Late Successional Reserve Memorandum to the Project Record
Highway 89 Safety Enhancement and Forest Ecosystem Restoration Project
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And Emelia Barnum, Supervisory Planner
January 10, 2017

The Shasta-McCloud Management Unit of the Shasta-Trinity National Forest is requesting confirmation that proposed silviculture activities associated with the Highway 89 Safety Enhancement and Forest Ecosystem Restoration Project (“Highway 89 project”) are consistent with the Standards and Guidelines (S&Gs) under the Northwest Forest Plan (NWFP) (USDA-FS, USDI-BLM, 1994).

Figure 1. Maps of Project Area and Vicinity

PROJECT CONSISTENCY WITH NWFP

The Highway 89 project was developed to be consistent with objectives from the (Shasta Trinity National Forest) Forestwide Late Successional Reserve Assessment (LSRA), all of which fall under LSRA Activity Design Criteria #4 (Thinning - Hazard Related), Activity Design Criteria #9 (Fuel Reduction, Hazard Reduction - Prescribed Burning), Miscellaneous Activity #1 (Maintaining Existing Facilities including Resorts, campgrounds, administrative sites etc.), or Miscellaneous Activity #7 (Maintaining Hardwood Stands, forest openings, meadows, and glades) (USDA-FS, 1999).

CONSULTATION SO FAR

The Forest discussed the project with the LSR Workgroup, including potential review of project activities on November 10, 2016. At that time the LSR Workgroup expressed concern that the proposed treatment...
of group selection in the LSR/MLSA (stands 7-52 and 26-300) would result in gaps up to 2 acres in size over up to 25% of the stand areas and this treatment would require further review.¹

Group selection treatments were proposed in mixed conifer and pine dominated natural stands in the LSR/MLSA to address ongoing pine mortality caused by black stain root disease, where the disease is spread by root to root contact.

Some other options were discussed with the LSR Workgroup. As a result of this discussion, additional review of the proposed group selection prescription by the project silviculturist and Forest pathologist identified an alternative treatment of sanitation/thinning within LSR/MLSA that would adequately respond to the need for public safety and address the spread of black stain root disease and break the root to root contact without creating gaps larger than ¼ acre, and over no more than 15% of the stand areas.

PROJECT OVERVIEW PERTAINING TO LATE-SUCCESSIONAL RESERVES

The Highway 89 Project planning area is located in the California Cascades Province on the McCloud Ranger District of the Shasta-Trinity National Forest (SHF) California.

Approximately 74 acres of the 13,514-acre project area (about 0.5% of the project) is within the McCloud Managed Late Successional Area (MLSA) DD-76 and Algoma LSR (RC-357) (Alternative 3, the preferred alternative.)

The project treats:

- 11.1 acres (0.4%) of the 2,596 acre McCloud MLSA (DD-76), and
- 62.9 acres (0.2%) of the 26,891 acre Algoma LSR (RC-357).

The McCloud MLSA was not part of the original northern spotted owl (NSO) Habitat Conservation Strategy (USDA-FS, 1999) (Interagency Scientific Committee, 1990). It was designated as part of an effort to supplement spotted owl protection in this area of low owl density. The Algoma LSR has its origins as a Habitat Conservation Area under the Interagency Scientific Committee's strategy. Its primary intent was to provide connectivity from [NSO habitat and range to] the west to the California subspecies of spotted owl in the Sierra Nevada Mountain to the east.

PURPOSE AND NEED FOR ACTION

The Purpose and Need for Action for the project is to:

- Improve public safety along Highway 89 and in developed recreation areas,
- Reduce hazardous fuels in WUI defense zones near the community of Mount Shasta and near powerlines, and
- Improve forest and ecosystem health.

The portion of the Purpose and Need for Action that most closely applies to the LSR treatments is Forest and Ecosystem Health, and in the case of the Algoma LSR, to improve safety in developed recreation areas. The Algoma LSR stands surround a developed recreation site: Cattle Camp Campground. Specific to the Highway 89 project in LSR/MLSA areas, there is a need to:

1. Increase the diversity of species composition, age, and structure.
2. Increase resilience to fire, insects and diseases.
3. Reduce competition by conifers in hardwood stands and riparian vegetation to ensure their growth and vigor.
4. Restore the natural role of fire in the ecosystem to facilitate vegetative and other fire-related processes.

¹ LSRA Activity Design Criteria #4, treatment standard c, bullet 2, states that “Up to 15 percent of the area would be in heavily thinned patches, or in openings up to 1/4 acre in size, to [promote] individual tree development, encourage some understory vegetation development and encourage the initiation of structural diversity.” (USDA-FS, 1999 p. 185)
5. Increase visitor safety from hazard trees and the risk of wildfires. [Applies to Algoma LSR stands].

PROPOSED ACTION

LSR/MLSA Treatments

The proposed treatments for the stands within LSR/MLSA include:

- Variable Density Thinning, Radial Release (falls under Activity Design Criteria #4: Thinning-Hazard Related)
- Black Oak and Aspen Release (falls under Miscellaneous Activities #7-Maintaining Hardwood Stands, Forest Openings, Meadows, and Glades)
- Plantation Thinning (falls under Activity Design Criteria #2 and 3)
- Sanitation/thinning (falls under Activity Design Criteria #4: Thinning-Hazard Related)
- Riparian Vegetation Release in the McCloud River Corridor (falls under Miscellaneous Activities#7-Maintaining Hardwood Stands, Forest Openings, Meadows, and Glades).
- Underburning (falls under Activity Design Criteria #9: Hazard Reduction-Prescribed Burning).

Variable density thinning would be implemented in mixed conifer and pine-dominated natural stands. Treatment entails variable thinning of trees ≥ 10 inches dbh to a target basal area (BA) range. Trees surrounding legacy ponderosa pine, sugar pine, aspen and black oak would be radially thinned to preserve these important ecosystem components. Clumps of non-pine species would be retained during thinning for wildlife microhabitat.

Black oak release would be done by radial thinning around individual black oak trees where they are being outcompeted for sunlight by conifers. Aspen release would be done by radial thinning around individual aspen trees and clumps of aspen.

Plantation thinning includes thinning, pruning, and/or masticating, either mechanically or by hand, in plantations with trees <10 inches dbh.

Sanitation/thinning treatments (gaps) would be implemented in areas with black stain root disease to slow the expansion of disease centers. Sanitation/thinning would incorporate no more than 15% of individual stands and result in gaps/openings that would be no greater than ¼ acre in size.

Where there is riparian vegetation, the smaller encroaching conifers would be cut and left on site. The smaller trees such as saplings would be cut by hand.

All stands would be underburned to reduce fuels and help return the natural fire interval.

Figures 2 and 3 are maps of the proposed treatment stands within LSR and MLSA (LSR and MLSA designated by purple fill).
Table 1 summarizes the treatments by stands within LSR and MLSA.

Table 1. Stands in LSR/MLSA, Including Characteristics and Summary of Treatments

<table>
<thead>
<tr>
<th>Unit</th>
<th>LSR / MSLA</th>
<th>Acres in LSR / MSLA</th>
<th>Species</th>
<th>BA; QMD; TPA; SDI</th>
<th>~Age (in yrs)</th>
<th>Prescription Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-52</td>
<td>DD-76</td>
<td>4.6</td>
<td>IC, WF, BO, DF (Mixed Conifer)</td>
<td>146 sf/ac; 10.8; 407; 463</td>
<td>~100</td>
<td>Variably thin trees ≥ 4” dbh to 125-150 sf/ac. Radially release legacy PP and BO. Retain clumps of non-pine species. Sanitation/thinning will be implemented in areas of mortality, if present (no more than 15% of stand). No mortality pockets at this time. Underburn.</td>
</tr>
<tr>
<td>14-71</td>
<td>DD-76</td>
<td>0.5</td>
<td>Pine dominated natural stand</td>
<td>0? sf/ac; 17; 74; 177</td>
<td>~32</td>
<td>Variably thin trees ≥ 10” dbh 80-120 sf/ac Radial release legacy pine. Underburn</td>
</tr>
<tr>
<td>14-73</td>
<td>DD-76</td>
<td>4.0</td>
<td>Pine dominated natural stand</td>
<td>124 sf/ac; 18.7; 65; 178</td>
<td>~60-115</td>
<td>Underburn only.</td>
</tr>
<tr>
<td>14-130</td>
<td>DD-76</td>
<td>0.5</td>
<td>WF, IC, PP, DF (Mixed Conifer)</td>
<td>184 sf/ac; 8.4; 479; 362</td>
<td>~64</td>
<td>Variably thin trees ≥ 4” dbh 80-120 sf/ac. Radially release legacy pine and retain clumps of non-pine species. Sanitation/thinning will be implemented in areas of mortality, if present (no more than 15% of stand). Underburn.</td>
</tr>
<tr>
<td>14-133</td>
<td>DD-76</td>
<td>0.5</td>
<td>PP (Pine dominated natural stand)</td>
<td>145 sf/ac; 20.4; 63; 201</td>
<td>~64-86</td>
<td>Variably thin trees ≥ 4” dbh 80-120 sf/ac. Radially release legacy pine. Sanitation/thinning will be implemented in areas of mortality, if present (no more than 15% of stand). Underburn.</td>
</tr>
</tbody>
</table>
## Unit LSR / MSLA | Acres in LSR / MSLA | Species | BA; QMD; TPA; SDI | ~Age (in yrs) | Prescription Summary |
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>14-389 DD-76</td>
<td>0.5</td>
<td>PP (Plantation &lt;10&quot; dbh)</td>
<td>41 sf/ac; 8.5; 105; 81</td>
<td>~29</td>
<td>Thin, prune, and/or masticate, either mechanically or by hand. Thinning will reduce relative densities down to 35-55% of maximum SDI. Underburn</td>
</tr>
<tr>
<td>McCloud MLSA Subtotal</td>
<td>6.6 acres</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26-300 RC-357</td>
<td>38.9</td>
<td>PP, WF (Pine dominated natural stand)</td>
<td>96 sf/ac; 9.0; 216; 184</td>
<td>~100</td>
<td>Variably thin trees ≥ 4&quot; dbh 80-120 sf/ac. Radially release legacy pine and retain clumps of non-pine species. Sanitation/thinning will be implemented in areas of mortality (no more than 15% of stand). Underburn.</td>
</tr>
<tr>
<td>Algoma LSR Subtotal</td>
<td>38.9 acres</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Total LSR Review Acres</td>
<td>44.5</td>
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</tr>
</tbody>
</table>

Legend: BA=basal area; QMD=quadratic mean diameter; TPA=trees per acre; SDI=stand density index; sf ac = IC=incense cedar; WF=white fir; BO=black oak; DF=Douglas fir; PP=ponderosa pine; square feet/acre; yr=year; dbh = diameter at breast height. (grayed out units are < 80 years old) 
Source: Alternative 3 Vegetation Treatment Map, Highway 89 Forest Plan allocation map, Highway 89 Silviculture Report (Sewell, 2016)

Table 2 summarizes applicable LSRA Activity Design Criteria and Miscellaneous Activities.

### Table 2. Applicable LSRA Activity Design Criteria or Miscellaneous Activity

<table>
<thead>
<tr>
<th>Stand</th>
<th>LSRA Objective$^2$</th>
<th>Activity Design Criteria</th>
<th>Miscellaneous Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-52, 14-133, 14-389</td>
<td>(I), III</td>
<td>4 (Thinning-Hazard Related) 9 (Hazard Reduction-Prescribed Burning)</td>
<td>7 (Maintaining Hardwood Stands, Forest Openings, Meadows, And Glades)</td>
</tr>
<tr>
<td>26-300</td>
<td>(I), III</td>
<td>4 (Thinning-Hazard Related) 9 (Hazard Reduction-Prescribed Burning)</td>
<td>1 (Maintaining Existing Facilities including Resorts, campgrounds, administrative sites etc.) 7 (Maintaining Hardwood Stands, Forest Openings, Meadows, And Glades)</td>
</tr>
<tr>
<td>14-71, 14-73, 14-130, 26-805</td>
<td>(I), III, (IV)</td>
<td>9 (Hazard Reduction-Prescribed Burning)</td>
<td>7 (Maintaining Hardwood Stands, Forest Openings, Meadows, And Glades)</td>
</tr>
</tbody>
</table>

$^2$LSRA Objectives I. Protect existing late-successional habitat from threats (of habitat loss) that occur inside and outside LSRs. II. Promote the continued development of late-successional characteristics. III. Protect mid and early-successional vegetation from loss to large-scale disturbance events. IV. Promote connectivity of late-successional habitat within LSRs (USDA-FS, 1999 p. 175).
Mixed-Conifer Natural Stands (stand 7-52, McCloud MLSA)

Mixed-conifer natural stands are composed of many tree species, some of which could be white fir, Douglas fir, incense cedar, pine (ponderosa, Jeffrey, lodgepole, sugar, and knobcone), and black oak. These natural stands have relatively high canopy cover and a full range of diameter classes. There currently are minimal snags in this stand.

Proposed treatments:

- Variable density thinning of trees 10 inches dbh and greater will be implemented to reduce uniformity of spacing BA retentions will match the dominant species type. For example, this stand with a more varied mix such as Douglas-fir, sugar pine, incense cedar, ponderosa pine and white fir, may be thinned to a BA of 125-150 sq ft/ac, or an approximate SDI range of 180-280. Some non-pine clumps will be retained for wildlife habitat structure.
- The largest and healthiest trees will be retained. Shade-intolerant and infrequent species such as sugar pine, Douglas-fir ponderosa pine and black oak will be favored for retention.
- Some trees with cavities and decadence will be retained where available.
- Legacy trees will be retained unless they are determined to be a hazard.
- Sanitation/thinning would remove diseased and dying trees infected with black stain root disease to break the root to root contact with non-infected trees. Sanitation/thinning could result in openings up to ¼ acre in size and up to 15% of the stand area as to improve forest and ecosystem health by reducing the threat of black stain spread in the LSR, and would encourage understory vegetation development and structural diversity.
- Where they occur, and can provide wildlife microhabitat function, clumps of trees will be retained and not thinned. Clumps will consist of tightly-grouped mixed conifer species (e.g. white fir, Douglas-fir, incense cedar, and/or sugar pine and with little or no ponderosa pine present) and will vary in size. Clumps may be as small as 4-6 trees and will generally be under 1/10th acre. Trees of varying size classes will be retained to provide shading, cover, structure (e.g. prominent lateral branching, forked tops, mistletoe brooms, etc. and visual cover for these structures), and heterogeneity important for wildlife microhabitat function (thermal and visual cover from predators and/or for use as resting and nesting/denning sites). Clumps will be retained at a rate of up to 10% of each mixed conifer treatment stand. The number of clumps will vary depending on the availability of habitat structure.
- Radial thinning will be done around some individual black oak trees 3 inches dbh or greater (see treatments applicable to all stands section below for details). The extent of the radial thinning will be 30 feet from the tree dripline on the north, east and west sides, and 60 feet from the dripline on the south side. During underburning, the understory surrounding unreleased oaks will be retained.
- Stands will be underburned.

Pine Dominated Natural Stands (14-130, 14-71, 14-133, McCloud MLSA)

Pine dominated natural stands are similar in species and structure to the plantations with trees 10 inches dbh or greater, but are older, larger, more fire resistant, and have greater variability in composition, size and spatial distribution.

Proposed treatments:

- Variable density thinning will be done across all diameter classes 4 inches dbh and greater, with BA retention between 80 and 120 sq ft/ac, or an approximate SDI range of 130-190.
- The largest and healthiest trees are preferred for retention.
- Legacy trees will be retained unless they are determined to be a hazard.
- Sanitation/thinning will remove diseased and dying trees infected with black stain root disease and to break the root to root contact with non-infected trees. Sanitation/thinning could result in openings up to ¼ acre in size over up to 15% of the stand area as to improve forest and
ecosystem health by reducing the threat of black stain spread in the LSR, and would encourage understory vegetation development and structural diversity.

- Any openings that are created will be evaluated to determine whether or not site preparation and replanting will be necessary. Replanting will include a mix of tree species appropriate for the site.
- In some pine-dominated stands, clumps of non-pine trees will be retained and not thinned where operationally feasible (see clumps description in mixed conifer section above).
- Stands will be underburned.

Pine Dominated Natural Stand – Developed Recreation Area (26-300, Algoma LSR)
This stand is a pine-dominated natural stand that contains the Cattle Camp campground (an administrative site). The stand is overstocked and has wounded trees inflicted from high levels of use by visitors. There are also expanding pockets of tree mortality from root diseases in the campground. There are at least 2 snags per acre averaging 20 inches dbh in the stand, including in the campground.

Proposed treatments:
- Variable-density thinning across all diameter classes will be done, including in the campground (developed recreation area) to stocking levels that promote health for pine dominated stands (BA retention between 80 and 120 sq ft/ac, or an approximate SDI range of 130-190).
- In general the largest and healthiest trees are preferred for retention.
- Legacy trees will be retained unless they are determined to be a hazard.
- Some trees with decadence, cavities and greater than 50% cull will be retained outside the campground where available for wildlife habitat.
- To retain privacy screening, there will be limited thinning between campsites, campsites and campground roadways, campsites and trails/pathways, within picnic areas, and day use areas. More thinning will be done around designated sites to promote healthy forests over time.
- In the Cattle Camp campground, a sanitation/thinning treatment will be implemented to remove black stain root diseased ponderosa pine trees that pose a potential hazard to campers, breaking the root to root contact of the diseased trees. Openings could be over ¼ of an acre in size due to the already existing openings in the campground, but any new openings would not be greater than ¼ acre. Openings will not exceed 15% of the stand area. This treatment would also encourage understory vegetation development and structural diversity.
- Stumps will be cut flush with the ground within campgrounds and picnic areas, and less than 4 inches high within 15 feet of developed recreation areas.
- Hazard trees that are cut (as per FSM 2332) will be removed to the extent practicable to remove safety hazards, and meet other resource objectives.
- Trees and native shrubs will be planted around campsites for privacy screening where lacking, utilizing mechanical equipment (such as an auger) where necessary due to extreme soil compaction.
- Portions of the campground will be underburned at low to moderate intensity to achieve a mosaic burn pattern.
- Woody debris will be bucked into campfire size pieces to encourage forest visitors to utilize them as campfire wood. In addition, wood would be available for removal and consumption with personal fuelwood permit. Large fuels not utilized by forest visitors in the developed recreation areas would be removed.
- Thinning treatments along the McCloud River Trail will be incorporated into the surrounding timber stands. Interpretive signs will be installed in areas where treatments are visually noticeable and follow the Sign and Poster Guidelines for the Forest Service (EM 7100-15).

McCloud River Corridor (26-805, Algoma LSR)
The McCloud River corridor consists of interior portions of Riparian Reserves along the river located within the inner gorge and adjacent to the river. This area also includes dense pockets of riparian

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vegetation, floodplains and steep areas within the McCloud River inner gorge. The McCloud River Trail runs through portions of the corridor.

Proposed treatments:

- Where there is riparian vegetation, the smaller encroaching conifers will be cut and left on site. The smaller trees such as saplings will be cut by hand.
- Hazard trees that are cut [as per Forest Service Manual (FSM) 2332] adjacent to developed recreation areas and along the McCloud River Trail (NFS Trail #01E01), within the corridor will be left or removed depending on location and access.
- Underburning (allowing fire to back into the river corridor) will occur within the McCloud River corridor. There will be no need for additional fire line construction beyond what is already planned for adjacent stands.

Plantations Less than 10 Inches Diameter at Breast Height (Stand 14-389, McCloud MLSA)

These plantations are defined as stands of trees planted by hand or machine (predominately ponderosa pine) with the majority of trees under 29 years of age and averaging less than 10 inches dbh. These plantations generally do not contain trees large enough to be considered commercially harvestable as sawlogs, but may have value as non-sawlog product, depending on the market at the time of treatment. The treatments described are intended to provide for health forest conditions into the future.

Proposed treatments:

- Stands will be thinned, pruned, and/or masticated, either mechanically or by hand. Thinning will reduce relative densities down to 35-55% of maximum SDI.
- Stands 10 years old or younger will be evaluated prior to underburning to determine fuel loading and mechanical treatment needs to minimize undesirable fire effects, such as reducing stand stocking to below desired levels.
- Stands will be underburned.

Fuels Only Area (Stand 14-73, McCloud MLSA)

This fuels only area consists of a pine-dominated natural stand that will not need silvicultural treatment before burning.

Proposed treatments:

- The stand will be underburned only, utilizing dozer line, existing roads and other barriers such as existing fire control lines.

Resource Protection Measures applicable to stands in LSR/MLSA

WLD-1 (Mixed conifer and riparian stand underburning)

During each prescribed fire entry, the mortality of residual trees within mixed conifer and riparian stands will not exceed 60% mortality for trees less than 4 inches dbh, 30% mortality for trees 4-8 inches dbh, and no more than 5% mortality for trees 9 inches dbh or greater. No snags will be directly ignited. The end result should be a mosaic of burned and unburned shrub and understory vegetation pockets throughout a treatment area.

Standard Operating Procedures applicable to all stands including in LSR/MLSA

- Some trees greater than 15 inches dbh with distinct traits common to older overmature trees (including large, decadent boles and limbs, cavities, and/or forked, broken or flat tops) will be retained as available unless a safety hazard. Treatments will not simplify stands through the removal of layers or structural components or a substantial component of broken and diseased trees that are important for snag recruitment, nesting, roosting, denning, and resting habitat, and retention of insects/diseases considered important to wildlife habitat development and processes.
- To minimize the loss of nesting, foraging, resting, denning, and prey base habitat components (including mycorrhizal fungi) during burning, retain large down wood at Forest Plan standards or
greater and large diameter trees (greater than 30 inches dbh) and snags (greater than 15 inches dbh) where available.

- Where snags are not a safety hazard, they will all be retained to meet the 40% of the potential population levels for cavity nesting birds as per Forest Plan page 4-62. Snags will be felled where they are determined to be a safety hazard. Cut snags will be removed where needed to reduce safety hazards or meet other resource objectives.  

**EXISTING LANDSCAPE AND STAND CONDITIONS**

Table 1 above provides basic stand information for species, age, quadratic mean diameter (QMD), basal area (BA), trees per acre, stand density index (SDI) and age.

Although none of the LSR/MLSA stands provide old growth forest, 6 of the 8 LSR/MLSA stands have an average age over 80 years (Barnum, 2016) (Sewell, 2016). Stand 14-130 is a natural stand that does not contain trees over 80 years. Stand 14-389 is a plantation with trees approximately 29 years old.

Stands in the Cattle Camp area are overstocked and/or have wounded trees inflicted from high levels of use by visitors. There has been an increase in expanding pockets of tree mortality over the past five years due to the presence of black stain root disease and western bark beetle. Hazard trees are a concern for public safety. High fuel loading from mortality caused by the insects and disease is present throughout the area, increasing the likelihood of undesirable effects in the event of a wildfire. There is currently a snag density of 2 snags/acre. Snags in the developed campground are considered a hazard to the public.

Project-wide, including in the LSR/MLSA, numerous natural forest stands are overly dense and at risk of density-related mortality. Stocking levels range from open conditions all the way up to 360 sf/acre BA (up to 184 sf/acre in the LSR/MLSA). In many areas mortality pockets are starting to occur, mostly in the McCloud Flats area. Root diseases, such as *Leptographium wageneri* (black stain) and *Heterobasidion annosum* (annosus) root disease, along with signs of western pine beetle activity have been observed.

Individual black oak trees, and stands of aspen and oak (important for vegetative diversity and wildlife habitat) are being encroached on by conifers, which are shading out these stands/trees. Due to a lack of disturbance, forest stands have followed a process of succession in which conifers grow taller than aspen and oak, blocking the sunlight the non-conifers need. Conifers are competing for soil nutrients and water with the other tree and shrub species. Aspen stands are declining at a rapid rate due to fire suppression (resulting in conifer encroachment), past commercial timber management, (site conversion from hardwoods to conifers and pine plantations), and livestock grazing.

Some Riparian Reserve areas located within the McCloud River corridor (inner gorge) contain dense pockets of young conifers encroaching on the riparian vegetation as well as dead and dying trees. Some of these areas are adjacent to trails, such as the McCloud River Trail, and Cattle Camp campground.

Effective fire suppression in the last century has greatly reduced the total area burned project-wide including the LSR/MLSA when compared to pre-historic levels. Approximately 73% of the project area historically experienced a high frequency (0-35 year return interval), low to mixed severity fire regime. Approximately 6% of the project area historically experienced a high frequency (0-35 year return interval), high severity fire regime, while 6% of the project area evolved under a low frequency (35-100 year) high severity fire regime (non-burnable area accounts for the remaining 15%).

Based on the historic fire return intervals and fire history data, the ecosystem is outside the historical range for fire occurrence. Approximately 80% of the project area is designated as a high departure from the historical fire return interval range. These areas have missed multiple fire return intervals. The

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3 Snags are in excess in some areas and in deficit in others throughout the project area. The snag retention rate on average over the project area post implementation will meet this Forest Plan guideline.

4 Note that vegetation diversity section relies on WHR strata to assess compliance with the 15% late-successional/old growth forest standard in the Forest Plan as it is assessed at the 5th field watershed level. Because the modeling relies on factors such as diameter, crown cover, density, etc., there may be differences in characterization, particularly at the stand level.
remaining 4% of burnable area is at a moderate departure, missing one or more return intervals. This departure has resulted in changes to vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and insect and disease activity. The risk of losing key ecosystem components is high.

PROJECT-WIDE DESIRED CONDITIONS

It is desired that natural stands have densities at levels that improve and protect forest health and vigor. The stands have structural diversity with varied species, multiple canopy layers, other types of vegetation, and appropriate levels of coarse woody debris and snags. Plantations and natural stands are resilient to epidemic insect or disease attack.

Hardwoods, especially oaks and aspen, remain a healthy and vigorous component of forest stands where they are naturally located. In hardwood-dominated stands, there are fewer conifers competing for resources (sunlight, nutrients, water) with the hardwoods. In riparian areas, the species composition and structural diversity of the native vegetation maintain a healthy riparian ecosystem, without excess competition for resources from conifers.

All stands and vegetation types experience fires in intervals that are historic to the area, have appropriate coarse woody debris and snag levels, but do not have excess fuel loads. Wildfires that occur within the project area during dry summer conditions are beneficial to the ecosystem, as occurred historically.

Hazardous fuels are reduced to allowing fire managers to effectively protect life, property, and natural resources during a wildfire. Hazard trees in developed recreation sites, along trails, and in campgrounds are removed for forest health and public safety utilizing Hazard Tree Guidelines for Forest Service Facilities and Roads in the Pacific Southwest Region (Angwin, et al., 2012). Forest stands within and surrounding campgrounds are healthy.

Late-Successional Habitat

The LSRA describes sustainable levels of late-successional habitat within LSRs as between 50 to 60% (of land capable of sustaining late-successional habitat) (USDA-FS, 1999 p. 196). Vegetation would be varied over the landscape, consisting of dense multi-layered stands, more open multi-layered stands, dense and open single storied stands, a variety of trees per acre with differing size classes, snags, down logs, etc. In this province, where forests were subject to frequent, low-intensity fire (such as ponderosa pine forest), the late-successional and old growth stages are typically characterized by relatively open understories and relatively few large fallen trees (in comparison to more moist Douglas-fir/western hemlock types) (USDA-FS, 1999 p. 15) (USDA-FS, USDI-BLM, 1994 pp. B-2). The desired character is in line with site capability, elevation, slope, and aspect and soil conditions. Insects and diseases create gaps and important attributes in stands, but should not reach levels that prevent the long-term sustainability of late-successional habitats (USDA-FS, 1999 p. 163).

Snags would occur in a variety of size and decay classes and distribution ranges from individuals to larger aggregations. In mixed conifer stands, snags of at least 20 inches diameter would average 2 to 6 per acre. Scattered individual snags and down logs as well as larger aggregations that result from natural events such as wildfire, insect outbreaks and wind-storms are desirable. Larger aggregations are desired as long as they do not put other important late-successional characteristics at risk to large-scale disturbances. Coarse woody debris (CWD) in mixed conifer stands would occur at 6 to 10 5 logs per acre, preferably of at least 20 inches diameter and 10 feet long, representing a range of decomposition classes.

The desired condition for density for late-successional and old-growth stands on the McCloud Flats is 50% to 70% of normal basal area\(^5\) (Dunning, et al., 1933), (USDA-FS, 1999 p. 167), and should apply to stands 150 to 200 years old (the Highway 89 project forest stands in LSR/MLSA are up to 115 years old). This density range allows stands to maintain desired characteristics for a longer time.

\(^5\) Basal area is the cross-sectional area of all trees in a stand measured at breast height and expressed as square feet per acre.
CONSISTENCY DISCUSSION

Proposed activities apply to very limited acres within the McCloud MSLA (0.4%) and Algoma LSR (0.2%). Though few in acreage, treatments are expected to maintain what connectivity exists (Mapula, 2016). The project’s treatment design, RPMs, and SOPs to maintain and protect important habitat components will contribute to the continued function for late-successional associated species’ use occurring now or in the future, and increase diversity and resilience of existing habitat. As such, Highway 89 project activities will not prevent the LSR/MLSA from playing an effective role for which it was established (Mapula, 2016). This will be achieved by retaining clumps within units that provide cover, layering and density; retaining important legacy components such as roosting and resting structures, large snags, large down wood, and large trees with cavities and decadence; retaining multiple canopy layers (where available); and varying the thinning prescriptions to increase individual tree and stand resilience and promote heterogeneity. Actions taken under the Alternative 3 will increase resilience to large-scale disturbance, but also retain stand elements and conditions, and be more representative of endemic insects, disease and mortality.

The Highway 89 project meets the stated objectives, stand attributes, and treatment standards for applicable LSRA activity design criteria and miscellaneous activities.

CONCLUSION

The actions proposed with Alternative 3 (preferred alternative) of the Highway 89 project are consistent with the LSRA under Activity Design Criteria #4 (Thinning - Hazard Related), #9 (Fuel Reduction, Hazard Reduction - Prescribed Burning), Miscellaneous Activity #1 (Maintaining Existing Facilities including Resorts, campgrounds, administrative sites etc.), and Miscellaneous Activity #7 (Maintaining Hardwood Stands, forest openings, meadows, and glades). The project is expected to contribute to decreases in the probability of large-scale habitat loss within the Algoma LSR or McCloud MLSA. It is anticipated the project will improve habitat conditions over the long term by increasing vegetative diversity, improving forest health, and reduce the risk of large scale black stain and *Heterobasidion* root disease infection and western bark beetle infestation associated habitat loss (above endemic levels) in the LSR and MLSA.

The project, as proposed, is consistent with the LSRA and NWFP standards and guidelines.
WORKS CITED


