

**NATURAL RESOURCES CONSERVATION SERVICE**  
**CONSERVATION PRACTICE STANDARD**  
**FOREST STAND IMPROVEMENT**

(Ac.)

**CODE 666**

**DEFINITION**

The manipulation of species composition, stand structure and stocking by cutting or killing selected trees and understory vegetation.

**PURPOSE**

- Increase the quantity and quality of forest products by manipulating stand density and structure.
- Timely harvest of forest products
- Development of renewable energy systems.
- Initiate forest stand regeneration.
- Reduce wildfire hazard.
- Improve forest health reducing the potential of damage from pests and moisture stress.
- Restore natural plant communities.
- Achieve or maintain a desired native understory plant community for special forest products, grazing, and browsing.
- Improve aesthetic and recreation, values.
- Improve wildlife habitat.
- Alter water yield.
- Increase carbon storage in selected trees.

**CONDITIONS WHERE PRACTICE APPLIES**

All forest land.

This standard is not applicable for Alley Cropping (311), Multi-story Cropping (379), Windbreak/Shelterbelt Establishment (operation and maintenance) (380) and Windbreak/Shelterbelt Renovation (650).

**CRITERIA**

**General Criteria Applicable to All Purposes**

The harvest-regeneration strategy will be identified for all planned forest improvement harvesting:

- Uneven-aged management systems (e.g., single-tree selection, group selection, coppice selection)
- Even-aged management (e.g., clear-cut, seed-tree, shelterwood, coppice)

The extent or size and orientation of treatment area(s) shall be identified as part of practice design.

Preferred tree and understory species are identified and retained to achieve all planned purposes.

Spacing, density, size class, number and amounts of trees and understory species to be retained will follow established guidelines for the intended purposes.

Stocking guidelines shall contain stocking in terms of basal area, spacing or trees per acre by species and size class distribution.

The method, felling direction and timing of tree cutting for harvesting shall protect site resources, e.g., residual trees, wetlands, cultural resources, improvements and utilities. Time tree cutting to avoid buildup of insect or disease populations. Felling direction must be compatible with trail layout as specified by Forest Trails and Landings (655). Forest stand improvement activities shall be performed to minimize soil erosion, compaction, rutting, and damage to remaining vegetation and maintain hydrologic conditions.

Refer to the Access Road (560) standard for roads associated with forest stand improvement activities.

Slash and debris will be treated such that they do not present an unacceptable fire, safety, environmental, or pest hazard. Such remaining material will not interfere with the intended purpose or other management activities. Refer to Woody Residue Treatment (384). Burning of slash and other debris on-site shall follow the standard Prescribed Burning (338).

#### **Additional Criteria for the Harvest of Forest Products**

Harvest, or other timber operations, for commercial purposes is under the control of the California Board of Forestry.

Anything harvested for commercial purposes needs to have a harvest plan developed as per the Forest Practice Rules and prepared by a registered professional forester

Timber operations refers to the cutting or removal, or both, of timber or other solid wood forest products, including Christmas trees and firewood, from timber-lands for commercial purposes. The minimum sized tree for a commercial saw log is 10 inch D.B.H. The log must be 10 feet long with a minimum diameter of 6 inches on the small end.

Discuss alternative harvest methods based on terrain and erosion hazard rating for soils.

#### **Additional Criteria to Develop Renewable Energy Systems**

Bioenergy intensity and frequency of energy biomass removals will be managed to prevent long-term negative impacts on the stand.

The harvesting of energy biomass shall be accomplished in a manner that will not compromise the other intended purpose(s) and functions. If applicable refer to State woody biomass Best Management Practices (BMPs).

#### **Additional Criteria to Reduce Wildfire Hazard**

Reduce stocking rates of trees to minimize crown-to-crown spread of fire.

Remove "ladder" fuels to minimize the occurrence of crown fires.

Further treat or eliminate slash accumulations next to roads and trails.

Reduce or eliminate species with high volatility but not to a level that would compromise other intended purposes.

For additional wildfire risk and damage reduction, refer to the standards Fuel Break (383) and Firebreak (394).

#### **Additional Criteria to Alter Water Yield and Quality**

Basic water quantity and quality are protected when the forest is resilient to catastrophic fire. Improvement practices must consider riparian areas separately and take steps to protect water resources. Maximize crown cover while reducing unwanted plant competition to increase water yield; support mature forest cover in riparian areas to sustain water quality.

Near surface water resources, forest elements of crown canopy cover, desirable mature vegetation species and macrobiotic nutrients from forest biomass shall be addressed. Forest improvement practices shall also address temperature, pesticides, sedimentation, and soil compaction.

#### **Additional Criteria to Improve Wildlife Habitat**

Manage for a variety of native tree species and stocking rates that meet desired wildlife and pollinator species food and cover requirements.

Create, recruit and maintain sufficient snags and down woody material to meet requirements of desired species and secondary cavity nesting species in balance with conditions needed to achieve other intended purposes.

Minimize improvement actions that disturb seasonal wildlife activities.

Refer to Early Successional Habitat Development/Management (647), Restoration of Rare and Declining Habitats (643), Upland Wildlife Habitat Management (645), and Wetland Wildlife Habitat Management (644) to further develop and manage wildlife-related activities.

#### **Additional Criteria to Increase Carbon Storage in Selected Trees**

Manage for tree species and stocking rates that have higher rates of growth and potential for carbon sequestration.

## CONSIDERATIONS

Silvicultural objectives and harvest-regeneration strategies may change over time and may be limited by prior management.

Successful regeneration of desirable species is usually dependent upon timely application of forest stand improvement and other practices, e.g., prescribed burning, site preparation, tree and shrub establishment, prescribed grazing and access control.

The extent, timing, size of treatment area, or the intensity of the practice should be adjusted to minimize cumulative effects (onsite and offsite), e.g., hydrologic and stream alteration, habitat fragmentation, sediment delivery, nutrient cycling, biodiversity and visual resources.

The practice should be timed to minimize disturbance of seasonal pollinator and wildlife activities.

Landowners should secure a written contract with any service provider that specifically describes the extent of activity, duration of activity, liability and responsibilities of each party and amount and timing of payments for services provided

Slash, debris and other vegetation (biomass) removed during stand improvement may be used to produce energy. Management alternatives should consider the amount of energy required to produce and convert the biomass into energy with the amount produced by the biomass. Wildlife and sustainability requirements should also be considered.

Invasive or noxious woody vegetation should be controlled,

Clients should be advised of responsibilities of wildfire control and consider the development of a wildfire control plan including "defensible" space, access routes, fire-season water source, and location of wildfire control facilities.

Consider the development and/or maintenance of an adequate and permanent road system with permanent landings. At each entry, address access issues, install permanent erosion control structures and take steps to hydrologically disconnect drainages from road and trail system from natural water drainage systems. Take the opportunity to upgrade and/or repair forest infrastructure (e.g., roads, crossings, gates, etc.).

Discuss the establishment of buffer zones along streams and around mountain meadows.

Soil compaction should be considered in the design of the transportation and harvesting system.

### **Additional Considerations for Improving the Quality of Forest Products and Health**

In developing the intermediate cuts before the final harvest cut, use a spacing guide which leaves a varying number of trees, depending upon site indices and average diameter class. Use spacing guide where this information is available.

Clients may only want to thin one time. If the stand exceeds 5 inches average diameter, an alternative is to increase the D+X spacing to that for a ten-inch diameter tree. Clients need to be aware that this may require more maintenance of the understory and pruning to maintain satisfactory growth and to develop quality material.

Leave healthy, full crowned, well-formed trees.

In mixed stands, favor the best adapted and highest quality species growing on the site.

Thin the highest site indices first.

Remove trees in the following categories: Crooked, dead or dying, diseased, and injured.

The best time for thinning to avoid Ips beetle damage is September through April.

### **Additional Considerations for Competing Vegetation**

Vegetative response is the determining factor indicating the success of a vegetation management practice.

- If increased forage is the objective, inability of forage species to take quick advantage of improved growing conditions by species may limit success.
- If improvement of wildlife habitat is the objective, planning should include specified levels of cover for individual species.
- If fuel load reduction is the objective, acceptable levels of woody plant control should be specified.
- If water quality improvement is the objective, reasonable chances of

improving herbaceous cover while reducing woody cover should exist.

- When improved recreation and esthetic values are the objectives, descriptions of desired vegetation type distribution should be provided.

The control of grasses or other herbaceous plants may be accomplished by mechanical, chemical<sup>1</sup>, biological, prescribed burning, or a combination of these methods.

When chemicals are used, they must be used in accordance with label instructions and state regulations. Evaluate the risk of the pesticides to ground and surface water quality from pest management techniques and pesticides utilizing WIN-PST.

#### **Additional Considerations for Improving Wildlife Habitat**

Consider retention of selected dead and dying trees, including down material, to enhance wildlife values.

For wildlife dens, it is desirable to leave an occasional hollow tree, and sometimes a dead snag, unless they are a hazard to either animals or people, or if they are a severe fire hazard.

Wildlife food and cover can be retained by minimal modifications to compositions and spacing regardless of the purpose for treatment

Minimize fragmentation effects by maintaining forested wildlife corridors

Retain Hardwoods. Hardwoods have high food value for wildlife and should not be completely eliminated from a stand of conifers. They can serve as nurse trees for more desirable conifers.

#### **Additional Considerations for Improving Recreation Values**

On areas with recreation values, denser or more open stands may be desired. On-site inspection will be necessary before specifications can be prepared.

In recreational areas it would be desirable to leave some large picturesque hardwoods and an occasional misshapen conifer. Girdling or poisoning is not desirable because of the creation of unsightly snag areas or danger from falling material.

## **PLANS AND SPECIFICATIONS**

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes and narrative statements in the conservation plan, or other acceptable documentation.

Specifications shall be based on soil interpretations for an area and shall include the following:

- species to be favored for better growth;
- spacing after thinning or weeding;
- methods of removal;
- best season for cutting or treating chemically; disposing of slash; and
- special treatments, if needed, to forestall the spread of disease, fungi, or insects.

## **OPERATION AND MAINTENANCE**

Periodic inspections during and after treatment activities are necessary to ensure that purposes are achieved and resource damage is minimized, e.g., assessment of insects, disease and other pests, storm damage, and damage by trespass. The results of inspections shall determine the need for additional treatment under this practice.

Management following initial treatments must be specified during the planning process. Decision-makers must be aware of maintenance and management requirements to insure success and prolong the life of initial treatment.

Following initial application some regrowth, resprouting, or reoccurrence should be expected. Spot treatment of individual plants or areas needing retreatment should be done as needed. These may need to be periodically controlled by any number of methods including cutting, use of prescribed fire, mowing or chemical application.<sup>1</sup>

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<sup>1/</sup> Chemical application recommendations and application rates will be made by a licensed applicator, farm advisor, or others licensed to do so in California.

There are a number of maintenance items that are necessary to maintain a healthy stand, and to achieve the benefits for which the plantings were established. A maintenance plan will be prepared that addresses the appropriate items:

- pruning
- weed control
- water and wind erosion control
- water quality management
- pest management
- grazing management
- harvesting methods
- wildlife habitat

## **REFERENCES**

USDA USFS:

The Effects of Thinning and Similar Stand Treatments on Fire Behavior in Western Forests. PNW-GTR-463. Sept 1999.

Science Basis for Changing Forest Structure to Modify Wildfire Behavior and Severity. RMRS-GTR-120. April 2004.