maintain fish habitat and fish populations at current levels. Improved fish passage at County and Forest roads will allow anadromous fishes to access more habitat. Goods Creek is modeled to decrease in WCC due to private timber harvest. Improvements in fish passage will allow fish to use more habitat in the creek but habitat quality and quantity may be decreased from its current level.

## Affected Environment – Hydrology

### CWE Analysis Watershed Characterization

The project area is located within the Klamath Geomorphic Province, and the drainage network dissects meta-sediment and diorite rock types. The project area is bounded to the west by a low gradient reach of Hayfork Creek and to the east by the Sacramento and Klamath Rivers watershed divide. The average annual precipitation is about 55 inches. Flooding typically occurs between early December and mid February. Major flooding occurs during El Nino weather cycles and results from warm mono winds and rapidly melting snow. The largest flood of record occurred in 1964, where the South Fork Trinity River near the community of Hyampom peaked at about 84,000 cubic feet per second. Another significant flood

occurred in 1997 that blew out several stream-road crossings within the project area. In December 2003 and 2006, Upper Hayfork Creek, including Goods Creek, peaked above flood stage and washed out roads and inundated homes near Wildwood.

**Table 3-36. Gemmill Project Watersheds**

| Watershed Name | WS # | 8th Field HUC | Drainage area (acres) | Drainage area ($mi^2$) | Mean Elev (ft) | 2 Year Flood Q (cfs) | 25 Year Flood Q (cfs) | Relief Ratio | Stream Density (-mi) | Geomorphic Index (Ps) >Q25 | Time of conc (Tc) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Good's Creek | 3 | 1801021203010304 | 1537 | 2.4 | 3655 | 138 | 568 | 0.11 | 6.4 | 0.06 | 0.42 |
| Unnamed South | 4 | 1801021203010305 | 361 | 0.6 | 3587 | 38 | 161 | 0.08 | 3.8 | 0.01 | 0.31 |
| Hall City Creek | 2 | 1801021203010401 | 2344 | 3.7 | 3670 | 201 | 819 | 0.10 | 5.8 | 0.09 | 0.68 |
| Unnamed North | 6 | 1801021203010402 | 325 | 0.5 | 3420 | 35 | 149 | 0.24 | 8.1 | 0.03 | 0.13 |
| Wilson Creek | 1 | 1801021203010403 | 1812 | 2.8 | 3864 | 155 | 649 | 0.10 | 5.7 | 0.10 | 0.69 |
| Chanchelulla Gulch | 5 | 1801021203010502 | 1772 | 2.8 | 3664 | 156 | 643 | 0.14 | 5.7 | 0.16 | 0.48 |
| Watershed Areas | -- | -- | 8150 | 12.7 | 3660 | 617 | 2424 | 0.17 | 5.9 | -- | -- |

The watersheds within the project area range from 325 to 2,344 acres, have an average relief ratio of 13%, an average elevation of 3,643 feet, and the drainage network is pear shaped and has a contorted dendritic pattern. The drainage size, network geometry, and density of tributary confluences indicate that confluences are likely locations of channel change and sources of channel complexity (Table 3-36 and Figure 3-11) (Benda et al., 2004). The majority of the stream channels are transport reaches (i.e., 3-20 % gradient) and source reaches (i.e., > 20 %), with coarse gravel bed-material, and deliver sediment to Hayfork Creek (Figure 3-11). There is less than 3 miles of response channel types with the majority in Hayfork Creek and the lower end of Good's, Hall City, and Wilson Creeks (Figures 3-11 and 3-12). The drainage network has downcut through more erodible bedrock (e.g., diorite) and fault zones. The present channel morphology is formed by large episodic (i.e., acute $>Q_{25}$) pulses of sediment and woody debris and is maintained by average annual bankfull flows ($Q_2$) (Table 3-36). The geomorphic index indicates that these watersheds have a 0.10 sediment delivery ratio meaning these are steep watersheds with limited sediment storage capacity that deliver sediment directly to the response reach of Hayfork Creek (Table 3-36). These high gradient channels limit sediment storage potential and provide limited aquatic habitat as compared to the more limited sections of lower gradient channels as found at the mouth of Chanchelulla and Hall City Creeks (Figure 3-11).

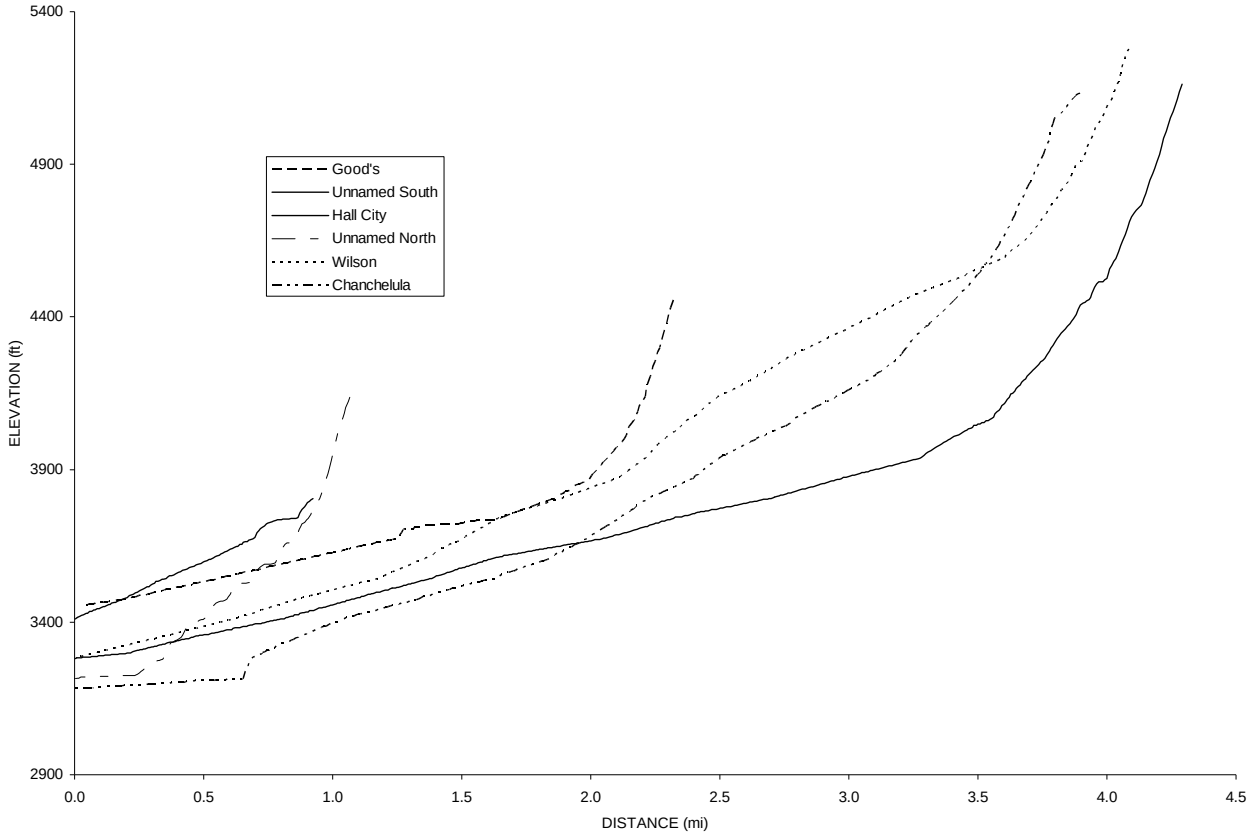



**Figure 3-11. Longitudinal profiles of main channels for Gemmill Project watersheds listed in Table 3-36. Horizontal distance represents the distance from Hayfork Creek. Vertical exaggeration is about 7 times.**

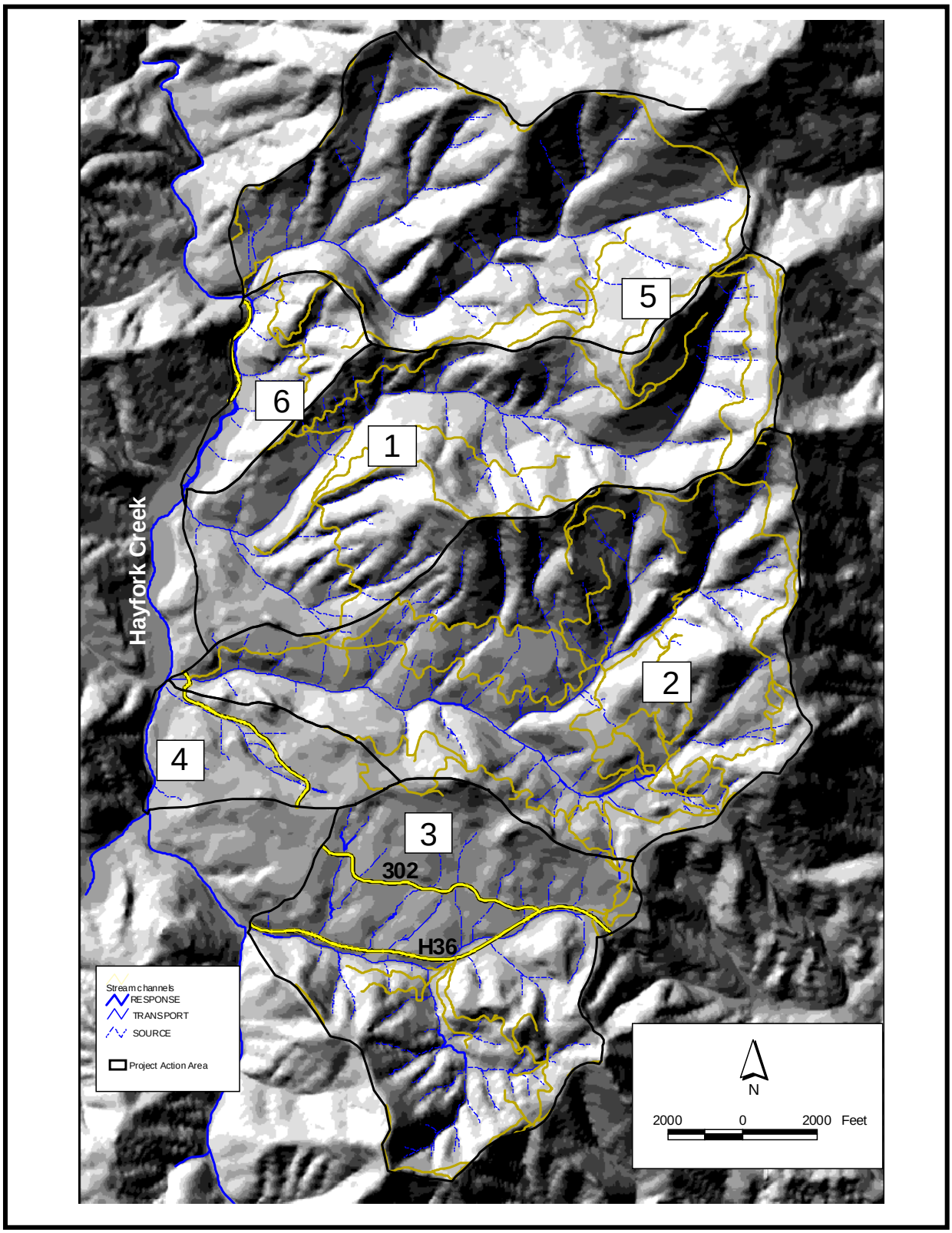



**Figure 3-12. Map illustrating the Gemmill Project area 8th Field HUC watersheds. Numbers in white squares correspond to watershed name and HUC number (see Table 3-36)**

## Water Quality and Geomorphology

### Gemmill Project CWE Analysis Overview

For the Gemmill Project, the Cumulative Watershed Effects (CWE) analysis process developed for the Shasta-Trinity National Forest, Klamath Geomorphic Province (Fitzgerald, 2007) is used to characterize and quantify the current and potential condition of water quality and quantity. The Equivalent Road Area (ERA)[117] and sediment budget methods are used to account rainfall runoff upland sediment delivery, sediment transport, and catchment sediment yield. The type, amount, frequency, duration, and timing of upland rainfall, runoff, and erosion are qualified and quantified using existing and project specific data. The three levels of CWE analysis include:

- **Level I**: relies on Haskins (1983) method, existing data, and the Forest Plan WCC to quantify the risk of CWE;
- **Level II**: relies on modified Haskins (1983) method, existing and field extensive data, and the CWE risk matrix to quantify the risk of CWE; and
- **Level III**: relies on Haskins (1983) and sediment budget, existing and field intensive data, and the CWE risk matrix to quantify the risk of CWE.

The level of CWE analysis is a function of the overall risk of the project negatively impacting water quality, quantity, and beneficial uses. Small projects (i.e., less than 200 acres) in the uplands with limited hydrologic connectivity (i.e., very few controllable sediment discharge sources) only need a Level I CWE analysis; whereas large projects (i.e., greater than 1,000 acres) with the potential for catchment scale impacts need a Level III CWE analysis.

For the Gemmill Project, a Level III CWE analysis was completed. Field extensive landform and land use data were collected, and a sediment budget was developed. The CWE process includes analysis of subwatersheds that drain out of the project area into Hayfork Creek. Hayfork Creek is water quality impaired by sediment and a Total Maximum Daily Load[118] is in place for reducing sediment to levels that will support local resident and anadromous fish. The Level I CWE analysis results indicated a high risk of negative cumulative watershed effects. Subsequently, a Level II and III CWE analyses were completed. Analysis results were used to develop project specific resource protection measures. Field extensive upland landform and land use data were collected, field intensive instream data were collected, and a sediment budget was developed. High risk subwatersheds were identified and analyzed further to determine which actions need to be taken to maintain or improve watershed condition. The project, including protection measures, was designed to prevent new controllable sediment discharge sources, eliminate existing sources, disconnect the road network from the drainage network, and to reduce the risk of stream-road crossing failure.

[117] ERA is defined in Appendix B Glossary
[118] See USEPA (1998) for the Total Maximum Daily Load document.

## Geographic Boundary

The project area includes four 8th Field HUC watersheds and two small unnamed subcatchments (Figure 3-12). The topographic boundaries defining a given watershed are used to geographically define the area because land disturbances within a given watershed can directly and indirectly impact downstream water quantity and quality and channel stability. Upland disturbances that change the magnitude, frequency, timing, and duration of runoff and sediment delivery are evaluated within the subcatchment watershed boundaries. The greatest risk for sedimentation is from units adjacent to streams or within and adjacent to unstable areas.

### Time Frame

This CWE analysis process utilizes a land use history to quantify the past and present impacts. Within the project area, placer and strip mining impacts that occurred before 1940 are presently directly and indirectly impacting stream channel stability in Hall City Creek. The existing roads and past and current timber harvest activities directly impact sedimentation levels in the South Fork Trinity River and its tributaries (Raines, 1998).

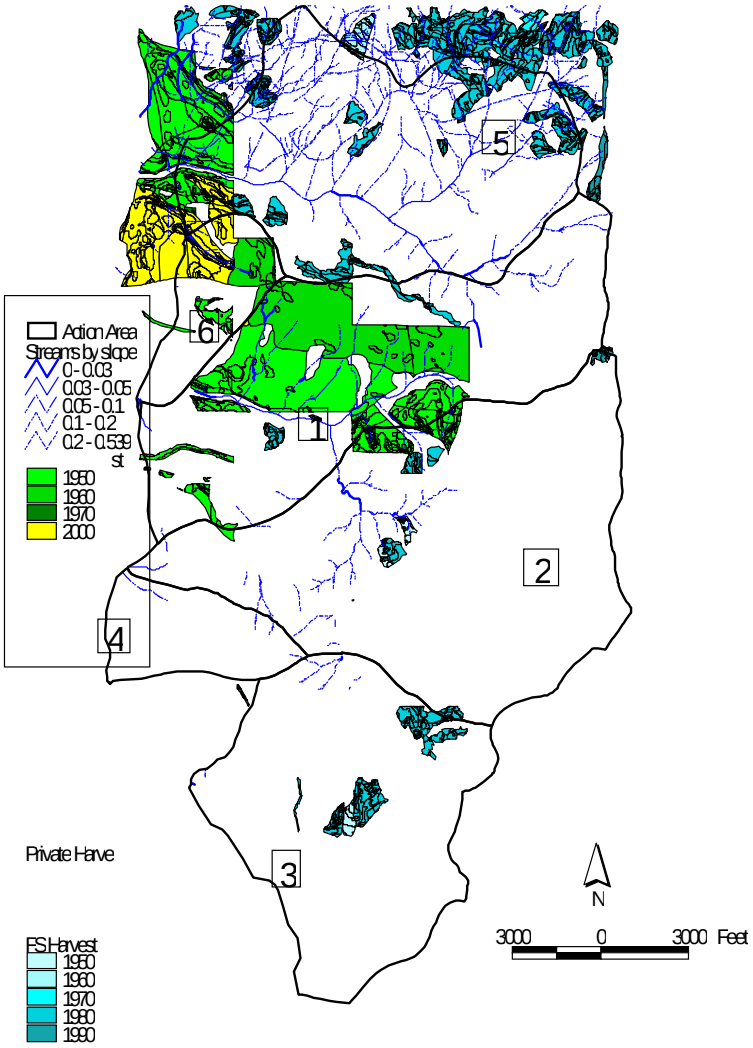



**Figure 3-13. Map illustrating the timber harvest history by land ownership and decade**

The timeframe of the potential impacts from the proposed action depends on the recovery period of a given activity. The longest lasting impacts are from roads and they recover little over time unless specific measures are taken to reduce runoff and controllable sediment discharge. Improvements to road drainage reduce the additive and compound impacts, but recovery from ground disturbance created by roads is very slow. Most direct disturbances caused by timber harvest activities recover within 10 to 40 years, depending on the type of activity. Prescribed burning and fire suppression actions tend to recover in five to 10 years; and watershed restoration activities like road decommissioning tend to recover in one to three years.

This analysis assumes that it will take three years to complete timber harvest activities, whereas the remaining treatments such as road decommissioning may take up to 10 years to complete. This analysis assumes that applicable USDA Forest Service Region 5 Best Management Practices and project specific resource protection measures[119] are implemented to prevent the direct, indirect, and cumulative effects of land use activities associated with this and other connected Forest Service projects. Treatments like soil ripping and road decommissioning will help reduce direct and indirect impacts caused by road and timber harvest activities until they recover within about 10 years following project implementation.

The timeframe of impacts caused by foreseeable actions is 10 years after project implementation. It is difficult to predict what activities will occur on private land; however, road and timber activities are very likely to continue for the reasonably foreseeable future. Additional watershed restoration activities are expected to continue such as replacing stream crossings in Wilson and Goods Creeks, see Cumulative Actions Table E-1 in Appendix E. These projects are expected to reduce erosion and sedimentation and improve habitat for beneficial uses of water and ultimately will directly benefit watershed condition.

## Environmental Consequences – Hydrology

The direct, indirect, and cumulative environmental consequences of implementing either no action, Alternative 1 (proposed action), and Alternative 3 of the Gemmill Project have been evaluated using the CWE analysis process described above. This analysis quantifies the present watershed condition relative to background or pre-human disturbance conditions and known land use disturbances caused by timber harvest activities, road construction and use, mine operations, wildland fire/fuel treatments, urban development, and grazing. The future watershed condition is estimated by factoring the potential impacts from the proposed action, connected actions (e.g., roads and fuels treatments), and foreseeable future actions (e.g., private timber harvest). Impacts from urban development and grazing are not quantified as part of the ERA or sediment budget because the area of impact is too small to be quantified (i.e., < 10 acres); however, urban impacts are indirectly accounted for by including private roads.

As explained in *Chapter 3 – Fisheries*, Watershed Condition Class (WCC) is used to describe likely conditions for instream (fish and fish habitat) and near stream (RR) resources. WCC predicts the condition of these resources through cumulative effects modeling that considers effects of management actions and natural events (i.e. wildfire and flood events).

### CWE Analysis Level and Confidence

For the Gemmill Project, the CWE analysis completed relied on field verified data and information. Due to the intensive field effort, the confidence in analysis is medium to high. About 45% of the available land use history data and information were ground verified which focused on past timber harvest, road condition, mine impacts, and other public uses. Due to the quality of the data, the ERA results have an error of +/- 10%, and the sediment budget results have an error of +/- 50%. The relatively low margin of error, especially for the sediment budget which normally has an error of over 100%, provides a

[119] Project-specific BMPs are in Appendix M, and resource protection measures are in Chapter 2.

conservative level of resource protection in the form of offsetting mitigation measures and watershed restoration treatments.

## Direct and Indirect Effects for Alternative 2

Based on the results of the existing condition Level III CWE analysis, most of the streams draining the project area are in a moderate condition (i.e., WCC II and CWE Risk Rating of 3) and are not supporting beneficial uses.[120]

Controllable sediment discharge from sources created by past land use activities is degrading fish habitat in Good's and Hall City Creeks. For the affected area, the existing CWE analysis results indicate a minor increase over background levels in chronic sediment delivery and a moderate increase in acute sediment delivery, with minor increases in turbidity, and a moderate stress on fish. The geographic extent of sediment impacts are moderate, immediately offsite, and do not translate to watershed scale impacts (i.e., Hayfork Creek). The duration and frequency of sediment delivery is moderate, relative to background, and is having an intermittent effect on beneficial uses.

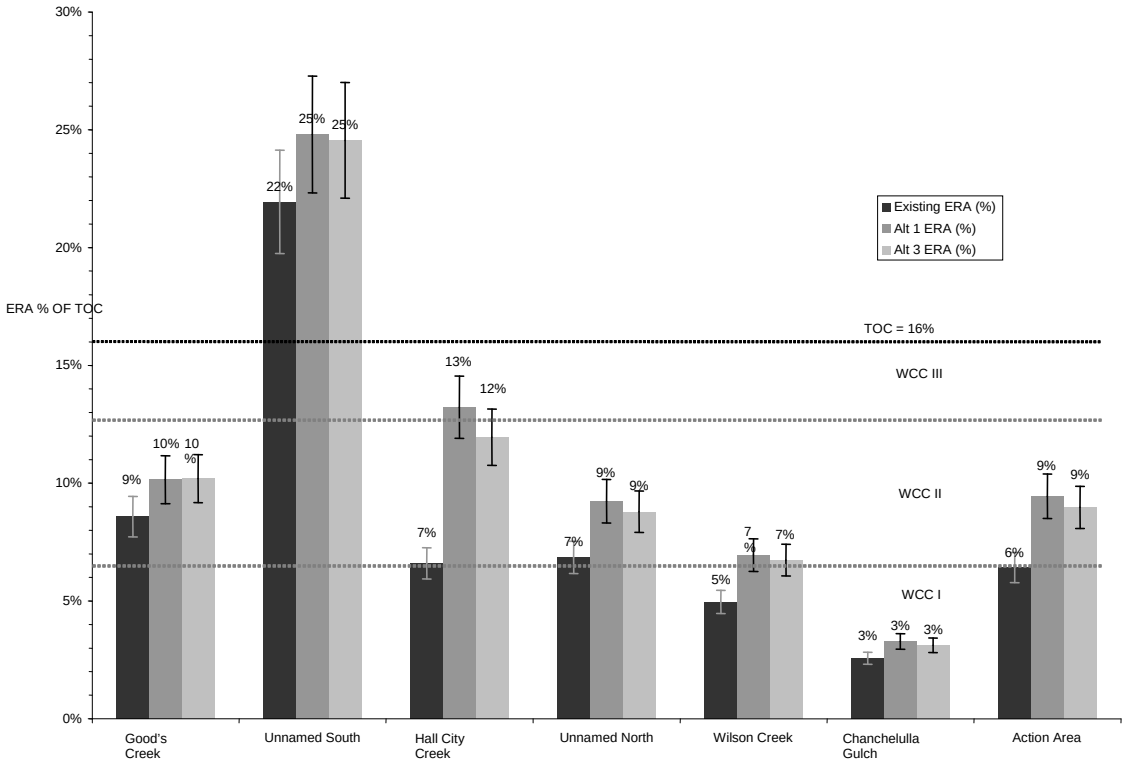



**Figure 3-14. Level I and II CWE analysis ERA model results for the affected area and Risk of Adverse CWE. High risk is >16%, Moderate risk is 13%, and low risk is <6%**

The percent over background sediment yield from acute ($Q_{25}$) sediment delivery (Figure 3-15) is significantly higher than the 250% of background highest risk level identified however there is basically

[120] As described in USEPA (1998)

little difference between the alternatives. The reason for this is that with storm events of this magnitude overland flow will occur and there will be a greater potential for erosion on newly disturbed sites. Overland flow will transport sediment to stream channels under each alternative (including the no action) at rates greater than 250% of normal. The chronic sediment delivery ($Q_2$) flood event (Figure 3-16) predicts a sediment yield that is substantially less than 125 % over background threshold (Figure 3-16) which means there is a relatively low risk for increased sedimentation with a relatively small frequent storm as opposed to what would be likely to happen with a larger storm event such as a storm with a 25 year recurrence interval.

Hall City Creek has an existing CWE risk of two (Figure 3-14), mainly due to controllable sediment discharge. The excess sediment delivery increases downstream with roads, legacy mining, and timber harvest activities contributing sediment. Where Trinity County Road 302 crosses Hall City Creek, the road creates a fish migration barrier and commonly overflows during average flood events. Field data show that the road has overflowed three of the last five water years. Trinity County (2002) inventoried the crossing and rated it as a fish migration barrier with a moderate priority due to the lack of upstream data. Substantial fill erosion and diversion occur as a result of the undersized culvert, and there is potential fish habitat upstream.

Goods Creek has an existing CWE risk of two (Figure 3-14), mainly due to controllable sediment discharge and channel alteration from Highway 36. The 29N28 road crossing creates a fish migration barrier. This stream-road crossing will be upgraded by the end of 2006 to improve fish and flood passage. Wilson Creek has an existing CWE risk of one (Figure 3-14). The road network is semi-stable with limited active surface erosion, and past timber harvest activities are almost fully recovered. The main issue for Wilson Creek is at the 30N04 road crossing that creates a fish migration barrier. This stream-road crossing will be upgraded by the end of 2008 to improve fish and flood passage. Chanchelulla Creek has an existing CWE risk of one (Figure 3-14). The north and north-east portion of this watershed drain wilderness and road-less area, and disturbances caused by past timber harvest are almost fully recovered.

## Direct and Indirect Effects for Alternative 1

The project was designed with resource protection measures designed to prevent degrading the water quality and beneficial uses of streams draining the project area. This analysis evaluates the direct and indirect impacts of the proposed harvest activities, fuel treatments, temporary road and landing construction, road drainage improvements, and road decommissioning, and it evaluates the cumulative effects of the project combined with connected actions and future foreseeable actions that include prescribed burning, plantation management, and private timber harvest (Figure 3-15).

As designed, Alternative 1 will not cause any direct or long-term indirect impacts that further exacerbate runoff and sediment delivery. During project implementation, the probability of chronic sediment delivery increases where haul roads, landings, temporary roads, and timber harvest activities dissect or are near streams. Short-term sediment delivery is probable at stream road or skid trail crossings. The Level III CWE analysis shows an increase in chronic sediment delivery ($Q_2$) for five to 10 years following project implementation. Disturbances associated with Alternative 1 do not raise sediment yield

over the 125 % over background threshold; however, when combined with connected and foreseeable actions, that include prescribed burning, Hall City Creek exceeds the threshold for the first five years following implementation (See Figures 3-14 and 3-15). Relative to present and foreseeable acute sediment yield, the short-term increases in chronic sediment are minor and will not measurably degrade water quality (See Figure 3-15 and 3-16). The potential impacts will be localized (i.e., less than ¼ mile downstream), minor, and last for two to three years.

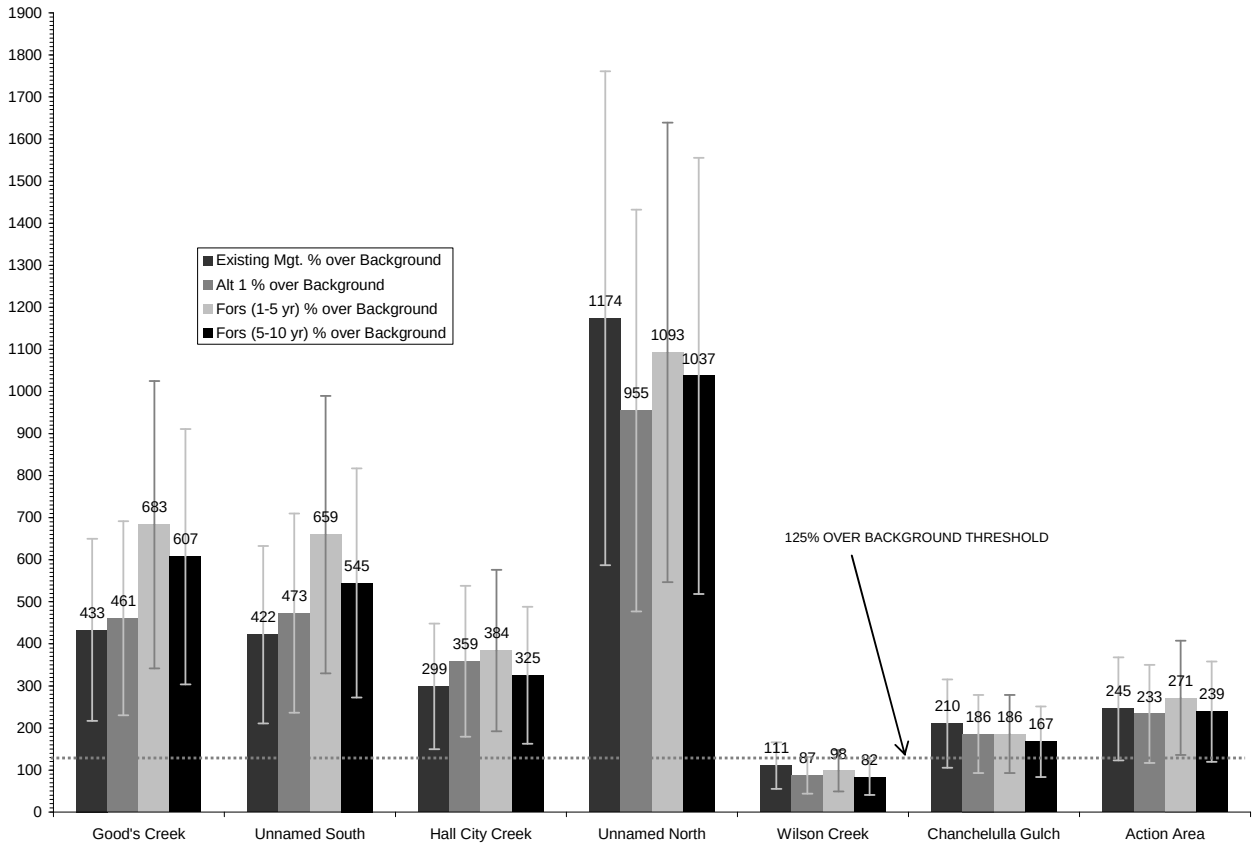



**Figure 3-15. Sediment yield $Q_{25}$ (i.e., acute) percent over background for existing, Alternative 1, 1-5 years post project, and 5-10 years post project.**

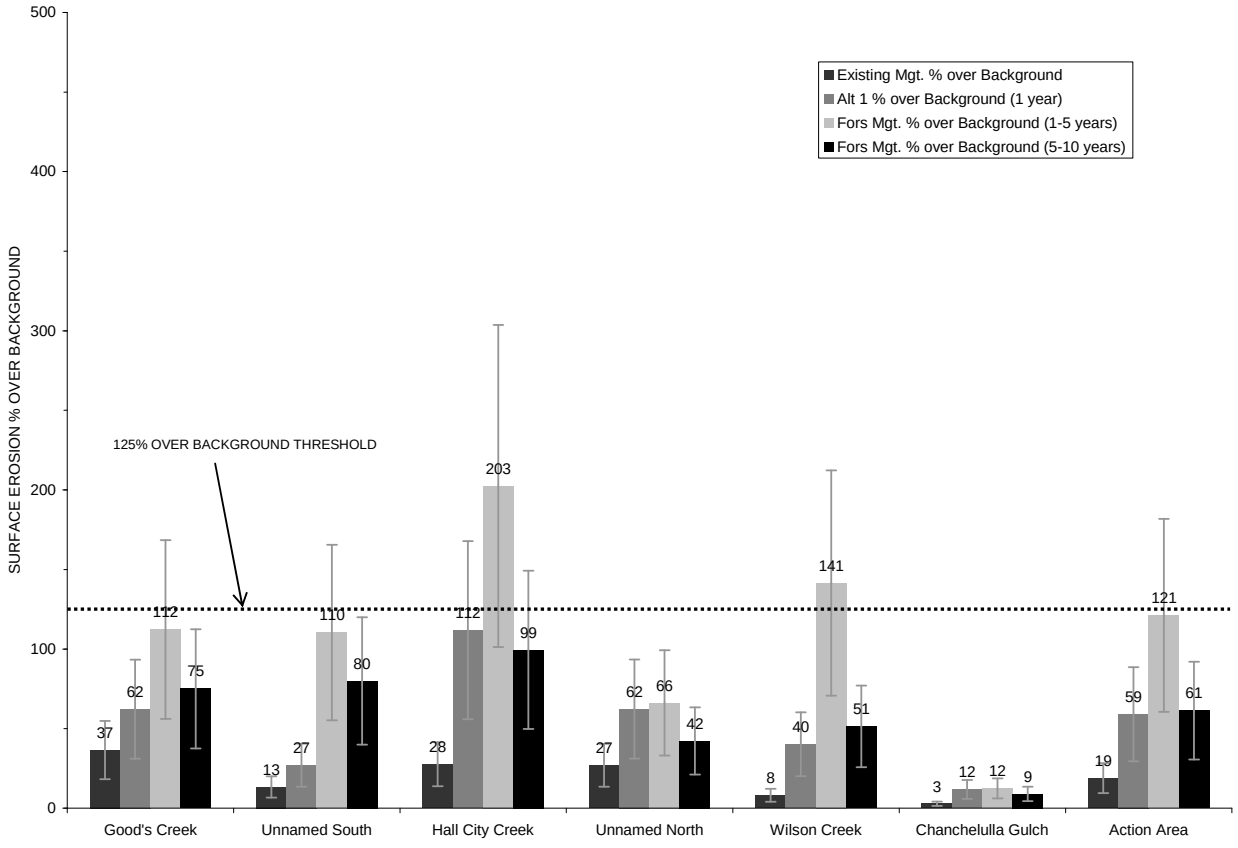



**Figure 3-16. Sediment yield $Q_2$ (i.e., chronic) percent over background for existing, Alternative 1, 1-5 years post project, and 5-10 years post project.**

Small short-term increases in chronic controllable sediment discharge ($Q_2$) are shown for Chanchelulla Creek (Figure 3-16) and long-term decreases are shown for acute sediment yield. The increased chronic sediment yield results from the future foreseeable prescribed burning, and not the proposed action. Regardless, the watershed would recover within five years of project implementation. Long-term the CWE risk is predicted to decrease and the WCC will be maintained and slightly improved (Figure 3-14). This improving trend is based on the reasonably foreseeable future activities on public lands that include fish passage improvement projects and road decommissioning.

Small increases in chronic controllable sediment discharge are shown for Wilson Creek (Figure 3-16). These short-term increases result from the future foreseeable prescribed burning. These impacts will recover within five years of project implementation. Long-term the CWE risk is predicted to decrease, the WCC is maintained, and acute sediment yield ($Q_{25}$) slightly decreases (Figures 3-14 and 3-15). A substantial increase in chronic sediment yield was predicted for Hall City Creek (Figure 3-16). Within five years of project implementation, Hall City Creek will exceed the 125% over background threshold for sediment yield (Figures 3-14 and 3-15). Relative to present and foreseeable acute sediment yield, the short-term increases in chronic sediment are minor and will not measurably degrade water quality (Figures 3-16 and 3-17). The potential impacts will be localized (i.e., less than ¼ mile downstream),

minor, and last for two to three years. A substantial increase in acute sediment yield ($Q_{25}$) above the present level was predicted for Good's Creek (Figure 3-15). Most of the increases result from activities on private land. The short-term increases in chronic sediment ($Q_2$) are minor and do not exceed the TOC (Figure 3-16).

One of the purposes of this alternative is to maintain and improve the long-term watershed condition. The resource protection measures, listed in Chapter 2, are designed to minimize the short-term impacts from timber harvest, fuels reduction, and road use activities and improve long-term watershed condition. Measures aimed at reducing peak flood flows and controllable sediment discharge are focused on disconnecting the road network from the stream channel by reducing road-stream crossing diversion potential and improving road drainage. In addition, soils within the disturbed areas will be de-compacted to improve infiltration and vegetation recovery at the watershed scale. Implementation of BMPs as well as the decommissioning of approximately 12 miles of existing roads, trails, old skid trails that are discharging sediment is expected to eliminate existing erosion sources and prevent new ones. Decommissioning entails removing culverts, ripping and out sloping the road surface, and closing road junctions. The goal of road decommissioning is to control surface runoff and erosion leaving the road unavailable for future use. See Appendix C for a list of roads proposed for decommissioning.

## Direct and Indirect Effects of Alternative 3

Like Alternative 1, this alternative is designed to prevent degrading water quality and beneficial uses. The major difference is that timber harvest activities prescribed in Alternative 3 will cause less ground disturbance because this alternative includes an 18 inch DBH[121] cutting limit which will result in less overall ground disturbance and subsequent runoff and erosion. This analysis evaluates the direct and indirect impacts of the proposed harvest activities, fuel treatments, temporary road and landing construction, road drainage improvements, and road decommissioning, and it evaluates the cumulative effects of the project when combined with connected and foreseeable actions that include prescribed burning, plantation management, and private timber harvest.

As designed Alternative 3 will not cause any long-term direct or indirect impacts that further exacerbate runoff and sediment delivery. Overall, Alternative 3 will not cause as much ground disturbance as Alternative 1, but the difference is insignificant since the short-term disturbances from haul roads, landings, temporary roads, and timber harvest are relatively the similar, and the fact that other foreseeable actions (i.e., private timber harvest) will contribute to increased sedimentation regardless of Forest Service actions (Figures 3-17 and 3-18). The Level III CWE analysis shows an increase in chronic sediment delivery ($Q_2$) for each of the watersheds. Disturbances associated with Alternative 3 do not raise chronic sediment yield over the 125% over background threshold; however, when combined with connected and foreseeable actions Hall City Creek exceeds the threshold for the first five years following implementation (Figure 3-18). Relative to present and foreseeable acute sediment yield ($Q_{25}$, Figure 3-

[121] Diameter at breast height

17), the short-term increases in chronic sediment are minor (Figure 3-18). The potential impacts will be localized (i.e., less than ¼ mile downstream), minor, and last for two to three years.

Small short-term increases in chronic controllable sediment discharge ($Q_2$) are shown for Chanchelulla Creek (Figure 3-18) and long-term decreases are shown for acute sediment yield (Figure 3-17). The increased chronic sediment yield results not from this project, but due to future foreseeable actions displayed in Appendix E (Cumulative Actions Table, Table E-1), that are expected to recover within five years of implementation. Long-term the risk for adverse CWE is predicted to decrease. This improving trend is based on the reasonably foreseeable activities on public lands.

Small increases in chronic controllable sediment discharge ($Q_2$) are shown for Wilson Creek (Figure 3-18). These increases result not from this project, but due to foreseeable actions that are expected to recover within five years of implementation. Long-term the CWE risk is predicted to decrease, and acute sediment yield slightly decreases (Figure 3-18). A substantial increase in chronic sediment yield ($Q_2$) was predicted for Hall City Creek to exceed the 125% over background threshold for sediment yield (Figure 3-18). Relative to present and foreseeable acute sediment yield, the short-term increases in chronic sediment are minor (Figures 3-17 and 3-18). The potential impacts will be localized (i.e., less than ¼ mile downstream), minor, and last for two to three years. A substantial increase in acute sediment yield ($Q_{25}$) was predicted for Good's Creek to increase above the present level (Figure 3-18). Most of the increases result from activities on private land. The short-term increases in chronic sediment ($Q_2$) are minor and do not exceed the threshold (Figures 3-17 and 3-18).

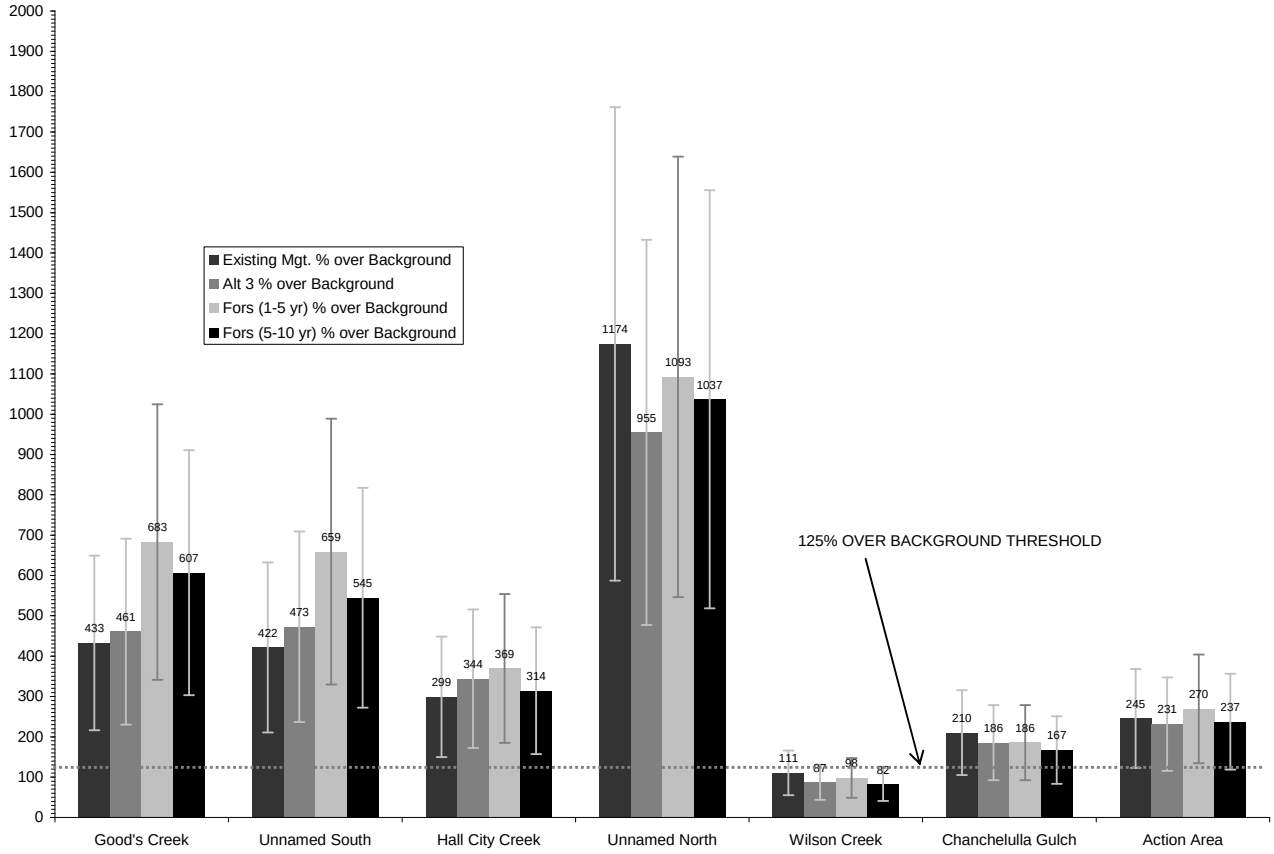



**Figure 3-17. Sediment yield $Q_{25}$ (i.e., acute) percent over background for existing, Alternative 3, 1-5 years post project, and 5-10 years post project.**

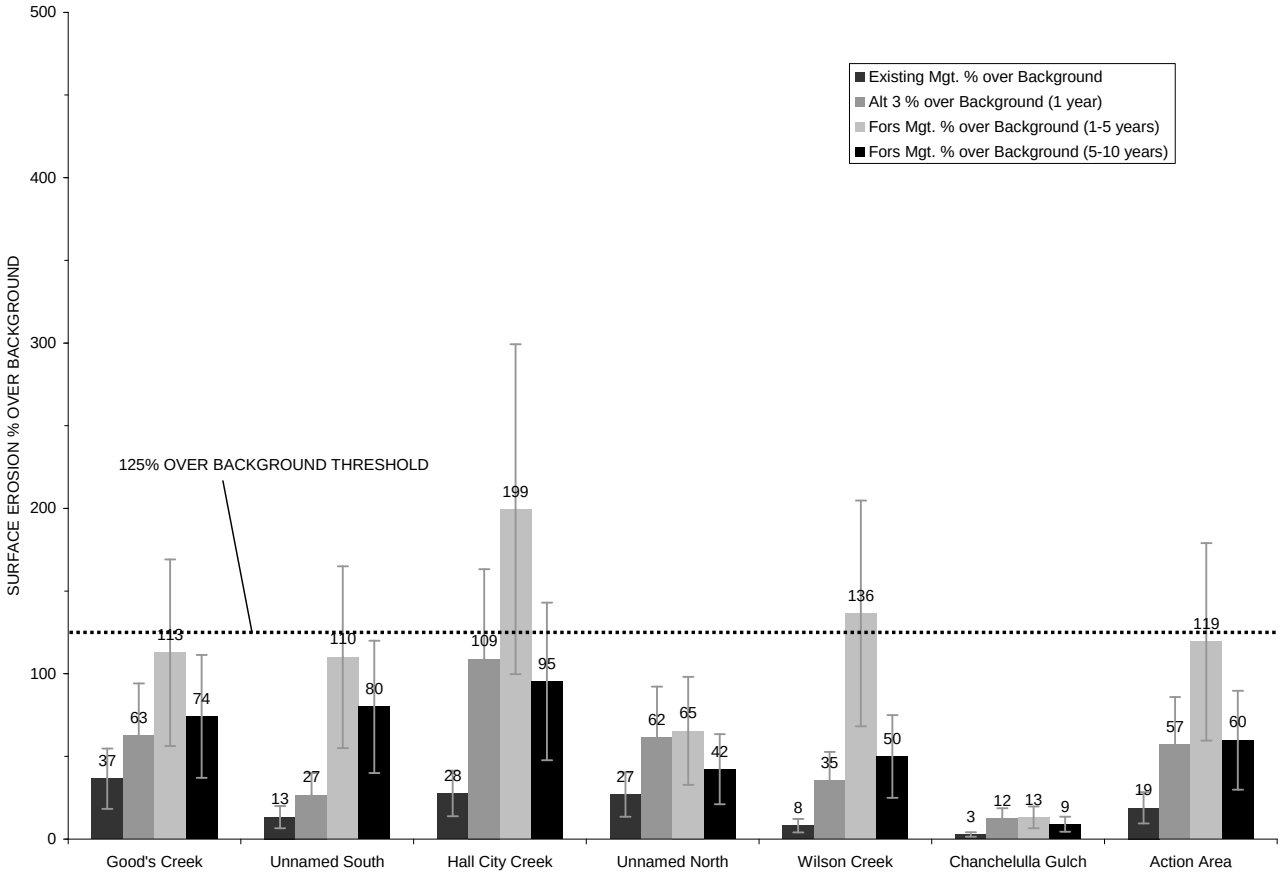



**Figure 3-18. Sediment yield $Q_2$ (i.e., chronic) percent over background for existing, Alternative 3, 1-5 years post project, and 5-10 years post project.**

## Cumulative Effects for Alternatives 1 and 3

The Level III CWE analysis shows very little difference between the CWE of Alternative 1 versus Alternative 3. The predicted percent over background sediment yield, for acute and chronic sediment yield, are within the models margin of error (i.e., 50%) (see Figures 3-15, 3-16, 3-17 and 3-18) and there is no difference between the modeled results for the two action alternatives. The ERA results are similar (Figure 3-14) with a 10% margin of error. For Hall City Creek, the ERA for Alternative 3 is 1% less than Alternative 1, a measurable difference. However, this difference is not realized in the sediment budget results since the margin of error is higher and the increases may be realized as increased runoff rather than increased erosion.

Short and long-term, the acute and chronic sediment yield will increase for both alternatives when combined with the connected and foreseeable actions. Private timber harvest, planned in the lower end of the watersheds will cause additional ground disturbance and increase sediment delivery. Conversely, fish passage barrier improvements implemented by the Forest Service will improve long-term WCC by allowing salmonids access to the upper reaches of Good's and Wilson Creeks.

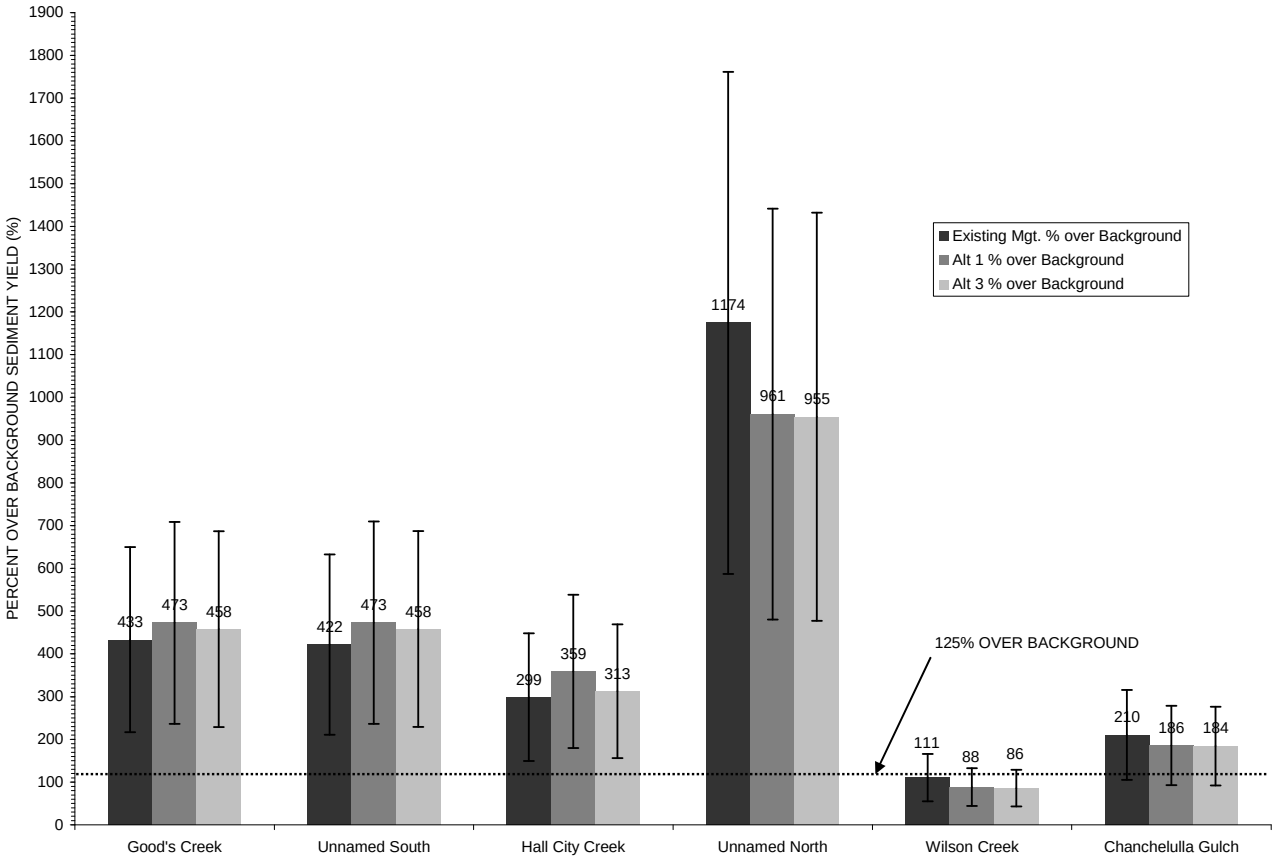



**Figure 3-19. Sediment yield $Q_{25}$ (i.e., acute) percent over background for existing condition, Alternative 1, and Alternative 3 for the first year following project implementation.**

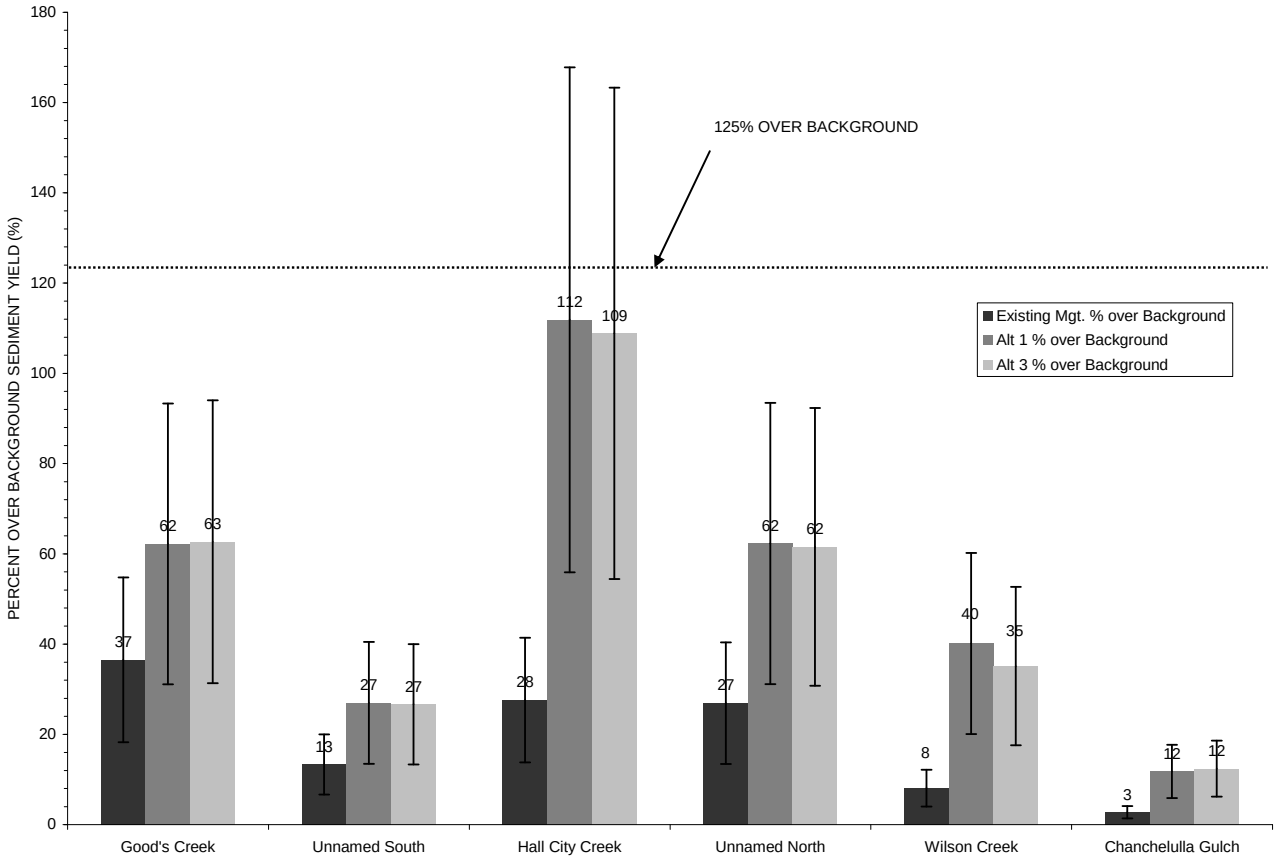



**Figure 3-20. Sediment yield $Q_2$ (i.e., chronic) percent over background for existing condition, Alternative 1, and Alternative 3 for the first year following project implementation.**

## Water Quality and Geomorphology Summary

The CWE analysis results show that the short and long-term sediment yield increases from the Gemmill Project are unlikely to degrade local and regional water quality. Long-term sediment yield decreases are predicted as well. There will be a moderate increase in chronic sediment yield with a minor increase in turbidity. The geographic extent of the predicted impacts are moderate, immediately offsite, and do not translate to watershed scale impacts. The duration and frequency of the impacts are moderate and may have intermittent effects to water quality (See Figures 3-14 and 3-21).

The sediment budget for the existing conditions (i.e., baseline) of the affected area indicates that the percent over background sediment yield is 19% per $Q_2$ flood event and 245% per $Q_{25}$ flood event. The sediment yield is predicted to increase between 9 and 40% per $Q_2$ flood event and remain the same for the $Q_{25}$ flood event for the first five years following project implementation (Figures 3-14 and 3-15). The acute sediment yield is predicted to decrease 5% within 10 years of project implementation. This conclusion is based on the sediment yield from the expected effects of the project combined with effects of reasonably foreseeable actions listed below.

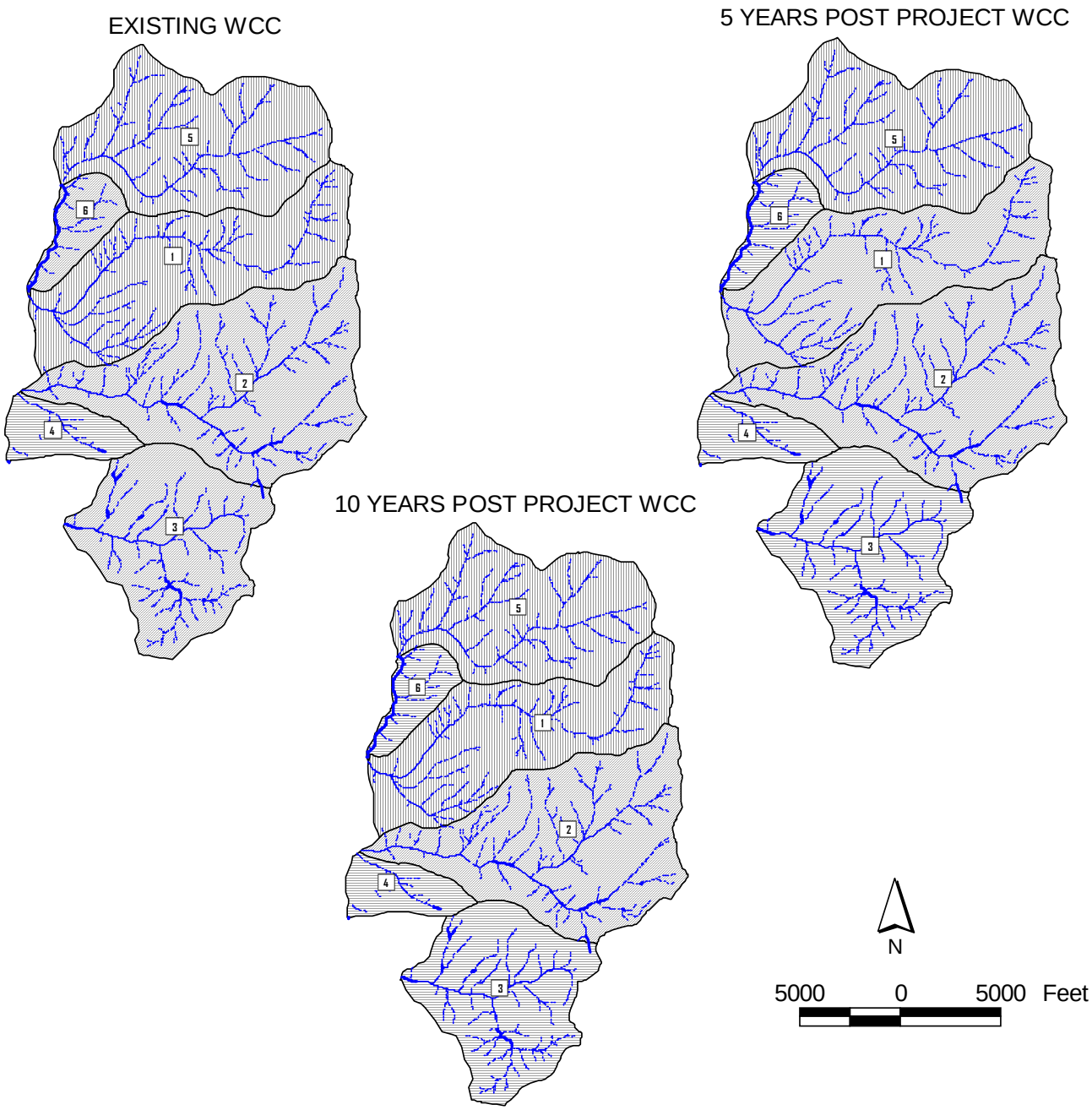



**Figure 3-21. Map of Gemmill Project showing WCC for the existing, 1 to 5 year, and 5 to 10 year time periods. Vertical lines = WCC 1, horizontal lines = WCC 2, and diagonal lines = WCC 3. Blue lines represent perennial stream reaches.**

## Affected Environment – Transportation

The Gemmill Thin project is located north of State Highway 36, west of the STNF Harrison Gulch Ranger Station, and south of Chanchelulla Gulch. Private land associated with community of Wildwood borders a portion of the southern and nearly all-of-the western project boundary. Trinity County road 302

(Wildwood Road) provides the connection between both Highway 36 and Highway 3. The entire project is on the South Fork Management Unit, Yolla Bolla Ranger District, in Trinity County.

The management prescription for the project area is Prescription VII: Late-Successional Reserves and Threatened, Endangered, and Selected Sensitive Species (Late Successional Ecosystem and Wildlife Habitat Management Emphasized; Road Construction and Reconstruction Permitted).

Both National Forest System Roads and unclassified roads are found in the project area. The project proposes decommissioning of non-system and system roads (12 mi.), construction of temporary roads and reconstruction of system roads (23 mi.) with post-project closure (administrative use only) of approximately 2 miles of road.

Primary arterial/collector routes in the project area are County Road 302, State Highway 36, and 30N01 (County Line Road). Overall, Forest Service System roads within the assessment area are in good condition. Most have crushed rock surfaces. Several of the main roads have been bladed and shaped within the last 5 years. In addition, 26 segments of existing unclassified roads totaling approximately 10 miles have been identified and mapped. These roads originated from previous mining, fires, timber harvest, and recreation activities, particularly on flatter terrain such as that found in many proposed treatment units, where overland pathways built by woodcutters, recreational OHV riders, hunters, and/or campers are frequently found.

## Environmental Consequences – Transportation

The proposed action includes several road-related actions planned with timber harvest, post-harvest fuel treatments, and road decommissioning (See Appendix C, Road Related Connected Actions for Alternatives 1 and 3). A combination of both system and unclassified roads will likely be used to remove commercial timber products as either saw logs or biomass.

The design vehicle for the timber harvest is the log truck. Road reconstruction and the use of existing unclassified, new temporary roads, and landings will impact rock surfaced roads. Replacement rock is recommended on all roads near temporary landings and road/trail intersections as an erosion control measure. Some unclassified roads will be used for harvest activities; many will be closed immediately post-harvest by the logger/purchaser while others will remain open longer to support post-harvest fuel treatments before being decommissioned.

The design vehicle utilized for biomass processing and product removal with post-harvest fuel treatments will be the chip van, which will require an upgrade in road standards. Use of chip vans will require more road width, clearing height, curve widening, and turn radius. Road grade, vertical curve, and turn-around opportunities for these vehicles must also be considered when developing road work proposals to accommodate this standard.

Each alternative would have some impact on State highways and Forest Service system roads due to timber hauling and/or administrative traffic, or lack thereof. With action alternatives this impact would primarily be in the form of wearing of the road surface with increased traffic, a reduction in the amount of surface erosion and potential sediment delivery into adjoining streams with proposed road reconstruction,

maintenance, and surface replacement, and a reduction in the road density by decommissioning several unclassified roads.

## Alternative 2 - No Action

The opportunity to refine the transportation system, including improving the road system and removing unnecessary roads within the assessment area, would be foregone. There would be no direct, indirect, or cumulative effect to the transportation system from implementing the no action alternative except for continued deterioration of the road system, user created trails, and erosion-related problems.

With the no action alternative there would be no increase in project-related traffic and surface wear, but also no correction of existing erosion-related problems on system and unclassified roads.

## Alternative 1

Alternative 1 would have some impact on State highways and Forest Service system roads due to timber/chip hauling and associated administrative traffic. This impact would primarily be in the form of wearing of the road surface, but with a reduction in the amount of surface erosion and potential sediment delivery into adjoining streams due to the proposed road reconstruction of 23.62 miles of system road. Road reconstruction will likely also improve efficiency and safety of travel on these roads. The Forest Service would monitor road reconstruction and maintenance on Forest Service system roads during and after harvest activities to assure that road reconstruction and maintenance is completed to specified standards as part of Forest Service timber sale contract requirements. In addition, there would be a reduction of future road maintenance needs because of the decommissioning of an estimated 12.05 miles of roads.

### Reconstruction

Under Alternative 1, grading and brushing will be required on all roads. With the exception of roads to be decommissioned, native-surfaced system roads planned for use and proposed for reconstruction activities will receive spot-rock surfacing as needed. Reconstruction for hauling will include widening roadbed to a minimum of 12-14 feet, including curve widening to accommodate log truck use, installing rock dips and/or culverts of suitable size to support $Q_{100}$ standards, and strengthening existing soft and predicted weak spots in road surfaces ahead of heavy traffic use. Twelve system roads are planned for use, and each requires some form of specified reconstruction. Aggregate surfacing is present on 10 of the 12 roads. Worn and thin sections on these roads will be replaced as determined by the design engineer. Approximately 2 miles of these roads were identified in the Gemmill Roads Analysis Report (RAP) for closure, with administrative access only. These closures will be completed following project implementation.

It is estimated that 10 segments of existing unclassified roads totaling 2.5 miles will be used as temporary roads necessary to facilitate timber and biomass removal. One of these roads, U29N07K, will have temporary road construction at both ends to facilitate access for timber removal. The use of this unclassified road will access units 21, 22, 23 without necessitating construction of addition temporary

roads and landings. At present, this road receives much local and regional recreational OHV use, including during wet weather which is an erosion concern. For project implementation, the road will be reconstructed to engineering specifications and used throughout the life of the project. Upon completion of project activities, the road will be decommissioned, with an effort to design the road closure around prohibiting access by OHVs.

### New Construction

No new construction of specified road is planned with this project.

### Haul Route

Haul comparison showed Weaverville to be the nearest appraisal point.

### Right of Way (ROW) and Cost Share Status

No transportation-related ROW or Cost Share issues have been identified with the proposed project.

### Water Source

A map of the designated water sources for drafting permitted for use for dust abatement during project implementation is provided in Appendix A maps. Lignin sulfate may be used in lieu of water for dust abatement.

### Alternative 3 - Diameter Limit

Expected effects to the transportation system from Alternative 3 are identical to the effects disclosed for Alternative 1 because there are no changes to total number or miles of roads constructed or reconstructed.

## Affected Environment - Heritage Resources

Within the Gemmill Thin project area there are 14 previously recorded sites that are either eligible for the National Register or have an indeterminate status. All sites located within or near project thinning units are listed below:

- 05-14-51-04 Hall City Caves
- 05-14-51-84 Wilson Cabin
- 05-14-51-85 Hall's City Creek Mine
- 05-14-51-86 Bill's Hideaway
- 05-14-51-92 China Cabin Sale Site #2
- 05-14-51-94 Muddy Waters Mud Site
- 05-14-51-96 Wade's Saddle
- 05-14-51-97 Flea Ridge
- 05-14-51-98 Gravel Slope
- 05-14-51-99 Flakey Scorpian
- 05-14-51-131 Shiell Flume Site
- 05-14-51-304 Upper Hall City Creek
- 05-14-51-338 New Poston Mine

- 05-14-52-395 Emmett's Little Blue Site

Two previously unrecorded sites were identified during field survey. They are:

- 05-14-51-339 Three Windfall Site
- 05-14-51-340 Bottom of B Spur

Each of these sites will be flagged and avoided following the standard resource protection measures in the Forest Service, Region 5 section 106 Programmatic Agreement. This work will be coordinated with the project planner and contracting officer representative overseeing the project.

## Environmental Consequences - Heritage Resources

The unit of measure used to analyze the direct and indirect cumulative effect(s) on archaeological resource sites is based on a linear scale that measures potential adverse effects. This method, developed by the project archaeologist from professional experience, has observed that the relative proximity of archaeological resources to some type of ground disturbing activity (GDA) increases the likelihood of direct and indirect effects. An example of a GDA could be a linear travel route, such as a road or treatment unit in a vegetation management project. Most sites beyond 100 yards from some manner of GDA suffer little chance for adverse effects. Sites within 100 yards or less generally suffer a greater potential for adverse effects.[122]

### Direct and Indirect Effects of Alternative 2

This alternative would have no effect (and therefore no cumulative effect) on heritage resources.

### Direct and Indirect Effects for Alternatives 1 and 3

Table 3-37 shows the potential for direct impacts of the alternatives considered on heritage resources. These are the only sites recorded to date within the project area for the Gemmill Thin Project:

[122] These conclusions are the result of professional training, experience and judgment of the project archaeologist (Mark Arnold)

**Table 3-37. Level of Potential Effect Considered, Alternatives 1 and 3**

| Recorded Archaeological Sites | High | Medium | Low | Low to No Effect |
|---|---|---|---|---|
| 05-14-51-04 | X | | | |
| 05-14-51-84 | | | | X |
| 05-14-51-85 | | | | X |
| 05-14-51-86 | | | | X |
| 05-14-51-92 | X | | | |
| 05-14-51-94 | X | | | |
| 05-14-51-96 | X | | | |
| 05-14-51-97 | X | | | |
| 05-14-51-98 | | X | | |
| 05-14-51-99 | X | | | |
| 05-14-51-131 | | | X | |
| 05-14-51-304 | | | | X |
| 05-14-51-338 | X | | | |
| 05-14-51-339 | | | X | |
| 05-14-51-340 | | X | | |
| 05-14-52-395 | | | | X |

To avoid direct effects on these recorded sites, each will be flagged and avoided following the protective measures outlined in the Region 5 Section 106 Programmatic Agreement. These sites will be noted in the timber sale contract as controlled areas to be avoided. Sale administrators will insure protective measures are followed. Therefore, each action alternative would have no effect on recorded heritage resources.

### Cumulative Effects of Alternatives 1 and 3

The project will have no direct effects on National Register eligible historic properties. Consequently, there will be no cumulative effects from the proposed action.

## Affected Environment – Socio Economics

This section analyzes the community cohesion, economic stability, mobility, and ease of access to public facilities associated with the Gemmill Thin Project. This section also addresses Executive Order (EO) 12898 regarding the disproportionate effects on minority, low-income, and elderly groups.
Trinity County encompasses a land area of 8,234 square kilometers (3,179 square miles) and has a population of 13,022 (U.S. Census 1990 and 2000). Statistically, there are 4.1 persons per square mile.

In 1848, Gold was discovered in the Trinity River and created a gold rush into the County. The search for gold resulted in mining claims along the Trinity River and Hayfork Creek. The influx of miners created opportunities for businesses, and the gold mining industry peaked about 1920. In the 1930's, with the increase of California's population, the need for timber products, expanded the lumber industry into Trinity County. Also, Federal projects that included the Civilian Conservation Corps who worked on fire suppression, timber stand improvement, and construction of Forest Service Administrative sites, telephone lines, roads and bridge projects, increased the population of Trinity County and communities such as Hayfork and Wildwood.

The population of Hayfork and Wildwood peaked in the 1930's and 1940's when the timber industry boomed with as many as 14 active sawmill in and around these small communities. Lumber remained a significant economic activity in Wildwood through 1977, when the Kimberly-Clark Mill closed. When the Mill closed, 50 employees were laid off from the town population of 150 (Record Searchlight March

31, 1977). Hayfork remained active in the lumber business until 1997, when the Sierra Pacific Mill closed. The mining industry peaked around 1920, but still continues to contribute to local economies.

According to the 2000 Census, Hayfork reported a population of 2,315. Hayfork is the second largest town in Trinity County. It is a year round service community that provides many services to the public. The population of Wildwood is 119 (census 1999). Wildwood is a year round community which provides postal service, emergency response services, store, gas station, restaurant, and Wildwood Inn. Several small businesses are located in Wildwood, they include fire emergency service vendors, mail order Smokey Bear supplies, and other contract vendors. California State Highway 36 passes through Wildwood which is a direct route from the Northern Sacramento Valley to the Pacific Coast. Wildwood is also where Trinity County road 341 (a.k.a. Wildwood road) intersects with Highway 36, leading to Highway 3. Wildwood Road provides the only access from Highway 36 to Hayfork during inclement weather.

# Environmental Consequences – Socio Economics

## Demographics

The Gemmill Thin project may affect socioeconomics in both Hayfork and Wildwood. Therefore, census data for both will be compared with that of Trinity County. Neither community is incorporated. The next table illustrates the populations of Wildwood which includes Census Tract 3, Block Group 8, and Hayfork which includes Census Tract 3, Block Groups 2, 3, 4, 5, and 6.

**Table 3-38. 2000 Census for Trinity County, Hayfork and Wildwood**

| | Trinity County | | Hayfork | | Wildwood | |
|---|---|---|---|---|---|---|
| Zone | Actual Count | % of Total | Actual Count | % of Total | Actual Count | % of Total |
| **Total Population** | **13,022** | | **2,315** | | **119** | |
| **Race** | | | | | | |
| White | 11,573 | 88.8& | 1,961 | 64.7% | 109 | 99.0% |
| Black | 58 | 0.4% | 3 | 0.1% | 0 | 0.0% |
| Native American | 631 | 4.8% | 193 | 8.3% | 10 | 1.0% |
| Asian | 61 | 0.5% | 4 | 0.2% | 0 | 0.0% |
| Pacific Islander | 15 | 0.1% | 0 | 0.0% | 0 | 0.0% |
| Other races | 114 | 1.0% | 9 | 0.4% | 0 | 0.0% |
| Two or more races | 570 | 4.4% | 145 | 6.3% | 0 | 0.0% |
| Hispanic* | 517 | 3.9% | 114 | 4.9% | 0 | 0.0% |

| **Age Group** | | | | | | |
|---|---|---|---|---|---|---|
| Under 19 | 3,234 | 24.8% | 641 | 27.7% | 11 | 9.20% |
| 20 to 24 | 403 | 3.1% | 86 | 3.7% | 10 | 8.40% |
| 25 to 34 | 1,026 | 7.9% | 204 | 8.8% | 20 | 16.8% |
| 35 to 54 | 4,334 | 33.3% | 743 | 32.1% | 25 | 21.0% |
| 55 to 64 | 1,784 | 13.7% | 299 | 12.9% | 40 | 33.6% |
| 65 and over | 2,241 | 17.2% | 342 | 14.8% | 13 | 10.9% |
| **Total** | **13,022** | | **2,315** | | **119** | |
| Median Age | 44.6 | | 42.0 | | 45.2 | |
| **Households** | | | | | | |
| Average Household Size | 2.29 | | 2.40 | 2.05 | 2.0 | |
| **Total Households** | **5,587** | | **96** | | **48** | |

*According to the US Census Bureau, Hispanics many come from numerous races, and are not separated into a racial category by themselves. Therefore, the total figures for the race category will add up to more than 100% if the Hispanic component is included in the total. This number was broken out to reflect the individuals that identified themselves to be of Hispanic origin, among all race categories.

In reviewing 1990 to 2002, *California Department of Finance, Demographic Research Data,* Trinity County has maintained and average population of 13,000 from 1989 with little to no change projected through 2005. Projections for 2010 reflect a population of 13,200 in 2001, the biggest change in demographics is a trend towards an increase in the number of persons above 35 years of age. In Trinity County and the Project Vicinity, the median age ranges from 42 to 48 years old as compared to California as a whole at 33 years of age (Census 2000). Relatively few persons are between 20 and 34 years old in both Trinity County and the Project Vicinity. This trend is expected to continue based on past United States Census data reflecting similar patterns.

## Environmental Justice

Environmental justice refers to social equity in bearing the burdens of adverse environmental effects that may result from a proposed action. Some ethnic minorities, elderly, and low income-income populations have historically experienced a disproportionate share of adverse affects resulting from large infrastructure projects. According to EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and on Low Income Populations, dated February 11, 1994, minority and low-income populations must not be disproportionately adversely affected by transportation or other such projects. In addition and in light of the fact that Trinity County has and aging population, the effect of the project on individuals over 65 will be analyzed. This subsection discusses the presence of minority, low-income families, and elderly persons. Table 3-39 illustrates criteria that were used to determine the presence of a high proportion of minorities, low-income residents, or elderly persons. As screening criteria, the area is compared with the State of California to determine whether there is a high presence of minorities, low income, or elderly persons.

**Table 3-39. Defining Minority, Low-Income and Elderly Populations and Evaluation Criteria**

| Population | Criteria* |
|---|---|
| Minorities, Low Income and Elderly Persons | Greater than or equal to the state average of the population within the Census Tract/Block OR percentage of affected area is meaningfully greater than the minority population percentage of the general population. |

*EPA's Region 8 Environmental Justice Program

According to the United States Census, 2000, California contains a population of 59.5 percent Caucasian, 10.6 percent of the population is over 65 years old, and 14.2 percent of the population lives below the poverty line. Table 3-40 indicates that over 80 percent of the population in Trinity County and the Wildwood area are white-Caucasian. Because the project will not occur until after 2005, the 2000 Census data for the elderly was considered for those 60 years and over. In 2005, this population will be 65 and over. Hayfork has 484 persons over 60 years of age, representing 20 percent of the total population. Wildwood has 13 persons over 65 years or older, representing 10.9 percent of the total population. Both of these communities have a higher percent elderly population that the state of California.

**Table 3-40. US Census data**

| | Wildwood | Hayfork | | | | | Project Vicinity | Trinity County |
|---|---|---|---|---|---|---|---|---|
| | Block Group 8 Census Tract 3, Shasta Cty, CA | Block Group 2, Census Tract 3, Trinity Cty, CA | Block Group 3, Census Tract 3, Trinity Cty, CA | Block Group 4, Census Tract 3, Trinity Cty, CA | Block Group 5, Census Tract 3, Trinity Cty, CA | Block Group 6, Census Tract 3, Trinity Cty, CA | Totals for Hayfork and Wildwood Combined | |
| **Total Population**: | 119 | 437 | 573 | 789 | 427 | 164 | **2390** | 13,022 |
| **Persons with Income in 1999 below poverty level** | 45 | 182 | 68 | 179 | 102 | 50 | **581** | 2435 |
| **Percent of Population** | 21% | 42% | 12% | 23% | 24% | 31% | **24%** | 19% |

**Source**: US Census 2000 data. Percentages actually for the year 1999.

According to 2000 Census data, 19 percent of Trinity County qualified as below the poverty level, and 24 percent of the Hayfork and Wildwood area, as compared to 14 percent of California. According to the United States Department of Labor and United States Department of Health and Human Services, the poverty level in 1999 was defined as those persons with an income of less than 70 percent of the lower standard income level. This translates to a poverty level for a one-person family, whose yearly salary would be $7,000; a yearly income for a two-person family would be $11,060; for a three- person family $13,880; and four-person family $16,700. Table 3-40 illustrates the individual data for each block group for both Hayfork and Wildwood.

### Community Resources

Relative to the population size, both the Hayfork, (population 2,412) and Wildwood (population 119) support several public meeting facilities, which is indicative of a strong cohesive community. Table 3-41 lists all the public accessible centers for both Hayfork and Wildwood.

Several of the facilities are used for a multitude of community functions, such as the Trinity County Fairgrounds which is used for the Annual Trinity County Fair, fireworks displays, and multiple service organization meetings. Service organizations include Service organizations include Hayfork Valley Horseman's Association, Hyampom Rod & Gun Club, Hayfork Chamber of Commerce, Lion's Club, Rotary Club, Mountain Actors, 4-H, Future Farmers of America, Boy Scouts, Girl Scouts, Pathfinders Club, Log Cabin Quilter's Guild, Peanut Women's Club, Nor-Rel-Muk Band of Wintu Indians, Hayfork Garden Club, Roderick Seniors Center, Hayfork Community Child Care Project, Hayfork Community Spirit Women's Club, Hayfork Scholarship Foundation, and Valley High Scholarship Foundation.

**Table 3-41. Hayfork and Wildwood Community resources**

| Resource Type | Hayfork | Wildwood |
|---|---|---|
| **Community Center** | Hayfork Community Center | |
| **Library** | Trinity County Library | |
| **Primary and Secondary Public Schools** | Hayfork Elementary, Hayfork High, & Valley High School | |
| **Youth Center** | Hayfork Youth Center | |
| **Parks, Recreational Resources** | Hayfork Park, Trinity County Fairgrounds, Ewing Reservoir | Deer Lick Springs, Campgrounds, Hiking, Horseback riding, and OHV use. |
| **Private School** | Hayfork Seventh Day Adventist School | |
| **Forest Resources** | Shasta-Trinity National Forest | Shasta-Trinity National Forest |
| **Cultural Facilities** | Mountain Actors | Wildwood Inn, Wildwood Store |
| **Religious Groups** | Seventh Day Adventist, Jehovah's Witness, Mormon, Rolling Rock Christian Fellowship, Catholic, Hayfork Community Church, Faith Assembly of God | Russian Orthodox Women's Church |

Informal interviews with several citizens of Hayfork and Wildwood indicate the attraction for living in these communities is access to the beauty of surrounding natural resources and the remote location. Hayfork Creek flows from Wildwood through Hayfork on to the South Fork of the Trinity River. Both Hayfork and Wildwood are surrounded by the Shasta-Trinity National Forest. Abundant recreational facilities within the Shasta-Trinity National Forest bring many visitors to the enjoy fishing, hiking camping, bird watching, swimming, mountain biking, and OHV use.

## Affected Environment - Project Economics

Employment effects on the population can be defined in terms of direct and indirect effects. Direct effects are associated most strongly with local communities where logging and sawmilling activities occur.

Indirect effects are associated typically with major urban areas supplying goods and services to the local communities.

Logging and milling activities typically require 4 to 7 person years of employment per million board feet (MMBF) of timber processed. Indirect employment ranges from 7 to 9 person years per million board feet of timber harvested.

The primary factors which affect project costs include road construction/reconstruction activities, the method of timber harvest activities, watershed and fisheries improvement activities, slash disposal, and reforestation activities. Harvest method costs are generally a function of the type of yarding equipment used. In general, tractor yarding is the lowest cost method, skyline yarding has a higher logging cost than tractor yarding, and helicopter yarding has the highest cost. Slash disposal costs vary by the accessibility for treatment and the type of treatment prescribed. Watershed and fisheries improvement costs are primarily a function of accessibility. Other cost factors include the alternative selected, mitigation measures and post-sale projects.

## Environmental Consequences – Project Economics

Implementation of this proposal would help support local communities for the short-term. It will provide opportunities for employment within the Wildwood and Hayfork areas. Management activities such as the proposed action create jobs for several seasons. Because of the remote location of the project area, contractors hired to accomplish the project are likely to use nearby services and accommodations in Wildwood and Hayfork, which brings additional revenues to local businesses. Additionally, the project is likely to provide seasonal employment opportunities for local residents.

The project would generate short-term increases in local employment for several months within a given year. The entire project may take several years to implement, which would increase personal income for local workers and businesses. The direct increase of employment would contribute to increases in local businesses and services. Indirect short-term effects would occur when workers from out of the area purchase items such as gas, supplies and accommodations during the seasonal work season. Indirect and induced income impacts, such as those that are expected due to the project, are important to rural communities and Trinity County.

### Project Environmental Consequences

The economic consequences are primarily a measure of the overall value of the alternatives under consideration for managing the assessment area. The level and mix of goods and services available to the public varies by alternative, which creates impacts on the social and economic environment. The impacts discussed in this section include estimated government expenditures and revenues, as well as monetary impacts upon local communities. Also displayed are the estimated direct and indirect job opportunities associated with implementation of proposed action alternatives.

In general, the monetary value of an alternative is a function of the timber harvest method employed, the amount of road construction proposed, and the number of acres rehabilitated.

This analysis does not include monetary values assigned to resource outputs such as wildlife, watershed, soils, recreation, visual and fisheries. It is intended only as a relative measure of differences between alternatives based on those direct costs/values used. Other values are discussed in other than monetary terms in appropriate sections of this EIS.

### Net Revenue to the Government

Net revenue is the difference between the revenues generated by an alternative and the costs required to implement it. In this analysis, revenues come from harvest of timber. Management costs include costs associated with timber sales, including sale preparation, administration, slash disposal, road construction, mitigation of timber sale activities and reforestation, as well as costs for resource measures other than those associated with timber sales.

The factors affecting costs are primarily road construction costs, which is generally a function of the miles of road built and the difficulty of terrain; slash disposal costs, which vary by the amount, kind of treatment prescribed and access; and management requirements and mitigation measures costs which are generally a function of access and extent of treatment areas.

### Employment

Direct and indirect employment levels are somewhat difficult to estimate because of the relationship between output levels from the assessment area and output levels from the rest of the Shasta-Trinity National Forests.

## Direct and Indirect Effects

### Alternative 2

Alternative 2 has no receipts or costs. There would be no management activities in the assessment area that would generate revenues or costs. No direct or indirect employment would result from this alternative.

### Alternative 1

With implementation of Alternative 1, an estimated $2,596,800 would be generated from the harvest of an estimated 4.8 MMBF of timber. The present net value of Alternative 1 is an estimated $49,236. The total value[123] is an estimated $209,693. The benefit-cost ratio would be an estimated 1.02:1.00. An estimated 19-34 person years of direct employment and an estimated 34-43 person years of indirect employment opportunities would be created with implementation of Alternative 1.

### Alternative 3

Under Alternative 3, an estimated $2,326,300 would be generated from the harvest of an estimated 4.3 MMBF of timber. The present net value of Alternative 3 is an estimated $113,047. The total value is an estimated $276,655. The benefit-cost ratio would be an estimated 1.04:1.00. An estimated 17-30 person

[123] Calculated as described by Rheinberger (2008)

years of direct employment and an estimated 30-39 person years of indirect employment opportunities would be created with implementation of Alternative 3.

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