Last Chance Integrated Vegetation Management Project Landscape Analysis Silviculturist Report

The American River Ranger District identified a 40,000 acre landscape in 2005 that showed signs of forest health decline (density and drought related mortality) and a landscape that needed fuels treatment. The goal of this initial assessment was to:

- Reduce the probability of catastrophic wildfire on National Forest and private lands while protecting habitat for Threatened, Endangered, and sensitive species (TE&S), and for Management Indicator Species (MIS), both plant and animal.
- Establish and maintain a pattern of area treatments that is effective in modifying wildfire behavior.
- Reduce the risk of insect/pathogen drought-related mortality by managing stand density levels. Improve conifer tree health, vigor, and resistance to fire, insects, and disease and enhance stand structure diversity.
- **Implement vegetation and fuels management activities to maintain the watershed health and vigor and improve the sustainability of riparian areas and to improve watershed condition by reducing current or potential sources of sediment.**

At the same time, the Sierra Nevada Adaptive Management Project (SNAMP) was formed to develop, implement and test the Adaptive Management Strategy (AMS) identified in the Sierra Nevada Forest Plan Amendment (SNFPA) ROD (2004). **This project was selected to gather information at the landscape level to evaluate the effectiveness of fuels treatments and protecting old forests, wildlife habitat and watersheds.**

The SNAMP is made up of researchers from the University of California, the University of Minnesota, the U.S. Forest Service (USFS), the California Resources Agency, the U.S. Fish and Wildlife Service, and the Public. The Science Team is working with the agencies to develop an adaptive management and monitoring program consistent with the Sierra Nevada Forest Plan Amendment. The American River Ranger District is responsible for the treatments within the Last Chance Integrated Vegetation Management Project area; and the Science Team researchers would function as an independent third party, and would implement methodologies that focus on the specific response variables.

The project was modified to fit the study design of two treatments subwatersheds and two controls. The Forest SPLAT layer was then used to further prioritize treatment areas based on SPLAT size and location in association with on-the-ground vegetation density issues.

The UC Science Team performed extensive vegetation and fuel surveys during the summer of 2007. The information is located in the project file. These data were used to become familiar with the current condition of the forest vegetation and fuels and model the vegetation and fire behavior changes over time. FVS modeling was completed on all stands and summaries are located in the project file. All stands were modeled as no treatment, to identify the current condition of the vegetation, modeled to evaluate the stand conditions if a 16 inch, 18 inch, 20 inch and 30 inch upper diameter limit for removal was proposed.

The environment and landscape ecology can be described as moderate to moist sites, moderately deep to deep soils formed from mainly volcanic and metamorphic substrates. Dry conditions with generally good soils result in moderate productivity. Scattered pockets of shallow soils exist as well as moist sites with high timber productivity on the north trending aspects.

The forest vegetation can be described as a late seral forest with open or moderately dense overstory layers. Ponderosa pine, sugar pine, Douglas fir, white fir, incense cedar and red fir dominate the overstory in varied mixtures. Black oak comprises less than 5 percent of the overstory. White fir is prevalent in the mid story and white fir and incense cedar dominate the regeneration. The shrub layer is scattered and the herb layer is comprised of scattered dry and moderate site indicators. The vegetation is heterogeneous and the structure and species composition has been altered by past harvest activities and fire suppression.

California black oak is widely distributed throughout the lower 1/3 of the project area. The goal in these stands is to release the oaks by removing all conifers that are competing with the oaks within 20' of the oak drip line.

There is a dominance of larger fire resistant pines and incense cedar suggesting a natural fire regime of frequent low intensity, wide spreading fires. The current downed woody material ranges from 0.5 to 28.1 tons per

acre in the cable thin units, to 1.5 to 63.5 tons per acres in the tractor units. Snag density varies from 0 to 201 per acre.

Existing Condition:
A landscape analysis was completed to compare the broad desired conditions identified in the SNFPA Record of Decision (ROD) with the more site-specific Last Chance Integrated Vegetation Management Project landscape.

This analysis compared the existing condition with the desired and came up with opportunities to move the landscape toward the desired condition. There are 77 acres of HRCA and the remaining acres are Old Forest Emphasis.

Table 1. Desired Conditions, Management Intent, and Management Objectives by Land Allocation.

Land Allocation	Desired Conditions	Management Intent	Management Objectives
HRCAs	Within home ranges, HRCAs consist of large habitat blocks having: - at least two tree canopy layers. - at least 24 inches dbh in dominant and co-dominant trees. - a number of very large (>45 inches dbh) old trees. - at least 50-70% canopy cover. - higher than average levels of snags and down woody material.	Treat fuels using a landscape approach for strategically placing area treatments to modify fire behavior. Retain existing suitable habitat, recognizing that habitat within treated areas may be modified to meet fuels objectives. Accelerate development of currently unsuitable habitat (in non-habitat inclusions, such as plantations) into suitable condition. Arrange treatment patterns and design treatment prescriptions to avoid the highest quality habitat (CWHR types 5M, 5D, and 6) wherever possible	Establish and maintain a pattern of fuels treatments that is effective in modifying wildfire behavior. Design treatments in HRCAs to be economically efficient and to promote forest health where consistent with habitat objectives.
Old Forest Emphasis Areas	Forest structure and function generally resemble pre-settlement conditions. High levels of horizontal and vertical diversity exist within 10,000 acre landscapes.	Maintain or develop old forest habitat in: - areas containing the best remaining large	Establish and maintain a pattern of area treatments that is effective in modifying

	Stands are composed of roughly even-aged vegetation groups, varying in size, species composition, and structure. Individual vegetation groups range from less than 0.5 to more than 5 acres in size. Tree sizes range from seedlings to very large diameter trees. Species composition varies by elevation, site productivity, and related environmental factors. Multi-tiered canopies, particularly in older forests, provide vertical heterogeneity. Dead trees, both standing and fallen, meet habitat needs of old-forest-associated species. Where possible, areas treated for fuels also provide for the successful establishment of early seral stage vegetation.	blocks or landscape concentrations of old forest and/or - areas that provide old forest functions (such as connectivity of habitat over a range of elevations to allow migration of wide-ranging old-forest-associated species). Establish and maintain a pattern of area treatments that is effective in: - modifying fire behavior. - culturing stand structure and composition to generally resemble pre-settlement conditions. - reducing susceptibility to insect/pathogen drought-related tree mortality. Focus management activities on the short-term goal of reducing the adverse effects of wildfire. Acknowledge the need for a longer-term strategy to restore both the structure and processes of these ecosystems.	wildfire behavior. Maintain and/or establish appropriate species composition and size classes. Reduce the risk of insect/pathogen drought-related mortality by managing stand density levels. Design economically efficient treatments to reduce hazardous fuels.

In 2007, Forest Health Specialists evaluated the project area. Their full evaluation is in the project file and a highlight of their recommendations includes *"…Current tree mortality attributable to insects and/or pathogens is occurring at a low level within the project area. However, Forest Health Protection aerial surveys have detected elevated mortality levels for all tree species over the past 4 years within and adjacent to treatment units (Figure 4). This mortality is generally occurring in true fir, growing in mixed conifer stands, or in ponderosa pine, growing in plantations, at less than one tree per acre. In 2005, mortality was detected over most of the project area at a level of 1 to 5 trees per*

acre. Elevated levels of tree mortality in this area, as well as in the rest of the Sierra Nevada range, are strongly associated with periods of below normal precipitation. Successive dry years can exacerbate unhealthy stand conditions; typically resulting in higher levels of bark beetle caused tree mortality. For example, the mortality that was recorded within and adjacent to the project area during the period of 2004 -2007 followed successive dry years from 2001 to 2004 within the Sierra Cascade zone (Zone 3, Palmer Drought Severity Index Data for California). Most of these affected stands were in an overstocked condition.

Most of the Last Chance SNAMP stands are also in an overstocked condition, averaging approximately 465 (range 158 – 524) on the stand density index (SDI); the maximum SDI for managing ponderosa pine density, the desired condition in this area, is approximately 450. This puts many of these stands in a relative density range of over 100 percent (range 35 to 116 percent). This is well above the Regional Forester's recommendation for density management that suggests SDI levels be maintained below 60% of maximum SDI. This high stand density also puts these stands at risk for elevated levels of bark beetle caused mortality during any extended period of below normal precipitation.

This area has become very dense with white fir through past management activities and with the exclusion of fire over the past 100+ years. With such a high percentage of white fir in the area, shade intolerant species such as ponderosa pine as well as many shrub species, tend to decline due to competition for sunlight, water and nutrients. Higher percentages of white fir in mixed conifer stands can also increase susceptibility to defoliation events caused by the Douglas-fir tussock moth (DFTM) (Orgyia pseudotsugata)…"

This prescription is designed to meet the standards and guidelines described in the Sierra Nevada Forest Plan Amendment ROD, Appendix A, Section D. Specifically it is designed to retain at least 40% of existing basal area, generally comprised of the largest trees and to retain all live trees ≥ 30" DBH. Select leave trees from dominant or co-dominant crown classes when possible. Selected trees shall be the best formed, disease and damage-free trees, with full crowns available. Intermediate crown classes may be retained when necessary to meet the required leave tree spacing. Overtopped and suppressed trees will not be retained.

The vegetation management objective is to maintain this heterogeneity while reducing the risk of insect/pathogen drought-related mortality by managing stand density levels. Conifer tree health would be improved, the stand structure diversity enhanced, and

species composition managed (less white fir and more pine species) while maintaining the largest most fire resistant trees. The emphasis is to retain clusters or groups of trees and maintain at least 50% canopy cover in the stands identified as old forest. Some of the stands are open and near 40% cover currently. The goal is to not go below 40% in these areas. The desirable forest conditions are characterized by more open stands of large fire resistant trees with reduced ladder and surface fuels while providing habitat for plant and animal species.

Table 2. Treatment Units

Proposed Treatment	Facts Identification	Unit Number	Acres	SNFPA Emphasis
Bear Grass Fire RX	0517542650140000000	134	78	Old Forest
			78	
Cable Thin	0517542700069000000	69	81	Old Forest
Cable Thin	0517542700070000000	70	95	Old Forest
Cable Thin	0517542700076000000	76	66	Old Forest
			242	
Tractor Thin	0517542700065000000	65	125	Old Forest
Tractor Thin	0517542700066000000	66	311	Old Forest
Tractor Thin	0517542700067000000	67	166	Old Forest
Tractor Thin	0517542700068000000	68	56	Old Forest
Tractor Thin	0517542700071000000	71	54	Old Forest
Tractor Thin	0517542700072000000	72	19	Old Forest
Tractor Thin	0517542700073000000	73	23	Old Forest
Tractor Thin	0517542700074000000	74	11	Old Forest
Tractor Thin	0517542700075000000	75	56	Old Forest
Tractor Thin	0517542700077000000	77	33	HRCA
Tractor Thin	0517542700078000000	78	142	Old Forest
Tractor Thin	0517542700079000000	79	141	Old Forest
Tractor Thin	0517542650133000000	133	32	Old Forest
Tractor Thin	0517542650134000000	134	151	Old Forest
Tractor Thin	0517542650135000000	135	121	Old Forest
Tractor Thin	0517542650136000000	136	45	Old Forest
			1,486	

Proposed Treatment	Facts Identification	Unit Number	Acres	SNFPA Emphasis
Underburn	0517542951000000000	1000	44	Old Forest
Underburn	051754270100100000	1001	51	Old Forest
Underburn	0517542951002000000	1002	14	Old Forest
Underburn	0517542701003000000	1003	241	Old Forest
Underburn	0517542701004000000	1004	170	Old Forest
Underburn	0517542701005000000	1005	57	Old Forest
			577	
			2,642	

The tractor thin RX is to **Thin with ground based equipment with follow-up mechanical fuels treatment**. This prescription is designed to meet the standards and guidelines described in the SNFPA ROD. Specifically it is designed to retain at least 40% of existing basal area, generally comprised of the largest trees and to retain all live trees ≥ 30" DBH. Leave trees from dominant or co-dominant crown classes when possible. Selected trees shall be the best formed, disease and damage-free trees, with full crowns available. Intermediate crown classes may be retained when necessary to meet the required leave tree spacing.

Retain all live conifers 30 inches in diameter at breast height or larger and at least 40 percent canopy cover (these are open stands or stands that are at or near 40% canopy cover). Maintain 50% canopy cover in stands designated as old forest (4M, 4D, 5M, 5D, and 6). The prescription would emphasize vertical and horizontal heterogeneity and retain higher basal area and canopy cover in the larger (>20" diameter) more fire resilient trees. The emphasis is to retain the *clumpiness* of the stands and trees that are defective with broken tops and other characteristics that are beneficial to wildlife. Maintain clusters of groups of large trees. The goal is to maintain clusters of 5 to 7 trees where present including clusters of trees in the 20-30 size class. Maintain roughly 1 to 2 clusters per acre.

Reduce ladder fuel and tree densities by removing understory trees greater than 4 inches in diameter and up to 30 inches in diameter while retaining the largest and healthiest tree roughly every 25 feet. Through stewardship contracts and service contracts thin forest stands **(1486 acres)** on slopes less than 25% "from below" with chainsaws and mechanical harvesters. The thinning treatment would also enhance the growth of California black oak by removing competing conifers that are within 20 feet of the hardwood drip line. The

goal is to manage for hardwoods at the density of 4 to 7 percent of the trees per acre where existing.

Short pitches less than 150 feet long and up to 30% in slope would also be included. Thinning would occur within the next 3 years followed by fuels treatments that include mechanically piling and burning, underburning, masticating, shredding, mulching, or chipping shrubs and slash with equipment, and by hand. The emphasis is on mechanically piling and burning as it is the most cost effective method. Whole tree yard material and cut and remove small trees damaged by the activity. Remove dead trees that are hazardous to operations in the units and along the haul route within the sale area.

Retain trees with greater than 40% crowns, free of damage or disease, with good form and give preference to Douglas fir, sugar pine, ponderosa pine, and incense cedar over white fir. Maintain 4 snags per acre and 10 to 20 tons of down woody material per acre. Apply borate compound to cut conifer stumps > 14 inches. Follow mitigation for Limited Operating Periods (LOPs), riparian conservation areas (RCAs) detailed on pp 16 through 23. Till temporary roads, skid trails and landings. This is an intermediate treatment and use of the skid trails, roads and landings would occur within the next 20 to 30 years. Artificial regeneration of the landings is planned.

Thinning from below, retaining large fire-resistant trees, and reducing ground fuels would encourage development of forest conditions similar to the historical conditions. Establishment of area treatments and Strategically Placed Area Treatments (SPLATs) across the landscape would reduce the potential for destructive wildfire, improve fire suppression safety and effectiveness, and increase the feasibility and effectiveness of a prescribed fire program aimed at establishing a more frequent less intense fire regime.

This project would be implemented with the Stewardship Contracting authority. The Forest Service was granted authority to enter into stewardship contracts or agreements to achieve agency land management objectives and meet community needs. Stewardship contracting allows the Forest Service to apply the value of timber or other forest products removed as an offset against the cost of services received. Stewardship contracts may be used for treatments to improve, maintain, or restore forest health; restore or maintain water quality; improve fish and wildlife habitat; and reduce hazardous fuels that pose risks to communities and ecosystem values.

The Cable Thin RX is cable yarding equipment with follow-up prescribed fire fuels treatments. Apply the same guidelines outlined above for oak management, canopy cover, heterogeneity and clumpiness.

Reduce ladder fuel and tree densities by removing understory trees greater than 10 inches in diameter and up to 30 inches in diameter and retaining the largest and healthiest tree roughly every 25 feet. Yard all stem material to a top diameter of 6 inches, from timber designated for cutting, with the following exception: Broken portions of logs and tops less than 8 feet in length need not be yarded. Broken ends of merchantable logs shall not be bucked off in the stands.

Through service contracts and commercial timber sale contracts thin forest stands **(242 acres)** on slopes > 25% "from below" with chainsaws. Thinning would occur within the next 3 years followed by prescribed burning wherever conditions permit.

Retain trees with >40% crowns, free of damage or disease, with good form and give preference to Douglas fir, sugar pine, ponderosa pine, and incense cedar over white fir. Maintain 4 to 6 snags per acre and 10 to 20 tons of down woody material per acre. Apply borate compound to cut conifer stumps > 14 inches. Follow mitigation in the EA for Limited Operating Periods (LOPs), riparian conservation areas (RCAs), etc. Till temporary roads and landings. Artificial regeneration of the landings is planned.

Effects of implementing the above RX:
The direct effects of implementing the Proposed Action are the beneficial decrease in canopy cover, stand density and basal area of the thinned stands from a forest health standpoint, and an increase in the quadratic mean diameter of the stands. Species composition in the stands would be directly affected with a decrease in shade tolerate white fir and incense cedar and an increase in shade intolerant species such as sugar and Ponderosa pine. Oak trees would also be enhanced with crown thinning around the oaks allowing them to maintain stand dominance.

The prescription would emphasize vertical and horizontal heterogeneity and retain higher basal area and canopy cover in the larger (>20" diameter) more fire resilient trees. The emphasis is to retain the *clumpiness* of the stands and trees that are defective with broken tops and other characteristics that are beneficial to wildlife. Clusters or groups of large trees would be retained as well as the late seral heterogeneity of the overstory. The plantations would be thinned to reduce the potential for insect related mortality and reduce the surface and ladder fuels as well. This treatment would reduce the risk of loss to wildland fire, increase stand heterogeneity and promote hardwoods.

The commercial thinning on the tractor and cable ground, the mastication in the plantations and the prescribed burning in the wild stands would connect and compliment all of the treatments creating a spatial pattern designed to reduce rate of fire spread and fire intensity at the head of the potential wildland fire.

The greatest benefit from thinning would be in the increased tree vigor creating a healthy forest that could withstand drought conditions. Indirect effects of the Proposed Action are the reduction in inter-tree competition that would permit individual trees greater access to light, water and nutrients, resulting in observable growth response for height and diameter, especially in smaller diameter classes that have been released from competition from brush species, hardwoods and conifers. Since the treatment areas would have improved growing conditions, the overall resistance to environmental stress including insect attack, drought, or disease would improve. As a result, mortality levels would decrease.

Oliver (1997) points out"…that thinning dense stands increases growth on the remaining trees and reduces morality is well-established in the literature." One objective of the Last Chance Project is to "thin from below" or "low thinning" and to release the dominant and codominant trees by removing the lower crown classes. The philosophy of low thinning according to Daniel, Helms and Baker (1979) "is that the lower crown classes use significant amounts of water and nutrients and thus detrimental to the growth of the upper crown classes." This thinning effort focuses on removing trees in the suppressed and intermediate crown classes; the expectation is that leave trees would be spaced at 25 feet between the co dominant and dominant trees. Trees would be well spaced, inter-tree competition reduced, vigor increased and individual trees growth increased.

The direct impacts of the No Action Alternative would be continued forest decline resulting in tree mortality from density induced insect activity. Trees would continue to die creating more surface fuels adding to potential fire spread. Black oak would be removed from the ecosystem due to crown competition of conifers. The Silviculturist Report is available at the District Office and contains all of the vegetation analysis.

Silvicultural effects of reducing tree density: Oliver, et, al (1996) state that stand density affects tree growth rates, vigor; cover for wildlife; fuels and fire potential and behavior; understory tree, shrub and herb density; growth and yield of forest products. As trees grow, trees become more crowded and fewer resources are available for maintaining tree stand vigor. An Oliver study located roughly 12 miles from this project

area followed stand development from stand ages 20 to 40 years. After thinning, the high tree density plots had (144 sq. ft. per acre basal area), tree diameters were 13.5 inches and crown ratios averaged 54 percent compared to the low density plots (64 sq. ft. per acre basal area), tree diameters were 21.2 inches and crowns averaged 70 percent. Managing density develops larger trees more rapidly (enhances the development of large trees) and trees with more vigor (greater crown mass for photosynthesis), results in a proportional increase in volume growth reduces the susceptibility to insects, drought and disease.

The existing density of trees per acre in all of the stands exceeds the desired. Dense stands lead to weak trees that lead to mortality which add fuels to the ground. The after treatment density in the above table is still more trees than the desired but it is yet one step closer to the desired. The high density after treatment may be a function of the modeling and how the program retains oak. Since the thinning effort focuses on removing trees in the suppressed and intermediate crown classes, the expectation is that leave trees would be spaced at 25 feet between the co dominant and dominant trees. Trees would be well spaced, inter-tree competition reduced, vigor increased and individual trees growth increased.

Silvicultural effects of reducing Stand Density Index (SDI): A common density management index is Reineke's SDI which is the number of trees per acre as if the quadratic mean diameter were 25 cm. Long, (1985) advocates translating specific management objectives (volume production, forage, wildlife hiding cover, etc) into specific growing stock levels or levels of SDI. A maximum SDI of 450 was selected to favor ponderosa pine. The goal therefore, is to manage the SDI below 50% of maximum SDI to avoid self-thinning or suppression-related mortality and to maintain vigor. The desired SDI is 40% of maximum (SDI of180) to allow trees to grow up to the 50% upper limit. The minimum SDI is designed to maintain full site occupancy (35% of max. SDI or SDI of 157).

The existing SDI for all stands exceeds the desired. After treatment SDI is still high but closer to desired.

According to Bakke (1997) a "thinning from below, with little or no crown thinning (removal of co dominant and dominant crown classes) should be sufficient in stands at the lower range of SDI values." This proposal is to remove the suppressed and intermediate crown classes. An occasional co-dominant would be removed to meet the spacing requirement or to release a hardwood but the thinning effort generally is limited to trees of the lower crown positions.

Silvicultural effects of reducing Basal Area: Existing stand basal area exceeds the desired in the priority stands. The desired basal area of 150 (in all stands except the PACs), corresponds to roughly 70 to 80% of normal. The lower the basal area, the faster the individual trees would grow. Trees would have larger diameter and larger crowns indicating vigor compared to stands with high basal area and smaller weak trees.

Silvicultural effects of reducing canopy cover: The desired canopy cover for the dominant and co-dominant trees range from 40 to 50. Thinning would reduce the canopy to within the desirable range in all stands. The thinning would remove the trees in the lower canopy classes retaining the larger healthiest trees. Canopy cover influences the potential for a crown fire, the moisture of the surface fuel, wind speeds and establishment and growth of ground vegetation. The goal is to keep stands dense enough to reduce surface vegetation growth yet open enough to maintain vigor and growth.

Silvicultural effects of increasing crown base height (CBH): The desired crown base height ranges from 15 to 25 feet depending on canopy cover. There is the less potential for a ground fire to become a crown fire when the distance from the ground to the live crown is greater. The data indicates that the lower base height existing in the suppressed and intermediate crown classes. Thinning removes these crown classes raising the CBH to the desired. According to Omi (2002) CBH is the strongest correlation for stand damage. Height to live crown is the variable that determines crown fire initiation and Van Wagner (1977) also said that CBH had the strongest correlation to fire severity. Thinning increases CBH by removing the small trees that have full crowns and limbs growing to the ground. Thinning removes the suppressed and intermediate trees, which are the dense young growth that the intolerant white fir and incense cedar with full limbs to the ground.

Silvicultural effects of reducing flame length: Flame length is manipulated by reducing the surface fuel. Less fuel corresponds to lower flame length. This thinning requires whole tree yarding that removes the limbs and tops from the forest to the landing area for further removal. Thinning is also follow by underburning that would reduce surface fuel.

Silvicultural effects of reducing Crown Bulk Density (CBD): The CBD change is negligible because the bulk of the crown mass is in the larger trees and these larger trees are retained. Agee (1996) described the threshold of CBD as 0.1 kg/ha as a determinant for active crowning under extreme fire conditions. The SNFPA provides desirable CBD ranges of .05 to .15 and thinning moves toward this desirable range. Obviously, the lower

the CBD, the lower the potential for active crowning. Thinning reduces CBD by removing the full crowned trees in the intermediate and suppressed crown classes.

Silvicultural effects of reducing existing surface and ladder fuel: Understory vegetation including shrubs reduces tree growth and increases fuel loads and uncharacteristic wildfire potential. Thinning followed up with underburning would remove the surface and ladder fuel and thinning would remove trees of poor vigor before they die and become fuel loading on the forest floor. The mechanical treatments proposed in this project would reduce surface fuel (whole tree yarding) and increase crown base height (removes suppressed and intermediate crowns).

Silvicultural effects of restoring structural diversity and increasing age diversity and **increasing the habitat for late successional dependent wildlife species:** Density management (thinning) enhances development of larger trees with fuller crowns. Thinning manipulates the distribution of trees of various diameters resulting in structural diversity. According to Helms (1996) "tree diameters are well correlated to tree height" and managing the diameter distribution affects both horizontal and vertical distribution. Structural diversity also includes gaps in the forest that would be provided by small landings created to facilitate thinning and natural openings due to rock and shrubs from past disturbances.

Structural diversity derived from down woody material would not be affected in the long-term. Short-term mitigation would protect existing down woody material from removal (old down logs) and it is understood that while some down woody material would be partially consumed during the underburn, the objectives would be protection of the large material. Thinning would promote hardwoods, reduce intolerant species, increase the average stand diameter that would accelerate the development of old forest characteristics and increase stand heterogeneity.

Silvicultural effects of increasing species diversity: Density management regulates species composition. Density management (thinning) would remove the over abundance of intolerant species (white fir) resulting in reducing the amount of intolerant species and increasing the habitat for tolerant more fire resistant species like pine and Douglas fir. Thinning promotes hardwoods. In the prescriptions, hardwoods would also be emphasized as thinning would favor hardwoods and remove the smaller conifers.

Leave trees shall be selected with the intent of meeting the following objectives:

a. To leave the healthiest well-formed trees at an average of 25 feet (roughly 70 trees per acre) between trees for continued health and tree growth.
b. To remove excessively damaged, diseased and when necessary some healthy trees to meet spacing guidelines.
c. To leave slightly damaged or diseased trees (not excessively damaged trees) when these are the healthiest trees available to meet the average spacing requirements.
d. Start by removing intermediate and suppressed trees first and work your way up to the Co-dominates and larger diameter trees. Generally, the Co-dominates and dominates trees in the stand will be retained.
e. To provide for *clumpiness* by leaving groups of trees (generally 5 to 7 trees in a clump) in the 20-30 diameter range to maintain the stand heterogeneity.
f. To provide 50% canopy cover in the largest trees in the identified old forest stands and a minimum of 40% cover in the remaining.
g. Retain broken topped and other characteristic trees that are beneficial to wildlife when providing the clumpiness identified above.
h. Observe the crowns of the trees to see if they are overlapping. If they are, one of them should be cut unless they are surrounded by an opening.
i. If selection criteria for two adjacent trees are equal, the following order of preference for leave trees shall be used: 1. Sugar Pine, 2. Ponderosa, 3. Douglas fir, 4. Incense Cedar, 5. Red/White fir.
j. Canopy cover is usually the "driving" criteria over meeting the 40% BA.

SUGAR PINE: A sugar pine tree shall be left unless it meets BOTH of the following criteria:

1. It is desirable to cut because of damage or defect and there is a better tree nearby.
2. It has obvious signs of blister rust evidenced by dead branches in the crown with swelling on the branch at the point of death. (see photos below)


Limb infected with blister rust.

Blister rust fungus on the stem.

SPACING: The desired spacing between leave trees is generally 25' + or – 25% to allow for selection of the best tree with the most favorable characteristics. As a final check for spacing, observe the crowns of the trees to see if they are touching. If they are overlapping, one of them should be cut unless that would result in a large "hole" in the stand. Another objective of this treatment is to release existing California black oak. Remove all conifers <30" DBH that are within 20" of the oak drip line.

MISTLETOE: In areas of mistletoe infection, select leave trees in the following order to meet the stocking requirements:

1. Healthy non-infected trees regardless of species.
2. Infected trees having the lowest calculated mistletoe rating. Do not leave any tree with a mistletoe rating greater than or equal to 4.

The objective is to not remove all mistletoe infected trees or create holes in the stand to accommodate mistletoe sanitation. Use these criteria to choose between leaving the best of the worst tree when a tree is required to meet the spacing or crown cover criteria. The emphasis is to retain the *clumpiness* of the stands and retain some trees that are defective with broken tops and other characteristics that are beneficial to wildlife.

CLUMPINESS: Maintain clusters of groups of large trees. The goal is to maintain clusters of 5 to 7 trees where present including clusters of trees in the 20-30 size class. Maintain roughly 1 to 2 clusters per acre.

WILDLIFE CONSIDERATIONS:

Wildlife Trees: Leave up to 4 of the largest snags per acre.

TWIN TREES: Trees whose bases are next to each other should either both be cut or both be left. There should be a hard hats width at ground level between them for them to be considered separate trees.

Leave both or cut both.

Cut one, leave the other.

Stand #	Logging System	Existing Basal Area Sq/Ft/AC	40% of Existing BA	Post Thin BA[1]	Existing Trees per Acre	Post Thin TPA	Existing QMD	Post Thin QMD	Existing Canopy Cover %	Post Thin Canopy Cover
65	T	174	70	70	348	159	9.8	9	48-76	50
66	T	374	150	167	248	109	16.6	17.8	31-73	50
67	T	172	69	112	256	144	15.3	15	50	50
68	T	120	48	98	240	198	9.6	10	48	40
69	C	119	48	89	243	168	9.8	14.2	48-62	50
70	C	53	21	23	126	93	9.3	10	38	40
71	T	156	62	72	248	112	10.0	12.3	73	50
72	T	64	26	58	104	69	10.6	12.4	44	40
73	T	200	80	160	408	285	9.2	9.3	65	50
74	T	81	52	52	200	91	8.6	10.2	42	40
75	T	129	52	106	56	48	20.6	22.4	33	40
76	C	235	94	94	240	91	13.4	11.0	70	50
77	T	235	94	94	240	91	13.4	11.0	70	50
78	T	192	77	77	128	68	16.6	13.2	44	40
79	T	162	65	141	92	73	17.7	19.1	39	40
133	T	150	60	91	160	92	12.4	12.6	44	40
134	T	102	41	51	187	124	9.9	11.9	35	40
135	T	221	88	89	224	210	13.4	13	82	50
136	T	221	88	89	224	210	13.4	13	82	50

Review the Harvest Activity Card for specifics in marking each stand. Leave all trees ≥ 30" DBH and cut trees shall be in the 4 inch to 29.9 inch diameter range. The 25' spacing is desired but the canopy cover requirement may override the desired spacing. Leave tree mark. Provide special visual zone adjacent to the 43 and 43-02 roads (see scenery and recreation management requirements). Apply paint to the "back-side" of the trees in this visual zone. Protect RCAs by

[1] Basal Area adjusted to be at least 40% of existing basal area.

establishing (posting) a 100-foot "riparian buffer" zone along each side of perennial streams, and 50-foot "riparian buffer" along each side of intermittent streams and a 25-foot "riparian buffer" zone along each side of ephemeral streams for protection of stream channel. Riparian areas or features not identified on the harvest activity card , NEPA document, or on the ground shall be brought to the attention of the marking crew leader and the Forest Hydrologist.

These stands are very heterogeneous and the goal of this project is to thin out the dense trees. Some areas may have minimal trees removed and other areas will have a lot of trees removed. Plan for variability.

Karen Jones, Certified Silviculturist
3/2008