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Jackson Advisory Group Recommendations

to the

California State Board of Forestry and CAL FIRE

on

Late-Seral Development Prescription

for Brandon Gulch Timber Harvest Plan

August 9, 2008

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Executive Summary

This Report from the Jackson Advisory Group to the Board of Forestry and the Director of CAL FIRE recommends a timber harvest prescription to be applied to the Brandon Gulch timber sale at Jackson Demonstration State Forest (JDSF). This prescription results from a directive from the Director to develop an approach to timber management that accelerates the development of late-seral forest conditions, while maintaining and developing important recreation values.

Little specific knowledge is available regarding exactly what "late-seral forest conditions" are and how to attain them. Late seral conditions relate to but differ from those in old growth forests. Elements within a late-seral forest include large trees, slowed tree growth, and occurrence of features such as snags, down logs, and mortality of overstory trees. The rate of development of these elements in redwood forests at Jackson Demonstration State Forest (JDSF) will be moderate reflecting the forest's moderate level of site productivity.

Because of the limitations of knowledge, the Committee took a cautious approach. The recommended prescription consists of two entries. The first will remove approximately 30 percent of current basal area and will be aimed at providing the largest trees with increased growing space to accelerate diameter growth rate. Most harvested trees will be redwoods from the co-dominant and intermediate crown classes. Most of the smallest, suppressed trees will be left to provide shade and site occupancy to limit the development of a new age class of regeneration. The prescription will be carried out to enhance multiple canopy layers and diversity in tree composition and density across the landscape. The second entry that will occur in approximately 20 years will be designed after evaluating the response of the stand to the first entry and in the light of new knowledge and experience.

Recreation values will be maintained and, where possible, enhanced by attention to layout and conduct of harvesting operations, special sensitivity towards visual quality in setback areas adjacent to trails, campgrounds and streams, treatment of logging slash, and restoration of trails and trailheads after harvesting.

Demonstrating to the public the experience gained in carrying out the prescription will require gathering before and after information to describe the response of Brandon Gulch to treatment, assessing the extent to which development towards late-seral conditions have been accelerated, and evaluating the compatibility of forest management with recreation.

1. Introduction

The Objective

A settlement agreement resolving various legal contentions among several parties, including Cal Fire, directed that an outstanding Timber Harvest Plan (THP) for Brandon Gulch "be amended such that the treatment objective shall be 'acceleration of the development of late seral forest conditions' (ALSF)." Further, the settlement specified that "The plan shall be treated as a demonstration in ALSF," and also that consideration will be given to potential "harvest modifications to reduce visual impact on recreation users" (Appendix 2).
The Committee on Late Seral Development, which is a committee of the Jackson Advisory Group, was appointed by the Director of Cal Fire to provide recommendations on a timber prescription for Brandon Gulch that meets the goals of the settlement.

Brandon Gulch

Brandon Gulch is a 100-year-old, 336-acre, unentered stand having a high percentage of redwood trees and substantial variability in species mix and density across the stand. An important feature is the presence of class 1 and class 2 streams. There are popular recreation trails and two rustic backcountry campgrounds.

Late-Seral Condition

A challenge in approaching this task is that there is no one definition of "late-seral condition". It is related to the concept of "old growth" and "climax forest", but is better described in terms of the elements of stand composition and crown structures of dominant trees found in mature redwood forests.

Little knowledge and experience exist about actively managing100-year-old stands to accelerate development of late seral conditions. Brandon Gulch is hundreds of years away from being an "old growth" stand, regardless of the treatments made now or in the future.
The nearly unique opportunity to actively manage a 100-year old stand for late seral is an exciting opportunity. At the same time, the limitations of knowledge make designing a management plan a formidable challenge.

Approach

The committee chose to be cautious in its approach. It also chose to focus on an obvious characteristic of late seral forests – developing large trees – while encouraging the continued development of complexity and diversity in the forest structure.

Based on the above considerations, a survey of existing literature and site visits, the committee recommends a prescription that will create openings around larger trees to accelerate their growth; keep canopy openings moderate to repress growth of a new age-class of trees and to maintain conditions for understory and ground-level biological processes; provide for recruitment of large woody debris; move the distribution of tree sizes closer to those existing in old growth stands; and maintain and enhance recreation values in the area.

2. Late-Seral Forest Conditions

The term "late-seral" is a broad category of stand conditions typified by large trees, slowed tree growth (senescence), and occurrence of features such as snags, down logs, and mortality of overstory trees (decadence). Examples of some late-seral forest elements present on JDSF are shown in Figure 1. Canopy gaps are filled in with shade-adapted understory trees and ground cover. With sufficient time, and without disturbance such as wildfire, shade-tolerant species may become a dominant stand component.

In redwood forests, stand-replacing events such as fire are rare and commonly are under-burns. Burned redwood trees commonly stay alive and replace their crowns with epicormic branches (small side branches formed following increased exposure to light or fire). Since redwood is shade-tolerant it often remains the characteristic, dominant species. With increasing age, redwood is more likely to topple than form standing snags. Redwood has renowned decay-resistance thus the presence of down logs is a better characteristic of late-seral conditions than is snag presence. In an ecological sense, "late-seral" is not equivalent to "climax" and development towards late-seral conditions does not necessarily preclude timber harvest.

Managing stands to accelerate the development of late-seral conditions can be suitable for a variety of goals including increasing the proportion of old forests, wildlife habitat, aesthetic enjoyment, recreation, and park management. However, accelerating late-seral conditions may not be a primary goal for timber management by industrial or small, non-industrial owners of redwood land.

3. Brandon Gulch

The Brandon Gulch timber harvest area is located within the south fork of the Noyo River watershed (Figures 2 and 3, Appendix 3). Productivity is Site Quality II and III with considerable variability across the area. The forest has grown up from natural regeneration following logging and burning in the late 1800s and early 1900s. The forest is basically even-aged with some remnant older trees, however stand conditions and tree sizes vary considerable depending on differences in soils, slope, aspect, and tree density remains high due to active fire suppression. The current high proportion of tanoak in parts of the stand probably results from the early logging and subsequent burning. The stand averages 129 trees per acre greater than 12 inches diameter at breast height (dbh) with an average basal area of 373 square feet. Species composition is 70 percent redwood, 20 percent Douglas-fir, 5 percent grand fir and hemlock, and 5 percent hardwoods. The number of trees by species and diameter class is shown in Figure 4 and Appendix 4.

There is a high degree of variability in structural attributes of late-seral forests. However, existing information suggests that Brandon Gulch has a larger number of small trees relative to what might generally be found in late-seral forests.

Late-Seral Elements from JDSF

Burned Stump

Down Log

Large Limbs

Root Ball

Goosepen

Douglas-fir Retained

Images removed to reduce file size

Figure 1. Late-seral forest elements from JDSF.

(Note: Photo deleted to reduce file size. The image will be full-size in landscape format)

Figure 2: Aerial photo of Brandon Gulch showing road system and stand diversity.

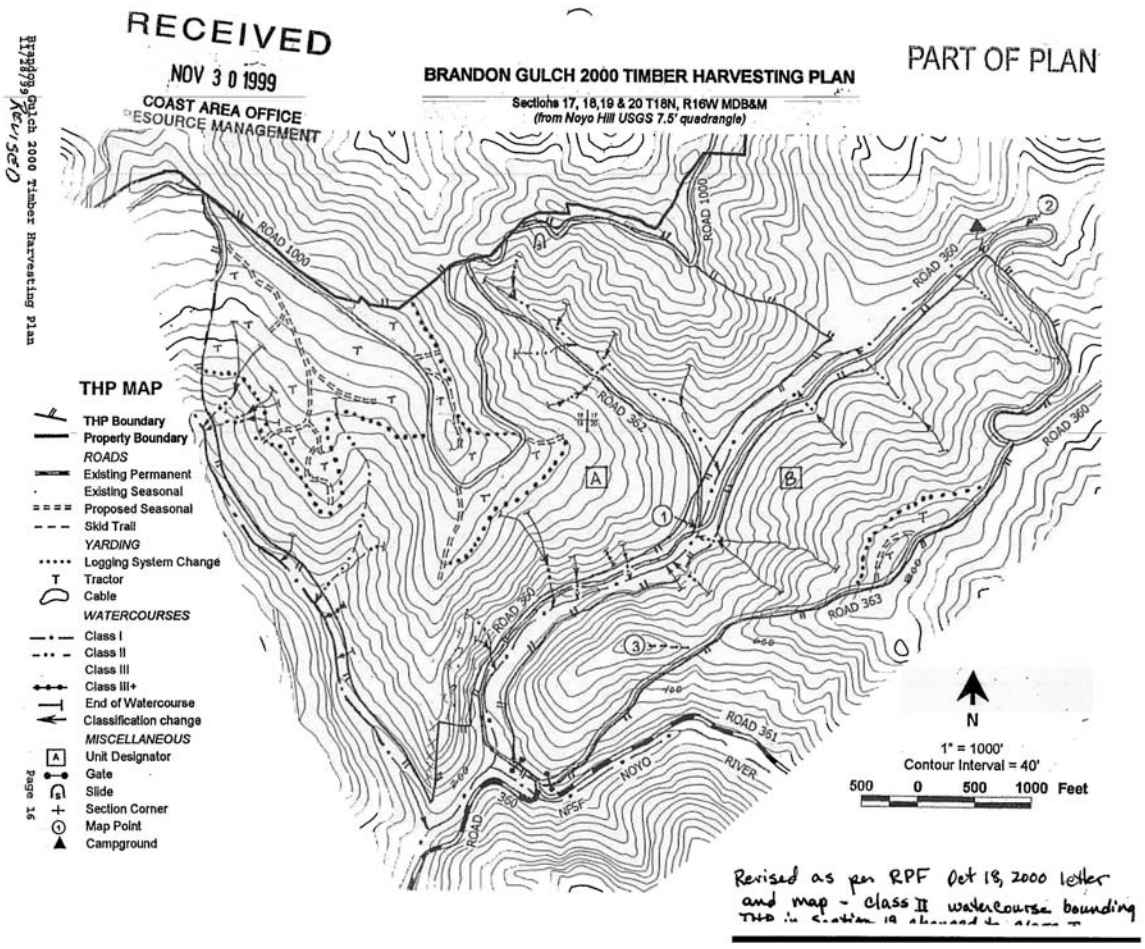

Figure 3: Topographic map of Brandon Gulch showing physical features.

(Note: Image will be full-size in landscape format)

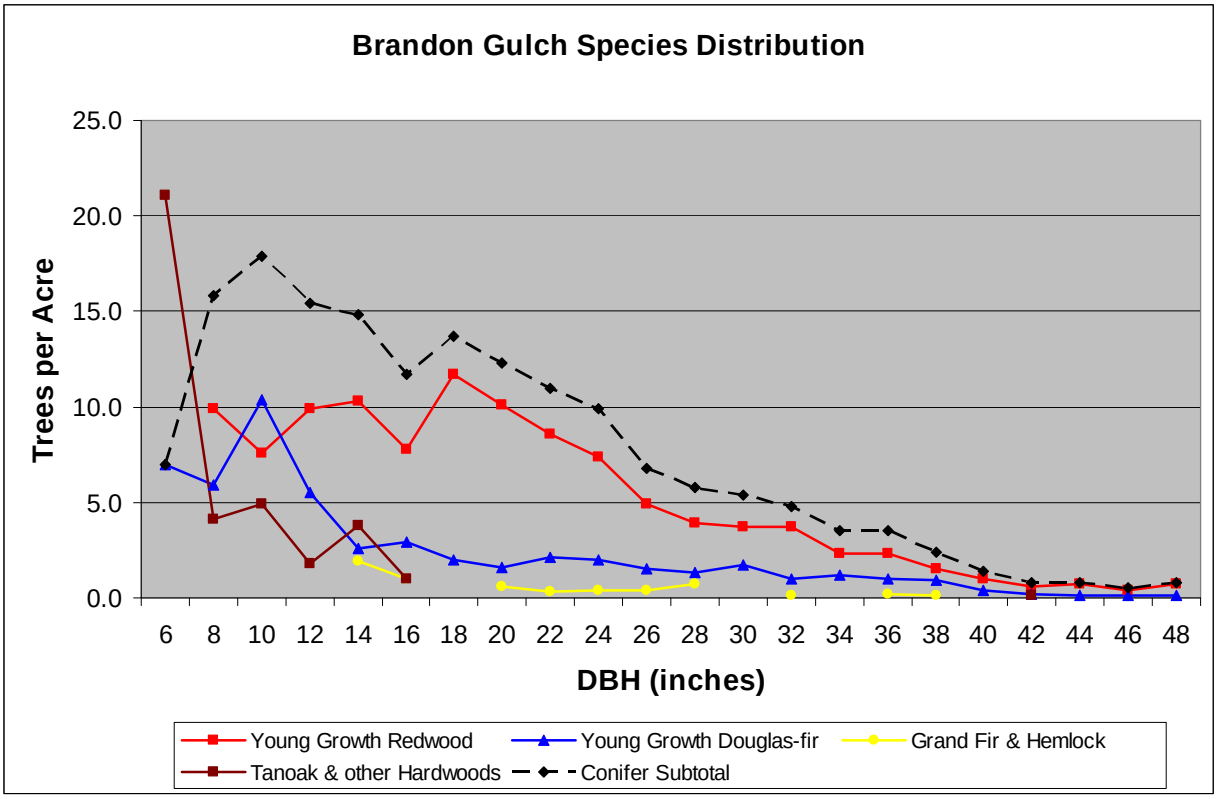

Figure 4: Frequency distribution of trees at Brandon Gulch by diameter class. Figure has been changed to combine tanoak and other hardwoods into one curve, and also grand fir and hemlock into a single curve.

(Note: Figure 4 will be full-page in landscape format)

Dominant and codominant trees have good growth, stem form and vigor with few bole cavities, broken tops, or epicormic branches.

There are approximately three snags per acre greater than 20 inches in diameter and are primarily young growth Douglas-fir. Down logs are infrequent. Old growth stumps commonly have burned-out basal hollows or cavities.

The area has evidence of use by Native Americans as well as historic logging and railroad sites.

4. Recommended Prescription

As outlined in the Settlement Agreement, the Brandon Gulch prescription goal is to accelerate the development of late-seral forest conditions (Appendix 2). It is expected that timber revenues from applying this prescription will exceed costs.

Previous experience in thinning redwood stands using a similar goal of accelerating late-seral conditions was available in a forest near Rio Dell, Humboldt County, managed by J. Able Consulting. This 60-year-old forest has been thinned three times in 1988, 1999, and 2008. The most recent entry (June 2008) removed 30 percent of the basal area leaving the best and largest trees. Appendix 7 shows photographs taken in July 2008 of two stands in this forest which, because of having higher site quality and higher growth rates than at JDSF, enabled using a 10-year interval between thinnings.

a. Prescription Emphasis and Entries

The JAG-recommended-prescription differs from standard prescriptions for timber production. It emphasizes:

1) developing complex, multi-layered forest structure
2) minimizing regeneration so that it is similar to natural levels in late-seral stands
3) diverse horizontal stand variability
4) provisions for enhancing ecological diversity
5) fewer trees of larger diameter, and
6) increasing stand and crown complexity

A prescription of two entries 20-years apart is proposed with the goal of attaining, in 100 years, the recommended high-end, conservative levels of tree numbers and composition that would be expected in a late-seral redwood stand. Specifics of the second entry would be outlined following an evaluation of the first entry and subsequent 20-years growth (adaptive management). Selecting only one entry would involve a heavier cut and entail the risk of stand-level blowdown or a higher than desired amount of regeneration. Selecting more than two entries, although permitting adjusting stand density in smaller increments, would entail more harvesting operations and greater accumulated disruption to ecological development.

b. Tree Density and Composition Targets

The prescription is based on estimates of number of large trees per acre expected to occur on older stands on Jackson Demonstration State Forest. Probably the best guidance is from what was described as a "virgin forest" in the original Caspar Lumber company ownership of JDSF having an average of 51 trees per acre -- 24 trees in the 10-30 inch diameter class and 27 trees greater than 30 inches in diameter (Mason and Stevens, 1929).

A recent survey of tree densities, mainly in the northern portion of the redwood region (Dagley and O'Hara, 2003), shows that the range of number of trees in the upper canopy (all species) ranges from 20 to 150 on the areas of highest site quality. Another survey (Giusti, 2004) of three old-growth coastal redwood stands shows the number of trees varying from 16-40, 15-40, and 12-35 in size classes 24-32, 32-40, and >40 inches in diameter, respectively. Trees on alluvial flats generally have higher tree densities than those on adjacent hillsides.

An appropriate target for younger redwood stands on poorer site qualities at JDSF at age 200 years (100 years later than the age of current stands at Brandon Gulch) is thought to be 40-100 dominant and co-dominant trees per acre plus numerous smaller trees in the lower canopy. The higher end of this stocking target for large trees is preferred to allow for some natural windthrow and mortality over time and to ensure reliable, long-term recruitment of coarse woody debris.

The target tree density (trees per acre at age 200 years) is divided into two size classes as follows:

	Site Quality on Brandon Gulch	
	Higher	Lower
12-30 inches dbh	30-50	30-50
>30 inches dbh	30-50	10-30
	60-100	40-80

The target species composition (percent by crown cover) of the dominant and co-dominant components of the canopy is as follows:

	Site Quality on Brandon Gulch	
	Higher	Lower
Redwood	80-90	65-75
Other Conifers	5-15	15-20
Hardwoods	<10	5-15

c. Thinning Prescription

Given that Brandon Gulch currently has an average of 129 trees per acre greater than 12-inches in diameter at an approximate stand age of 100 years, JAG projects that at 200 years Brandon Gulch should have, overall, about 40-100 codominant and dominant trees plus numerous smaller trees. The intent is to provide selected large trees with increased growing space. This suggests that treatments designed to accelerate this development would entail removing approximately 50 trees per acre primarily in the intermediate and co-dominant crown classes greater than 12 inches in diameter. Over the next 100 years, many existing trees currently less than 12 inches in diameter will, of course, grow into the greater than 12-inch diameter category.

Entry 1: Time 0 yrs. Reach half the overall target density goal by removing approximately 30 percent of existing ~~tree number and~~ basal area and ensuring that the thinning is economically viable. As shown in Figure 4, the current diameter distribution of trees at Brandon Gulch has a larger number of trees in the 16 inch and 24-28 inch diameter classes where a large proportion of the harvest should be removed. Figure 5 also shows the approximate distribution of diameter classes immediately after the first harvest entry and the likely distribution after growing 20 years. The effect of the first thinning treatment is to lower tree numbers and increase tree sizes (the curves are

shown to move down and towards the right). Figure 4 also shows the frequencies of trees by diameter classes that were present in the "virgin forest" in the Caspar Lumber Company ownership in 1929 (Mason and Stevens, 1929) that can be used as an example of late-seral condition.

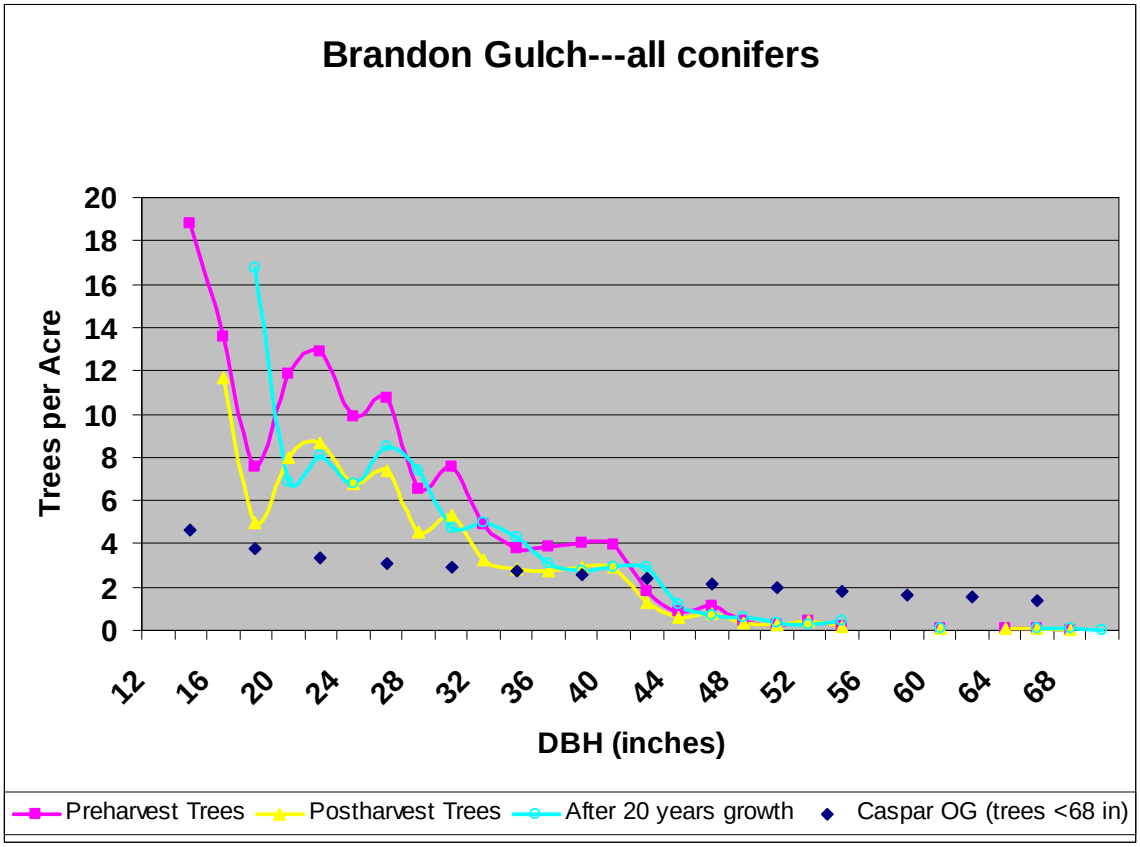

Figure 5: Frequency distribution of diameter classes of all trees in Brandon Gulch pre-harvest, post-harvest, and after projected growth of 20 years. No ingrowth of smaller size classes is shown. Superimposed is the number of trees by diameter class in a "virgin forest" in the Caspar Lumber Company ownership reported by Mason and Stevens, 1929. The graph of Caspar trees is truncated at 68 inches diameter with data base showing a maximum tree diameter of 126 inches.

(Note: Figure 5 will be full-size in landscape format)

Entry 2: Time 0+20 yrs. Following principles of adaptive management, stand conditions and responses after 20 years following the first entry should be evaluated relative to the goal of advancing late-seral conditions. This evaluation will require quantitative measures of stand growth over time. New research, demonstration, and experience will be available that will enable a more accurate assessment of the need for, timing, and nature of a second entry.

Prescription emphasis will focus on: 1) accelerating the growth of dominant and co-dominant trees into larger size classes, and 2) retaining and developing other basic elements of late-seral conditions such as deformity, decadence, and abundant dead wood.

Existing groupings or clumps of redwood will be the source of most harvested trees and most will be thinned to variable levels to promote random stem distribution and variable growth responses. Entire clumps should not be removed to minimize establishment of a new cohort of regeneration. About 10 percent of the clumps should remain unthinned to promote slow tree growth, fine tree rings, and enhance heterogeneity in stand structure. About 10 percent of the clumps should be heavily thinned.

Prescribing desired harvest goals in terms of stand average tree number and basal area provides an overall guide to accelerating development of late-seral conditions. This does not, however, recognize existing variability in stand density and diversity or how to apply the prescription to maintain or enhance irregular, old forest structure. The task of professional staff will be to determine an effective and practical thinning approach, possibly with input from JAG in the initial phase of field implementation. One approach that could be considered is to develop rules using a list of thinning options together with a random number generator to select the specific proportion of trees to be removed from a particular redwood clump. A similar approach could be developed to establish thinning guides for individual Douglas-fir trees and individual redwood trees between clumps. The rules would be constrained to leaving larger diameter trees, Douglas-fir retained for diversity and future snag production, and other desired ecological and diversity outcomes described below.

d. Use of Models to Test Prescription Sensitivity

To provide guidance on the sensitivity of redwood stands to alternative prescriptions, five preliminary runs projecting growth and yield were made using the CRYPTOS growth model using a 60-year growth period. The model showed, in the long term, relatively little sensitivity to different prescriptions of light, medium, and heavy thinnings in terms of likely development of tree size, basal area, volume, and yields (see Appendix 10). To provide further insight, the MASAM model that projects leaf area development was run using the same CRYPTOS prescriptions (see Appendix 11). Although this model was developed using data from redwood stands that are more productive than those at JDSF, it supports the view that the prescriptions being considered are likely to result in rapid crown closure. Moderate harvests of trees mainly in lower canopy classes will ensure that light levels will be sufficiently low to slow down the growth of sprouting redwood clumps. This is desirable to meet the goal of enhancing the development of old forest conditions. The importance of focusing prescriptions on canopy conditions is supported by Lindquist, 2004, who reported that "the growth of redwood regeneration is inversely proportional to overstory canopy".

e. Stand Structure Old forests are characteristically very diverse and have heterogeneous structure both vertically through various canopy layers and horizontally across the landscape.

a) Vertical Structure and Canopy Diversity

Vertical structure can be promoted by developing multiple tree layers. These provide varying light and microclimates favorable to diverse populations of understory plants, animals, fungi, and lichens characteristic of late-seral redwood forests. As shown in the table on page 9, species composition within a mature redwood forest at JDSF would probably range from 65-90 percent redwood, 5-20 percent other conifers, and 0-15 percent hardwoods, depending on site quality. These proportions should be used to guide treatments that affect overall vertical structure and canopy diversity.

b) Horizontal structure and spatial distribution

To encourage variable density and species composition across the landscape, tree marking should maintain and enhance existing mosaics of trees.

f. Old Growth The existing JDSF old-growth retention policy will be implemented (Page 104 JDSF Management Plan). This ~~requires that any live conifer present in the original stand before historic logging in 1860 will be retained~~ specifies retention of large old-growth trees of any size that exhibit unique structural characteristics as described in the policy.

g. Tree Retention In general, all dominant trees will be retained except where their removal will enhance desired stand structure. ~~The better co-dominants and trees in the middle canopy, especially among the non-clonal trees, should be retained to contribute to the mid-canopy stratum.~~ (repetitive). Emphasis should be placed on developing stand variability, minimizing impacts on ecosystem components and functioning, and sensitivity to aesthetics.

h. Suppressed and Small Low-Canopy Trees will mostly be left unthinned to provide shade and site occupancy and to repress new regeneration. Their numbers, however, will be reduced through light harvest and related logging activity.

i. Regeneration No targets should be made to manage regeneration and its occurrence will be incidental to stand treatments. The moderate thinning prescribed should limit light levels sufficiently to reduce the development and competitiveness of regeneration and redwood sprouts, which is needed to promote the development of late-seral conditions.

j. Tanoak and Other Hardwoods All hardwoods will be retained for wildlife and other values. This may depart from the JDSF Management Plan guideline (page 107) of retaining hardwood tree composition at approximately 10 percent (West end of Forest) to 15 percent (East end of Forest) of stand basal area. Hardwood composition and quality should be evaluated prior to the second entry and treatments considered to balance or enhance their role in the late-seral forest.

k. Sanitation/Salvage Cutting

Limited cutting to salvage mortality or to mitigate the effects of insect or disease infestation or wildfire could be undertaken if these natural disturbances are so extensive as to detract from the goal of achieving late-seral conditions. Care should be taken, however, not to diminish meeting wildlife habitat and ecological goals.

5. Special Considerations

a. Recreation and Aesthetics

Recreation use on Brandon Gulch consists primarily of two campgrounds and use of recreational trails (Roads 360, 362, and 1000, see Figure 3) used by campers, hikers, bikers, equestrians, shooters, and unauthorized use of OHVs.

The direction given in the Settlement Agreement (Appendix 2) is to ensure that:

> "Recreation use will be considered when devising the THP amendments. Potential harvest modifications to reduce visual impact on recreation users, including but not limited to those provided by the Management Plan and the Forest Practice Rules, shall be considered for incorporation in the THP amendments."

To meet this directive, treatments should be applied in the close vicinity of campgrounds and trails to mitigate the effects of timber harvest and to enhance vegetation development that promotes desirable aesthetic and visual conditions. Concerns and suggestions provided by an initial recreation user survey (Appendix 8) should be considered in carrying out timber harvesting and mitigating its effects.

The following elements provide additions or emphasis to the recreation guidelines in the Management Plan:

1) Roads and Trails. Roads 360, 362, and 1000, are used by hikers, equestrians, and trail bike riders and are valued for providing aesthetic experiences and views of the forest. Trails used by equestrians should provide adequate width and overhead height clearance. To lessen visible impacts of timber harvesting in sensitive areas, setbacks on the uphill side of trails should be 150 feet along the slope, possibly with greater setbacks on the downhill sides where visibility penetrates further into the forest. Removal of any trees within setbacks should be limited to those necessary to ~~enhance specific needs of forest and ecological development~~ enable harvesting operations. The setback can be reduced in size when no significant impact will result. Any proposed tree harvesting within setbacks should be controlled by visual confirmation from professional staff on the trail, possibly with input from JAG in the initial phase of field implementation. Trails along streamsides are especially scenic and setbacks along Brandon Gulch and the North Fork of the Noyo River may exceed specifications of the Forest Practice Rules to protect particularly identified values. Sherwood Trail is of particular importance requiring special maintenance to prevent erosion.

   After harvest, all trails should be restored as much as possible to their original or desired condition. All trails and trailheads within Brandon Gulch should be well marked and mapped. Opportunities should be taken to provide information to the public on sustainable forest management, advancing late-seral stand conditions, and balanced resource use on portions of trails from which harvesting can be observed.

2) Existing Campsites and Day-Use Areas at JDSF provide a remarkable sense of solitude and therefore careful attention is required to ensure adequacy of setbacks. Setback size should be 200 feet within which harvesting should be excluded (Management Plan, page

275) with added sensitivity given within 300 feet (Management Plan, page 119). Prior to harvesting, onsite evaluation of potential visible impacts should be conducted by JDSF staff and one or more JAG representatives to ensure that desirable visibility screens are prescribed. These will likely vary considerably around campsites due to variability in terrain and vegetation. Thinning near campgrounds and day-use areas should be limited to enhancing understory development, future screening, and removing potential hazard trees. Planning for thinning should be controlled by visual confirmation from professional staff in the campground, possibly with input from JAG in the initial phase of field implementation. Trails to campgrounds should receive the same visual protection provided to other recognized trails. Riparian buffers may exceed standards of the California Forest Practice Rules to protect special values at particularly important locations of recreation areas.

3) Cable Corridors should be kept as narrow as possible and, if practicable, aligned ~~at the most acute angle as possible to trails~~ to minimize visibility. Care must be taken to avoid injuring leave trees at the edge of corridors.

4) Tractor Logging should leave as much vegetation as possible for visual screening from roads and trails. Tractor use should be restricted when soils are moist to avoid soil compaction.

5) Landings and Access Routes should be limited to the minimum size needed consistent with providing safe working areas. Landings (including those from previous logging entries) should be cleaned up and planted unless designated for reuse. All access roads and landings should be decommissioned by covering with slash to limit non-authorized use, stabilize surface soil, and enhance regeneration of native plants. Special care should be taken to avoid conditions conducive to establishment of exotic plants.

6) Logging Debris away from trails and visitor use will be treated using standards within the Forest Practice Rules. If visible from trails and visitor use and on entrances to access roads and landings, logging debris should be lopped and scattered if not removed via prescribed burning treatments. Slash abatement may in places exceed the normally-prescribed 50 feet from a road (Management Plan pages 119 and 273) to reduce fire risk or enhance recreation and aesthetic values.

7) Garbage Increased attention must be given to discouraging the dumping of garbage, which should be promptly removed where it occurs.

b. Wildlife

Wildlife species likely to occur on JDSF are listed in the Management Plan (page 18). Over the course of time after the prescription has been applied, increased diversity of wildlife populations are likely to develop corresponding to enhanced diversity of vegetation and other flora, size of trees, and increasing occurrence of late-seral elements such as snags, down logs, and cavities.

Wildlife expected to occur in stands of different type can be predicted using the California Wildlife Habitat Relations model. Although the model is not explicitly designed to address "late-seral" as a distinct type, redwood stands with canopy cover greater than 40 percent, with trees greater than 24-inches in diameter, and with a multi-layered canopy were predicted to be inhabited by 167 wildlife species. Of these, none were found exclusively in vigorous stands, In forests having elements typical of late-seral conditions, 123 species were predicted to occur. The model predicts that 60 species were insensitive to the modeled stand conditions, 56 minimally sensitive, 19 species moderately sensitive, 9 species strongly sensitive, and 23 species predicted to have no habitat value in young stands. These predictions suggest that a broader array of species is expected to find suitable habitat in forests with adequate amounts of the decadent elements that typify late-seral forests (see Appendix 9). (Text that was deleted now reinstated).

Brandon Gulch and the North Fork of the South Fork of the Noyo River provide habitat for coho salmon and steelhead trout and both species are found during most years. Over most of the past 20 to 30 years, juvenile populations have been dominated by steelhead, but during some periods when ocean conditions and spawning coho populations are high, coho are dominant due to having an earlier spawning period. Historically, coho spawning and juvenile populations were much larger than steelhead and this situation may return when streams are restored to previous conditions. Although large woody debris is critically important to both fish species, Coho, especially, favor deep pools and cover provided by down logs, slower water, and clean gravels. The current, low occurrence of logs is due to historic logging practices and mis-guided restoration efforts. An important component of accelerating late-seral stand conditions is to increase recruitment of large woody debris in the two streams and take other measures as prescribed in the Jackson Management Plan (pages 8, 23, 63, 104, and elsewhere).

Brandon Gulch has been surveyed for potential marbled murrelet nesting habitat with no apparent likelihood of "take or impact" (Management Plan pages 18, 61, 66, and elsewhere). Surveys should continue to be conducted annually for northern spotted owl and habitat protected as outlined in the Management Plan, page 64.

1) Snags and Coarse Woody Debris

Snags: JDSF Management Plan guidelines (page 106) will be followed, and preferably exceeded, requiring no less than three snags per acre -- two greater than 20-inches dbh and one greater than 30-inches dbh -- distributed unevenly across the landscape. Active creation of Douglas-fir snags in the first entry might not be feasible due to their current small size.

Conifer and hardwood trees having current or potential value for wildlife, mast production, or as hosts for other biota such as epiphytes, fungi, and lichens should be retained considering both the short-term period between treatments and the long-term period beyond the second entry. Trees retained for potential wildlife values, snags, and coarse woody debris should vary in vigor. In particular, dominant Douglas-fir should be retained that exhibit low vigor and slow-growth (finer rings), are diseased, and have heavy limbs and cavities. Exceptions are trees that must be removed for safety reasons, for example near trailheads.

Coarse Woody Debris: JDSF Management Plan guidelines (page 107) will be followed, and preferably exceeded, requiring no less than three down logs per acre 20 feet long -- two greater than 16 inches dbh and one 24 inch dbh at the large end -- distributed unevenly across the landscape. If the stand is currently deficient in this material, trees should be felled to meet this goal since the Management Plan guidelines are unlikely to adequately meet levels of coarse woody debris normally found in stands approaching late-seral condition. Existing down logs and larger, dead trees should, as far as possible, be left undisturbed to maintain wildlife values. Coarse woody debris from hardwood trees should be encouraged to provide needed habitat diversity for animals and plants.

The presence and quality of snags and coarse woody debris should be assessed against desired targets prior to considering the second entry. Specific targets and treatments can be developed at that time in light of changed conditions.

2) Species protection and Habitat Management: Prior to the first and proposed second treatment entries, Brandon Gulch should be surveyed for species protection using standard protocols and guidelines endorsed by the appropriate federal or state agency (JDSF Management Plan, beginning page 110).

c. Forest Ecosystems

Biological diversity (fauna and flora) should be evaluated prior to the first and second entries to determine what management activities are needed to ensure long-term conservation of existing or needed species common to late-seral forests in the Brandon Gulch area (see JDSF Management Plan, page 107). Attention should be addressed not only to the presence of these species, but ensuring conditions for diverse and healthy ecosystem processes and functions by providing habitat (retaining old forest elements) and encouraging the use of prescribed fire. Attention should be given to enhancing diverse populations of understory plants, animals, fungi, and lichens. As stated in the Management Plan (page 108), survey protocols should be established after consultation with state and/or federal agencies, recognizing that the Brandon Gulch area is not designated primarily for research purposes and has high recreation and education values.

1) Understory: Shrubs and groundcover should be impacted as little as possible. Some level of disturbance will occur from logging operations but those impacts should be limited and restricted to skid trails, landings, roads and other necessary infrastructure needed for harvesting.

2) Legacy trees, snags, and down logs

Avoid skid trails, treatments, and logging damage that are likely to affect existing ecosystem components and structures needed to provide critical elements of ecosystem and late-seral values. The largest trees commonly left from early logging, snags, and down logs constitute important ecological "legacies" and should be protected.

3) Elevated Structure Development:

Late-seral redwood forests are characterized by elevated deformities in trees that typically result from mechanical damages that accumulate over time due to wind, wildlife damage, adjacent tree fall, etc. Important tree characteristics include reiterated trunks (redwood stems in which large, upturned branches form complex, multiple-crown structures), large branches with varied growth patterns, snag tops, and broken tops. To ensure that harvesting does not inadvertently set back the amount and development of these elevated structures, retention of existing trees with these features should be a high priority.

e. Prescribed Burning

Prior to early logging, the return interval for low-intensity forest fires in the Mendocino redwood forests was 5-25 years. From an ecological standpoint it would therefore be desirable to reintroduce fire into the redwood ecosystem.

It is recommended that, after the first prescription entry which will be done mechanically, stands be evaluated using the adaptive management principle to determine whether progress towards desired stand structure could be advanced and demonstrated by prescribed burning on suitable portions of the Brandon Gulch. Burning would mostly affect Douglas-fir, mimic natural, low-intensity ground fires, lower potential fuels, reduce stand density in the lowest size classes, promote plant diversity, create char on large, down woody material, and encourage basal cavities or goosepens in redwood. The timing of burning would be governed by weather and atmospheric conditions, fuel moisture levels, and operational and legal constraints.

f. Exotic Invasive Plants Special effort should be made to control exotic invasive plants that are ~~becoming increasingly prevalent~~ evident on JDSF, especially along roads, using guidelines established in the JDSF Management Plan (pages 10, 28, 38, 51, 93).

5. Demonstration, Interpretation, and Education

Brandon Gulch is intended as a demonstration area and particular attention needs to be given to defining what is meant by demonstration, interpretation, and education. It is especially important to determine the amount and kind of quantitative information needed to demonstrate and explain the nature and purpose of the prescription, associated costs, the extent to which it is actually accelerating the development of late-seral conditions, and effectiveness of treatments aimed at maintaining and enhancing recreation use.

Suggestions for possible demonstration, interpretation, and education include:

- Maintain costs and other details of administration and operation for use by other landowners.

- Identify key challenges and opportunities to managing for late-seral development.

- Evaluate the applied silvicultural prescription for advancing late-seral (or old forest) development.

- Identify and explain treatment effects on ecosystem components such as understory and tanoak.

- Use interpretative signs and self-guiding trails to inform the public regarding stand growth and use of silviculture to enhance late-seral conditions.

- The old railroad up the North Fork of the Noyo River provides an excellent opportunity to provide public information on logging history and forest recovery from past logging operations that were commonly carried out both in and alongside streams.

- Encourage opportunities for diverse, collaborative initiatives for demonstration (and research). For example:1) treatment(s) such as branch and/or canopy manipulation aimed at enhancing late-seral development; 2) evaluate changes in northern spotted owl prey base as late-seral stand conditions are advanced.

- Create snag-top or snag Douglas-fir and redwood for wildlife habitat.

- Develop questionnaires to solicit hiker, camper, equestrian, and other public reactions to forest treatments aimed at providing timber products while moving the stand towards late-seral conditions while developing recreation values.

- Establish photopoints to show before and after stand development.

- Demonstrate compatibility of managing forests for wood products while accelerating late-seral conditions.

6. Literature Cited

Dagley, C.M. and K.L. O'Hara. 2003. Potential for Old Forest Restoration and Development of Restoration Tools in Coast Redwood: A Literature Review and Synthesis. Report to Save the Redwoods League. 72 p.

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Mason and Stevens. 1929. An Economic Analysis of the Timber of the Caspar Lumber Company Block with reference to Selective Cutting. Portland, Oregon. Copy on file at JDSF.

7. Appendices

1. Members of Jackson Advisory Group
2. Prescription goals from Settlement Agreement.
3. Brandon Gulch Forest Stand and Resource Description
4. Brandon Gulch UNIT FRI Report.
5. Old Redwood Forest Stand Characteristics
6. Elements of Late-Seral Stage Redwood Forests
7. Two Redwood Stands at Rio Dell after Three Thinnings
8. Report of Meeting of the Recreation Committee of the Jackson Advisory Group. June 28, 2008.
9. California Wildlife Habitat Relations Assessment of Consequences of Late-Seral Management on JDSF
10. Projections of Preliminary Prescriptions for Brandon Gulch Using the CRYPTOS Simulation Model.
11. Projections of Leaf Area Index for Brandon Gulch Preliminary Prescriptions Using the MASAM Simulation Model.