

Appendix H

Overview of Modeling and Prescriptions

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1. Modeling

Results from the computer modeling effort are only approximations of what to expect when any given alternative is implemented. The objective of modeling is to aid planners in estimating likely future consequences of alternative management actions. The computer modeling used for this FEIS is based upon the modeling protocol used by the Framework. Full documentation of the approach is found in Appendix B, Volume 4 of the Framework FEIS, and is incorporated by reference. The Framework appendix also includes descriptions and graphical representations of prescriptions used to model treatments. This appendix provides a description of prescriptions that were developed for this management plan, as well as those which were used in the Framework. Definitions of the general treatments are found in the glossary in Chapter 7 of this FEIS. Where appropriate, data that were specific to the Sequoia National Forest were used during modeling. These included, but are not limited to, the desired conditions, the standards and guidelines specific to the Monument, and the estimated treatment amounts per decade for each alternative.

The outputs provide an estimate of landscape-level predictions of effects, and also predict a general amount of acres that might be treated by decade for broad activities (prescribed fire, thinning, etc). Certain assumptions are provided in order for the model to produce its outputs. These outputs are used by the analysis team to help identify major effects for each alternative and also to distinguish differences between alternatives. The following is a general list of key information used to “fine-tune” the analysis to reflect the alternatives and conditions in the Monument.

a. Treatment Amounts (feasible programs based upon program manager recommendations)

In order to ensure that modeling outcomes approximated feasible programs of work, program managers on the Monument were consulted to define upper limits. These upper limits are based upon local experience, available resources, and historical funding levels. These are used as upper limit treatment amounts during the modeling process:

- **Alternatives 1 and 2:** Approximately 3,500 acres/year (based on Framework’s implementation assumptions of completing protection strategy over a 25-year period)
- **Alternatives 3 and 4:** 6,000 acres per year (prescribed burning as primary treatment method)

- **Alternatives 5 and 6:** 8,000 acres per year (prescribed burning and mechanical treatments as primary treatment methods)
- **Modified Alternative 6:** 8,000 acres per year (prescribed burning as initial preferred treatment method, with mechanical treatment/removal if clearly needed)

b. Treatment Priorities (general priorities for treatment)

- Completion of initial treatments for protection of urban areas
- Protection of special features and critical habitat, such as giant sequoia groves, protected wildlife activity centers, and riparian areas
- Reducing risk of wildfire in areas of high or moderate fire susceptibility
- Restoring a more frequent fire return interval
- Restoring more natural conditions in plantations established after timber harvesting

Many areas of the monument have both protection and restoration objectives, and treatments will be designed to the extent practical to meet both objectives. Specific treatment priorities will be determined through the landscape analysis process.

c. Resource Constraints and Allocations

See the descriptions of alternatives in Chapter II for other Framework allocations and/or management strategies that are used in the modeling process.

- Follow the Aquatic Management Strategy consistent with Framework for Alternatives 1, 2, 3, 4, and 5; for Alternatives 6 and Modified 6, follow Aquatic Management Strategy, except reduce buffer along ephemeral drainages to 50 feet on either side.
- Strategically placed fuel treatment areas (SPLATs) are located in areas of high susceptibility. Within SPLATs, approximately 1/3 of the area would be treated during implementation.

d. Modeling-related Changes Between the Draft EIS and the Final EIS

During the time between the DEIS and the FEIS, a number of changes were made to resource inventory data, geographic information layers, treatment priorities, and modeling assumptions. Some of these changes were directly responsive to comments received on the DEIS, while others were due to the availability of new information or refined technologies. These changes include:

- In Modified Alternative 6, the “gap thin” prescription is not modeled because the management direction that prescribes the application of this treatment is removed (as compared to Alternative 6).
- The fire susceptibility mapping was updated to reflect the effects of the McNally Fire, which burned after the DEIS was published.
- The estimated rate of wildfire was changed from the last 25 years average to the last 10 years average. This change is felt to be more indicative of future occurrences.
- A new prescription was developed to model the effects of a prescribed fire to reduce the fire susceptibility in a stand in association with a thinning of the residual larger trees.
- The boundaries of the wildland urban interface defense and threat zones and the SPLATS have been modified to better reflect local conditions and to improve the modeling of outcomes associated with treatments in these areas.
- For Modified Alternative 6, the Old Forest Emphasis and Southern Sierra Fisher Conservation Area allocations have been removed and are replaced by the Fisher/Old Forest allocation and its associated standards and guidelines.
- The protection and treatment priorities are more clearly modeled for the first two decades. The treatment priority for protection has not changed, but the restoration priority is much more focused for Modified Alternative 6 (treatment of plantations for the first two decades).

2. Treatment Prescriptions

This section provides an overview of the prescriptions that were developed to model the general effects of treatments under Alternatives 1 through 6 of the DEIS. A complete description of all the prescriptions is found in Appendix B, Chapter 4 of the Framework FEIS. In addition to those developed and modeled under the Framework, one additional management prescription (Gap Thin) was developed to model the treatments.

A prescription is a group of management practices applied to a specific land area. The planning process includes the allocation of land to various prescriptions. The range of prescriptions describes the possible activities for a given analysis area. SPECTRUM allocates land to prescriptions based on forest constraints, the given management alternative, and the objective function.

a. General Management Prescriptions Used to Model Treatments

(1) Terms

Re-treatment – A second associated treatment applied in the same decade.

Re-entry – A second and similar treatment applied on the same place in a different decade or planning period.

(2) LET-GROW

The objective of the management prescription is to let stands grow naturally over time without any fuel treatments, timber harvests or wildfire. Stands conditions are projected without treatments using the Forest Vegetation Simulator. The only tree mortality is associated with inter-tree competition.

(3) UNDER-BURN

The objective of this prescription is to restore fire as an ecosystem process. While the prescription is successful in restoring fire as an ecosystem process, it has little or no effect in meeting fuel reduction objectives necessary to modify wildfire behavior, either within the individual stand or across a broader landscape. However, meeting Finney height to live crown targets though this prescription may occasionally occur. In simulating the under-burn prescription, estimates of mortality are made for each individual tree within a stand. The factors that affect tree mortality include scorch height and bark thickness. Scorch height was based on estimated flame-length.

When an area is treated with an under burn, the burning was assumed to be successful on 75% of the area. This is due to the fact that under burning frequently does not occur evenly throughout the area. Each subsequent time the area is burned again on a re-entry, a different 75% of the area is randomly selected. Some of the results of applying this prescription include:

- An average flame length of 2 feet.
- Dead and down material < 3.0" is reduced by 25%, dead and down material >= 3.0" is reduced by 25%.
- Snags numbers are reduced by 10%
- Shrub density is reduced by 100%.

(4) PRESCRIBED FIRE

The objective of this management prescription is to remove surface and ladder fuels and return fire to the ecosystem. The prescription results are expected to be highly variable. In simulating the prescribed fire prescription, estimates of mortality are made for each individual tree within a stand. The factors that affect tree mortality include scorch height and bark thickness.

Scorch height was based on estimated flame-length. When an area is treated with prescribed fire, the burning was assumed to be successful on 75% of the area. This is due to the fact that prescribed fire frequently does not occur evenly throughout the area. Each subsequent time the area is burned again on a re-entry, a different

75% of the area is randomly selected. Some of the results of applying this prescription include:

- An average flame length of 4 feet.
- Dead and down material < 3.0” is reduced by 90%, dead and down material \geq 3.0” is reduced by 50%.
- Snags numbers are reduced by 50%.
- Shrub density is reduced by 100%.
- The prescription is effective in changing wildfire behavior both within the stand itself, and across the landscape as well. Therefore this management prescription is considered to meet the “Finney” condition.
- Re-entries occur every 20 years.
- In re-entries, the height of shrubs is $\frac{1}{2}$ of initial effective shrub height or 2-ft, whichever is smaller.
- For re-entries, subsequent treatments include:
 - Prescribed fire only.
 - Prescribed fire followed by chain saw cutting, manual piling, and burning.

(5) MECHANICAL BRUSH TREATMENT

The objective of this management prescription is to reduce risk of catastrophic fire (both on-site and to upslope resources); return fire to the ecosystem; improve wildlife habitat; and remove surface and ladder fuels. When an area is treated with mechanical methods, the treatment is assumed to be successful on approximately 35% of the area. This is due to the fact that a mosaic of age classes is desired, and mechanical treatment allows for flexibility and some precision in determining the amount and location of areas to be either burned or left untreated. Each subsequent time the area is burned again on a re-entry, a different 35% of the area would be treated. Some of the results of applying this prescription include

- An average flame length of 4 feet.
- Dead and down material < 3.0” is reduced by 90%, dead and down material \geq 3.0” is reduced by 50%.
- Shrub density is reduced by 100% in the treated area.
- The prescription is effective in changing wildfire behavior both within the stand itself, and across the landscape as well. Therefore this management prescription is considered to meet the “Finney” condition.
- Re-entries occur every 20 to 40 years.

(6) LIGHT THIN FROM BELOW

The objective of this prescription is fire hazard reduction. The prescription results are less variable compared to the prescribed fire prescription. Variation will be designed into site-specific prescriptions. This prescription may require a service

contract to accomplish. Material will either be disposed of on-site or removed for products. Some of the results of applying this prescription include:

- Stands are thinned from below until the height to live crown is 8.5' above effective shrub height and the fuel ladder tree non-overlapping canopy cover is less than 10%. Tree selection is in order of increasing height to bottom of crown base.
- Treatments are applied to 95% of sample points. On re-entry, a different set of sample points is randomly selected.
- A post-thinning (re-treatment) Rx-fire [model using a 2.0' flame length] will occur within 10 yrs.
- Dead and down material < 3.0" is reduced by 75%, dead and down material >= 3.0" is reduced by 25%.
- Snag numbers are not reduced.
- Shrub density is reduced by 75%.
- Re-entries occur every 20 years.
- For re-entries, subsequent treatments include:
 - Thinning (for disposal or for chips) only
 - Thinning followed by prescribed fire

(7) MODIFIED MEDIUM THIN FROM BELOW

This management prescription applies commonly to plantations. It has the objective of a moderate level of fire hazard reduction and protection from drought related mortality. Plantations are thinned using this prescription to accomplish these objectives. As plantations age, other prescriptions would apply. This prescription may be accomplished with a timber sale. Chips and other material may either be removed or disposed of on-site. Some of the results of applying this prescription include:

- Approximately 95% of the stand will be treated. On re-entry, a different 95% will be treated.
- The stand will be treated once it is at or above 55% of maximum stand density index (SDI) and the harvest volume exceeds 3 mbf/ac. During treatment the basal area will be reduced by 35%.
- Dead and down material < 3.0" is reduced by 75%. Dead and down material >= 3.0" and snags are reduced by 25%.
- Snags numbers are reduced by 25%.
- Shrub density is reduced by 50%.
- Re-entry will occur every 20 years after initial treatment.

(8) MEDIUM THIN FROM BELOW

The objective of this management prescription is a moderate level of fire hazard reduction and protection from drought related mortality. A byproduct of this

prescription may include wood products. Results of this prescription will be less variable compared to the prescribed fire prescription. What variation there is will be designed into site-specific prescriptions. This prescription may be accomplished with a timber sale. Both chip and sawtimber removals may occur in the first entry. Some of the results of applying this prescription include:

- Approximately 90% of the stand will be treated on the first entry. On re-entry, a different 90% will be treated.
- No trees greater than 30" dbh will be harvested.
- The stand will be thinned from below to 50% canopy cover (or more if all residual trees are over 30" dbh). Tree selection will be in order of increasing height to live crown.
- After thinning, prescribed fire will be used in the stand every 20 yrs.
- Dead and down material < 3.0" is reduced by 75%, dead and down material \geq 3.0" and is reduced by 25%.
- Snags are reduced by 25%.
- Shrub density is reduced by 50%.
- For re-entry, subsequent treatments include:
 - Thinning only
 - Thinning followed by prescribed fire

(9) SINGLE-TREE SELECTION

The objective of this management prescription is to move stands towards the averaged characteristics found in California Spotted Owl foraging areas and maintain those conditions for the longest time possible. As a byproduct this prescription may also have wood products. This prescription will be accomplished with a timber sale. Some saw timber removal might be required.

Chips may either be removed or disposed of on-site. While either single tree selection or group-selection would be used in practice, the singletree selection silvicultural system best responds to this objective because it has the potential to maintain conditions for the longest time possible.

Some results of applying this prescription include:

- Re-entries treatments will occur when the basal area in trees greater than 10" dbh exceeds 136 square feet per acre.
- Only those trees in excess of California Spotted Owl foraging needs will be harvested.
- Dead and down material < 3.0" is reduced by 75%, dead and down material \geq 3.0" is reduced by 25%.
- Shrubs density is reduced by 50%.

(10) HEAVY THIN FROM BELOW

The objective of this management prescription is a high level of fire hazard reduction and protection from drought related mortality. As a byproduct of this prescription there may be some wood production. The prescription results will be less variable compared to the prescribed fire prescription. Variation will be designed into site-specific prescriptions. This prescription may be accomplished with timber sales. Both chip and saw timber removal may occur. Some of the results of applying this prescription include:

- Approximately 95% of the stand will be treated. Subsequent treatments on re-entry will treat a different 95%.
- No trees greater than 30" dbh will be harvested.
- Stands will be thinned from below to a 40% canopy cover (or more if all residual trees are over 30" dbh). The treatment will be repeated every 20 years or when height to live crown is less than 8.5-feet.
- After each thinning, an under burning will occur within 10 years to maintain the stand conditions.
- Dead and down material < 3.0" is reduced by 90%.
- Dead and down material >= 3.0" and snags are reduced by 90%.
- Shrub density is reduced by 90%.
- Subsequent treatments may involve:
 - Thinning only
 - Thinning followed by prescribed fire

(11) GAP THIN

The objectives of this management prescription are three-fold: 1) to encourage the creation of gaps in the forest canopy that are consistent with the desired conditions for giant sequoias and associated mixed conifer vegetation, and that lead to the establishment of young seral stage vegetation; 2) to thin the remaining portion of the stand to promote healthy growing conditions and protect against drought-related mortality and 3) reduction in fire hazard. When using mechanical methods, emphasize gap location in areas of the stands with the lowest existing stocking levels (in order to minimize impacts to existing overstory canopy). In the remainder of the stand outside of gaps, thin from below in the "matrix" (the areas between the gaps). This prescription may lead to an opportunity for removal of biomass material or commercial sale of wood products. The prescription results will be less variable compared to the prescribed fire prescription. Some of the results of applying this prescription include:

- Between 5% and 10% of the stand will be treated to create gaps by mechanical methods. Subsequent treatments on re-entry would treat a different 5%.
- No trees greater than 30" dbh will be removed.

- The remainder of the stand will be thinned from below
- After each entry, a prescribed fire will occur within 10 years to continue to move the stand toward desired condition or to maintain the desired conditions once they are achieved.
- For modeling purposes, apply this prescription only during the first 2 to 3 decades of implementation. Transition to prescribed fire as the primary method for continuing to develop desired conditions.