Practice Specification
Forest Stand Improvement (Code 666)
Ponderosa Pine / Jeffrey Pine / Sierra-Nevada Mixed Conifer

I. SCOPE

The work shall consist of conducting the operations specified within this Practice Specification at the locations as shown on the drawings or plans.

II. FOREST LAND WEEDING

Scalping will be a minimum of 5 feet in diameter with all the surface vegetation removed. If a mulch which will persist more than 3 years is used, the scalps may be a minimum of 4 feet in diameter.

Hardwood treatment: Cut or sever the stems or sprouts at the base within a minimum 5-foot diameter. If a mulch will persist more than three years is utilized the area may be a minimum of 4 feet in diameter.

Follow-up: Follow-up original weeding method once each year to determine results and recovery of released trees.

III. PONDEROSA PINE AND ASSOCIATED SPECIES

Start thinning operations in Ponderosa Pine at 5 to 10 years of age and when tree crowns are overlapping. More than one thinning may be needed before the stand reaches merchantability to ensure adequate space between trees for wildfire resilience. The thinning practice is often based upon operating in tree sizes of average stand diameter from 6 to 10 inches D.B.H. In other cases, thinning should include treatment of all diameters sizes necessary to meet post-harvest basal area, tree per acre, and fire hazard reduction objectives. Thinning intensity should consider the minimum sized merchantable products. When a substantial number of trees greater than 10-12 inches require thinning, commercial timber harvesting permits may be required. Consult CAL FIRE or a Registered Professional Forester when stands require thinning larger diameter trees.

Timing thinning operations during November through April will lessen the possibility of bark beetle damage to the residual stand.

Ponderosa Pine, and the species associated with it, can sometimes and in some areas be sold as for low value wood product such as, biomass chips for heat and power generation, poles, piling, firewood, landscaping shavings, and Christmas trees. When low value harvested trees are used for a commercial purpose a harvest plan or permit must be developed as per the Forest Practice Rules and prepared by a Registered Professional Forester. Do not include Practice 666 in an NRCS agreement when projects include thinning of material of sufficient size, quality, and quantities where they can be sold for more valuable small sawlogs for dimension lumber.

The spacing distance between leave trees is based upon maintaining a level of basal area that will reduce competition until the stand reaches merchantable size. Several different methods can be used to do this.

1) A simple method is to cut a pole the length of the spacing desired and use this as the spacing distance between the leave trees. This is a particularly good system in young stands where the trees have not expressed dominance.

2) Use a standard D+ factor, where "D" is the diameter in inches changed to feet, plus the standard factor. Example: Ponderosa pine, D+6. Diameter is 7 inches. 7 feet + 6 feet = 13 foot spacing distance.

3) Spacing by a calculated and tabulated guide, based upon Site Index: Using any method, favor leave trees of superior form and vigor, rather than trying to achieve exact spacing. For example: Assume

desired spacing is 14 feet. Some trees may actually be 12 feet apart, and others may be 15 feet apart, etc.

Tabulated in Section VIII Appendix is Table 2 recommended thinning spacing guides for stands of ponderosa pine by Site Indexes. The calculations assume the rate of diameter growth will be increased 100 percent or more. For pure stands of interior Douglas-fir, use Table 3.

4) A fire/fuel hazard reduction method that focuses on crown spacing, terrain, and fire hazard rating.

See Figure 1. This prescription is primarily intended for Wildland Urban Interface (WUI) areas with higher density of homes and human infrastructure.

Figure 1a: SHRUBS (<15 ft tall): HORIZONTAL SEPARATION DISTANCES

Separation distances are measured between canopies (outer most branches) and not between trunks. Separation can be between individual shrubs or groups of shrubs.

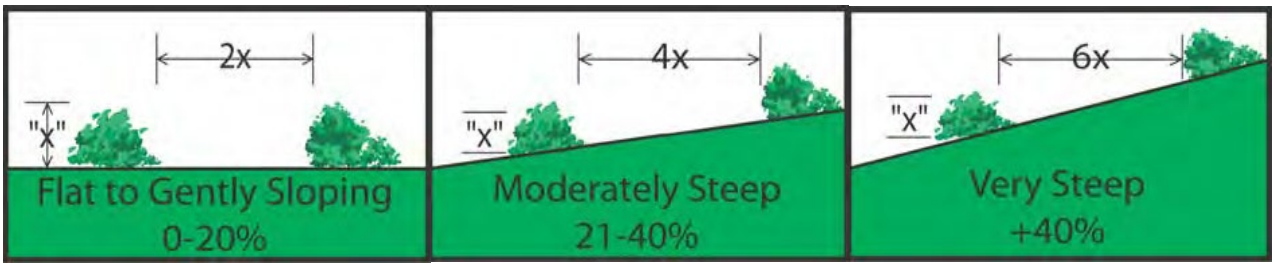
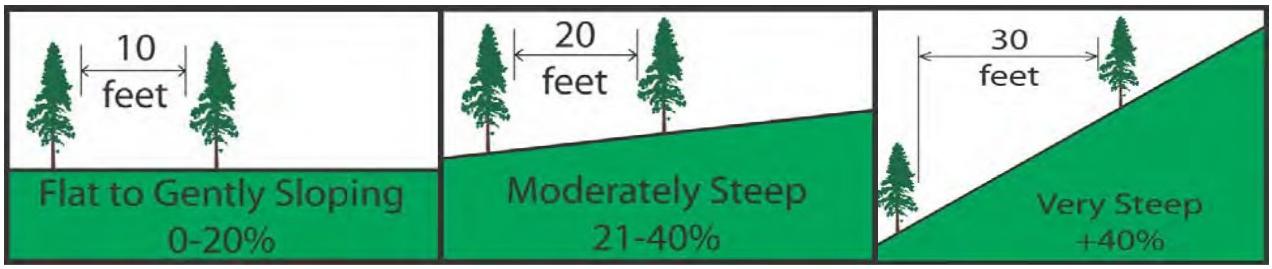


Figure 1b: LARGER TREES: HORIZONTAL SEPARATION DISTANCES BETWEEN TREE CANOPIES

For forested areas, the recommended amount of separation between tree canopies is determined by steepness of slope. Crown separation can be between individual trees or clumps of trees (2-5 mature trees per clump).



5) State of CA Forest Practice Rules (FPRs) Minimum Stocking Standards

The CAL FIRE FPRs codified a rule in 14 CCR 1038 (f) for fire hazard reduction projects. It set minimum basal are stocking standard for the cutting or removal of trees that eliminates the vertical continuity of vegetative fuels and the horizontal continuity of tree crowns for the purpose of reducing flammable materials. The exemption is known as the Small Timberland Owner Exemption. The minimum post-harvest standards (paraphrased) are shown below:

a) On Site I lands, a minimum of 150 square feet of basal area shall be retained within the coastal forests and minimum of 100 square feet of basal area shall be retained within inland forests.

b) On Site II lands, a minimum of 100 square feet of basal area shall be retained within the coastal forests, and 75 square feet of basal area shall be retained within inland forests.

c) On Site III lands, a minimum of 75 square feet of basal area shall be retained.

d) On Site IV and V lands, (50) square feet of basal area shall be retained.

The mean diameter of trees greater than eight (8) inches dbh in the pre-harvest treatment area shall be increased in the post-harvest stand.

IV. TREATMENT OF LARGE DEAD AND DYING TREES

Bark beetle, post wildfire, and invasive species restoration projects often result in a substantial number of larger trees (greater than 10-12 inches DBH) to be cut in the forest. Practice 666 can be included when substantial portions of the forest stand contains dead or dying trees as a result of catastrophic damage or invasive species situations. Cut dead and dying trees of any diameter size necessary to meet the silviculture prescription when trees do not have value for sawlogs for dimension lumber. Do not include these larger tree sizes and Practice 666 when forest stands contain sufficient size, quality, and quantities of larger trees where they can be sold for more valuable sawlogs for dimension lumber.

V. SLASH DISPOSAL

Slash disposal methods may include lopping and scattering, burning, chipping, etc. Refer to Woody Residue Treatment (Code 384) Practice Specification for complete information on treating slash created from thinning and other tree cutting conducted under this Forest Stand Improvement (Code 666) practice.

Lop and scatter should only be used when there are low quantities of slash to treat. Overall slash height will not exceed 30 inches, and less than 18 inches depth is recommended. In high wildfire hazards areas, overall slash height will not exceed 18 inches.

When slash is around infrastructure, more complete slash treatment is required. Any slash generated within 100 ft. of habitable structures or edge of public and private roads open for use will be hauled away, chipped, or piled and burned.

Ips (a bark beetles genus) Control. *Ips pini*, pine engraver, found throughout California with the exception of the coastal ranges, normally only has one generation per year. *Ips paraconfusus*, California fivespined Ips, found west of the summits of the Cascades and Sierra Nevada's, including the Coast range, may have multiple generations per year depending upon locality and season. *Ips mexicanus*, Monterey pine Ips, is found in the coastal ranges. Up to three generations per year may occur.

The possibility of increased *Ips* activity is dependent upon site characteristics such as open or closed canopy, aspect, precipitation zone, and elevation. Forest management activities in low elevation ponderosa pine (below 3500 feet) and Jeffrey pine can be more susceptible to *Ips* than similar activities at higher activities. The best time to thin and avoid *Ips* beetle damage from thinning activities is from September through April. If *Ips* is anticipated to be a major problem slash from thinning activities will be treated.

Where *Ips* is considered to be a major problem:

1) All pine slash from 3 to 9 inches outside bark diameter will be cut into pieces no longer than 30 inches.
2) All pine slash exceeding 9 inches outside bark diameter will be cut into pieces no longer than 18 inches.
3) All pine slash will be monitored for infestations of Ips for a period of 1 year after thinning operations are complete. If the slash becomes infested, CAL FIRE Forest Pest Specialists will be notified for assistance in treating the infestation.
4) Preferably, treat slash via burning, chipping, or removal prior to the next insect breeding period.

VI. SPECIAL REQUIREMENTS

1) Permitting and Environmental Compliance **-** All activities associated with applying practice shall comply with federal, state, tribal and local forestry and related laws and regulations. It is the landowner's responsibility to obtain appropriate permits and/or applications prior to commencing an activity. Typical permits that may be needed include slash burning from an air quality control district, commercial harvesting permit from CAL FIRE when vegetation is used for commercial purposes, Pesticide Control Advisors Report when herbicides are applied, archeological protection review by NRCS, TES protections, and stream bed alteration permits.

   Compliance with State fire protection statutes (Public Resource Code 4427) is required regarding equipment needed during open burning (sharp point shovel and fire extinguisher etc.) and fire suppression tools when operating internal combustion (Public Resource Code 4428). Advise clients to contact local CAL FIRE Office for information. Also, CAL FIRE will advise on periods of no/curtailed operations of equipment use and post operations fire patrols during extreme fire conditions such as Red Flag Warnings or Fire Weather Watch when issued by the National Weather Service.

2) Migratory Birds - Refer to Technical Note TN-Biology-CA-23 for timing forest stand improvement activities to minimize disturbance Migratory Birds. Follow other requirements described above as agreed upon in a ESA consultations with UFWS, NOAA Fisheries, or Requirements of a state or federal permit (i.e. Lake, Streambed Alteration Permit, 401 Water Quality Certification, 404 Clean Water Act.

3) Snags - Projects shall be designed and implemented to retain standing dead and dying trees (snags) as wildlife trees. Snag shall be retained where they pose a minimal hazard to human safety and do not affect infrastructure such as roads, buildings, utilities or public safety or commercial features. Desirable wildlife trees/snags for retention include dead or dying trees and live "culls"; and larger trees with large forked or horizontal branches, broken tops, or existing cavities.

   Snag requirements:

   a) Retain all snags >15" dbh and >15' tall within Class I and II perennial watercourse protection zones and within 500' of meadows.

   b) Retain an average of 1-2 snags per acre for all other areas. Snags can be dispersed across the stand or can be clumped into groups of 5-10 when possible.

   c) Exceptions to the above requirements:

      - Exception (i): Snags that can fall on roads and structures.
      - Exception (ii): Where required for insect or disease control.
      - Exception (iii): Where it is a threat to human health and safety (hazard).
      - Exception (iv): When a biologist recommends a greater quantity for protection of TES habitat.
      - Exception (v): Fuel breaks.
      - Exception (vi): When the forester and biologist agree the quantities may be reduced, such as to address post wildfire or insect mortality excess biomass/wildfire hazard resource concern in buffer zones.

   d) Snags shall be designated prior to operations to ensure a sufficient number are retained, suitable snags are selected, and appropriate locations are sited.

4) TES - No known threatened, endangered, sensitive (TES) or rare plants or animals will be disturbed, harmed or harassed, except when authorized by the relevant regulatory agencies. Measures to avoid adverse effects to TES may be required if known species are present or suitable habitat is found on-site in areas accessible to TES.

In consultation with NRCS Biologist, develop a project alternative that avoids or minimizes these potential effects. Avoidance and/or minimization measures may include:

- Buffer zones around nests and dens,
- Limitations to types of equipment and/or times used,
- Limited operating periods,
- TES monitoring prior to or during activities,
- Additional snag and downlog retention.
- Any requirements when provided from ESA consultation with USFWS, NOAA Fisheries, or requirements of a state or federal permit (i.e. Lake, Streambed Alteration Permit, 401 Water Quality Certification, 404 Clean Water Act.)

5) Biological retention areas - Areas of uncut live and dead trees, shrubs, and grass/forbs, are recommended to be retained on the site for biodiversity and erosion control purposes. Untreated patches may include watercourse buffers or coincide with unique features such as rock outcrops, down logs and snags, woodrat middens, or other valuable habitat elements.
When size of an individual untreated areas exceeds 2% of the size of the treatment area, it is excluded from payment. The sum of small untreated areas should not exceed 15% of treatment area. (Example: 10 acre/43,560 sq ft treatment unit. Maximum size of untreated area = .2 ac/ 8700 sq ft./ 93 ft by 93 ft. Maximum cumulative amount of untreated areas = 1.5 acres).

6) Watercourses and Meadow Protection Standards - The Implementation Requirements shall include information on watercourses, riparian areas, wetlands, including a map, in the project area. Protection measures/treatment limitations must be provided when the project affects any Class I or II perennial watercourses, or Class III seasonal/intermittent watercourses (see California Forest Practices rules section 14 CCR 895.1). Refer to the Table 1 below for watercourse protection zones in non-anadromous water bodies. If slopes are greater than 40%, the buffer will extend to the topographic break above the stream. All watercourse riparian stream buffer areas exclude entry by heavy equipment, except at existing crossing or designated locations.

Vegetation treatment and heavy equipment is generally excluded in watercourse buffer zones, particularly in remote areas that are not associated with WUI areas or presence of public safety infrastructure. These exclusions are needed to continue large snag/wood recruitment and avoid impacts to species that utilize aquatic and riparian areas such as fish, red-legged and yellow-legged frogs, Pacific fisher, and great gray owl.

Table 1 – Protection measures/treatment limitations for watercourse protection zones (Buffer Zones)

	Class 1 wet	Class II wet	Class III dry	Class III wet	Wet meadow
Work Exclusion Zone (from channel edge or edge of meadow)	25 ft.	25 ft.	None	25 ft.	100 ft.
Heavy Equipment Exclusion Zone (Hand work only)	75 ft.	25 ft.	25 ft.	25 ft.	N/A
Total Buffer for Limited Work	**100 ft.**	**50 ft.**	**25 ft.**	**50 ft.**	**100 ft.**

Vegetative treatments and equipment entry within watercourse buffer zones can be included when an assessment is made that the buffer treatment is needed to protect human life, structures, or public safety and commercial infrastructure assets that are at risk to damage from wildfires. Vegetative treatments and equipment entry to address post wildfire and insect mortality resource concerns can also be included following an assessment and consultation with a NRCS biologist. Contact a NRCS biologist early in the planning process if working in the buffer zones. Consultations may be required with USFWS, NOAA Fisheries, or other state or federal regulatory agencies (i.e. Lake, Streambed Alteration Permit, 401 Water Quality Certification, 404 Clean Water Act.)

Forest management operations outside the watercourse buffer zones will ensure tree falling and other operations minimize felled trees enter into buffer zones. Slash will not be placed, piled or burned in any watercourse channel, buffer zone, or ephemeral drainage carrying seasonal runoff. Additional operating restrictions around ponds will apply, contact below NRCS Biologist for specification.

7) Use of heavy equipment - Thinning and other tree cutting projects often use mechanical cutting heavy machinery to severe trees at their base and bunch trees for disposal using Practice 384. Special precautions should be taken to avoid environmental impacts from use of heavy equipment in thinning/tree cutting operations:

   a) Do not damage boles (remove bark) of live, standing, residual trees during equipment operations.

   b) CAL FIRE will advise on periods of no/curtailed operations of equipment use and post operations fire patrols during extreme fire conditions such as Red Flag Warnings or Fire Weather Watch when issued by the National Weather Service.

8) Maintaining Soil Quality/Soil Health - All operations will be planned and executed in a manner that maintains or improves soil quality. This includes using machinery that minimizes compaction, displacement, rutting and other disturbances to the forest floor. Surface organic material will be retained or improved throughout the treatment process.

   Soils, site factors, and timing of application must be suitable for any ground-based equipment utilized to avoid excessive compaction, rutting, or damage to the soil surface layer.

   Operations with heavy equipment shall not occur during periods of wet weather with saturated soil conditions as defined by the California Forest Practice Rules.

   No new tractor trails or heavy equipment operations on slopes greater than 35%, except for limited distances on up to 45% slopes.

9) Pest Control –

   a) Pine Beetle Infestations: When feasible, delay cutting live trees until the end of the bark beetle breeding period is completed, typically late fall. Avoid long time delays (2 months during March-September breeding season) between green vegetation piling and burning.

   b) Sudden Oak Death (SOD) and Goldspotted Oak Borer: In areas with known infections of pathogen or insects, specific sanitation precaution will be implemented including no transport of woody debris outside the State designated Zone of Infestation, covering vegetative debris moved by vehicles, and equipment sanitization measures. Sanitation of equipment entering and leave these zones of infection is recommended. See Best Management Practices:

      - SOD: http://www.suddenoakdeath.org/wp-content/uploads/2014/12/forestry-08-10-with-new-2014-map.pdf
      - Goldspotted Oak Borer: http://ipm.ucanr.edu/PMG/PESTNOTES/pn74163.html

10) Archeology - No operations may begin until archeological clearance is provided by NRCS. No operations will occur in known archeology or historical sites.

11) Other **-** The client or client's RPF representative shall conduct an on-site, pre-operational meeting with client's vegetation treatment contractor hired to perform the work. The meeting will review property lines, watercourse protection zones, equipment limitation zones, sensitive plant/animal species, known cultural sites, and possible seasonal restrictions for nesting birds.

VII. BASIS OF ACCEPTANCE

Upon completion of the work conducted by the owner/client, a field inspection will be made to determine if 85 percent of the planned work as described within the Plan has been satisfactory completed.

VIII. OPERATION AND MAINTENANCE

Once a year after the completion of the work, the owner/client will conduct a field inspection to determine the area that require additional attention to advance the Forest Stand Improvement, and to identify locations that need work to reduce soil erosion.

IX. Appendix - Thinning Guide Table

Table 2. Thinning Guide for Ponderosa Pine based on Site Index (SI) by Meyer

Spacing for Ponderosa pine:

SI 113+ (D+5 Spacing when average diameter exceeds 6 inches [Growing Stock Level 106])

Tree Diameter at Breast Height (D.B.H.) (inches)	Trees per Acre to Leave at any age up to 10" D.B. H	Average Spacing between Leave Trees (Feet)
1-3	436	10
4-5	360	11
6	360	11
7	303	12
8	258	13
9	222	14
10	194	15

SI 85 - 112 (D+6 Spacing when average diameter exceeds 6 inches [Growing Stock Level 93])

Tree Diameter at Breast Height (D.B.H.) (inches)	Trees per Acre to Leave at any age up to 10" D.B. H	Average Spacing between Leave Trees (Feet)
1-3	436	10
4-5	360	11
6	303	12
7	258	13
8	222	14
9	194	15
10	170	16

SI 70 - 84 (D+7 Spacing when average diameter exceeds 6 inches [Growing Stock Level 82])

Tree Diameter at Breast Height (D.B.H.) (inches)	Trees per Acre to Leave at any age up to 10" D.B. H	Average Spacing between Leave Trees (Feet)
1-3	360	11
4-5	303	12
6	250	13
7	222	14
8	194	15
9	170	16
10	151	17

Table 2. Thinning Guide for Ponderosa Pine based on Site Index (SI) by Meyer (continued)

Spacing for Ponderosa pine (continued):

SI 60 - 69 (D+8 Spacing when average diameter exceeds 6 inches [Growing Stock Level 73])

Tree Diameter at Breast Height (D.B.H.) (inches)	Trees per Acre to Leave at any age up to 10" D.B. H	Average Spacing between Leave Trees (Feet)
1-3	303	12
4-5	250	13
6	222	14
7	194	15
8	170	16
9	151	17
10	134	18

Eastside Pine Type:

SI 85+ (D+7 Spacing when average diameter exceeds 6 inches [Growing Stock Level 82])

Tree Diameter at Breast Height (D.B.H.) (inches)	Trees per Acre to Leave at any age up to 10" D.B. H	Average Spacing between Leave Trees (Feet)
1-3	360	11
4-5	303	12
6	250	13
7	222	14
8	194	15
9	170	16
10	151	17

SI 57 – 84 (D+8 Spacing when average diameter exceeds 6 inches [Growing Stock Level 73])

Tree Diameter at Breast Height (D.B.H.) (inches)	Trees per Acre to Leave at any age up to 10" D.B. H	Average Spacing between Leave Trees (Feet)
1-3	303	12
4-5	250	13
6	222	14
7	194	15
8	170	16
9	151	17
10	134	18

Table 2. Thinning Guide for Ponderosa Pine based on Site Index (SI) by Meyer (continued)

Eastside Pine Type (continued):

SI 43 – 57 (D+10 Spacing when average diameter exceeds 6 inches [Growing Stock Level 60])

Tree Diameter at Breast Height (D.B.H.) (inches)	Trees per Acre to Leave at any age up to 10" D.B. H	Average Spacing between Leave Trees (Feet)
1-3	222	14
4-5	194	15
6	170	16
7	151	17
8	134	18
9	121	19
10	109	20

SI 42 or less (D+12 Spacing when average diameter exceeds 6 inches [Growing Stock Level 50])

Tree Diameter at Breast Height (D.B.H.) (inches)	Trees per Acre to Leave at any age up to 10" D.B. H	Average Spacing between Leave Trees (Feet)
1-3	194	15
4-5	151	17
6	134	18
7	121	19
8	109	20
9	99	21
10	90	22

Table 3. Managed Douglas-fir

PLANNING GUIDE-FOR MANAGED DOUGLAS-FIR

Site Index	100	120	140	160	180	200
Spacing (Ft)*	D+6	D+5	D+5	D+4	D+4	D+4
Thinning Cycle (Yrs)	12	10	8	6	4	3
Rotation for 12" Trees (Yrs)	72	60	48	36	25	20
Rotation for 16" Trees (Yrs)	96	80	64	48	32	25

* Add 1 or 2 feet for woodland grazing