



Natural Resources Conservation Service
CONSERVATION PRACTICE STANDARD
FOREST STAND IMPROVEMENT

Code 666

(Ac.)

DEFINITION

The manipulation of species composition, stand structure, or stand density by cutting or killing selected trees or understory vegetation to achieve desired forest conditions or obtain ecosystem services.

PURPOSE

- Improve and sustain forest health and productivity
- Reduce damage from pests and moisture stress
- Initiate forest stand regeneration
- Reduce fire risk and hazard and facilitate prescribed burning
- Restore or maintain natural plant communities
- Improve wildlife and pollinator habitat
- Alter quantity, quality, and timing of water yield
- Increase or maintain carbon storage

CONDITIONS WHERE PRACTICE APPLIES

All land where the quantity and quality of trees can be enhanced.

CRITERIA

General Criteria Applicable to All Purposes

Describe the extent or size and orientation of treatment area(s).

Identify and retain preferred tree and understory species to achieve all planned purposes and landowner objectives.

Use available guidelines for species and species groups to determine spacing, density, size-class distribution, number of trees, and amount of understory species to be retained. Schedule treatments to avoid overstocked conditions using approved silvicultural/ stocking guides.

Describe the current and desired future condition of each stand that will be treated. Include the species, cover type, and size-class distribution. Stocking will be described in terms of crop trees per acre, basal area per acre, trees per acre, between-tree spacing, or by any other appropriate and professionally accepted density or stocking protocol.

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)

Refer to WIN-PST criteria in NRCS Conservation Practice Standard (CPS) Code 595, Integrated Pest Management, and comply with applicable State and local laws if an herbicide will be used.

Time tree felling to avoid buildup of insect or disease populations.

Implement forest stand improvement activities in ways that avoid or minimize soil erosion, compaction, rutting, and damage to remaining vegetation, and that maintain hydrologic conditions. Protect site resources by selecting the method, felling direction and timing of tree felling, and heavy equipment operation. For temporary access use NRCS CPS Code 655, Forest Trails and Landings, to protect soil and site resources from vehicle impacts.

Use NRCS CPS Code 560, Access Road, for more heavily used roads associated with forest stand improvement activities.

Where slash and debris will be generated, use NRCS CPS Code 384, Woody Residue Treatment, to appropriately treat slash and debris, as necessary, to assure that it will not present an unacceptable fire, safety, environmental, or pest hazard. Remaining woody material will be placed so that it does not interfere with the intended purpose or other management activities. Do not burn vegetative residues except where fire hazard or threats from diseases and insects are of concern or when other management objectives are best achieved through burning. When slash and other debris will be burned onsite use NRCS CPS Code 338, Prescribed Burning.

Comply with State best management practices for water quality (California Forest Practice Rules).

Additional Criteria to Improve and Sustain Forest Health and Productivity

Treatments, including woody biomass removal, will be sustainable and will not compromise soil organic matter, the recruitment and retention of coarse woody debris, or wildlife habitat. If needed, use NRCS CPS 384, Woody Residue Treatment. If applicable, use biomass harvesting guidelines (The Forest Guild, 2010) and/or State guidance.

Manipulate stand characteristics to mitigate risk of insects and disease. Examples of stand manipulations include creating a diversity of tree species and a mosaic of age classes.

Additional Criteria to Reduce Wildfire Risk and Hazard and Facilitate Prescribed Burning

Reduce stocking rates and alter spatial arrangement of trees to minimize crown-to-crown spread of fire.

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

Use criteria for wildfire risk and damage reduction, including reduction of ladder fuels, in NRCS CPS Codes 383, Fuel Break; 384, Woody Residue Treatment; 394, Firebreak, or 660 Tree/Shrub Pruning as appropriate.

Additional Criteria to Improve Wildlife and Pollinator Habitat

Manage for specific or a variety of cover types, species, size-classes, and stocking rates at the appropriate scale that meet desired wildlife habitat requirements.

Create, recruit, and maintain sufficient snags, nest, cavity, and den trees, and down woody material to meet requirements of desired species.

Use one or more of the following tools for improving wildlife habitat:

- State Wildlife Habitat Guidelines as described in the California Wildlife Habitat Relationships (CWHR),
- California Wildlife Habitat Evaluation Guide (Forestland & Woodland, Riparian, and/or Wetland)
- Stream and wetland habitat assessments
 - NRCS Stream Visual Assessment Protocol (SVAP)
 - Hydrogeomorphic Wetlands Assessment (HGM)
 - California Rapid Assessment Methods (CRAM)
 - Proper Functioning Condition Assessment (PFC)
- CA Biology Technical Note 24
- CA Biology Technical Note 25

For Pollinator habitat refer to the Pollinator Habitat Assessment on Range and Pasture.

Use habitat creation and maintenance criteria in NRCS CPS Codes 643, Restoration and Management of Rare and Declining Habitats; Code 645, Upland Wildlife Habitat Management; or Code 644, Wetland Wildlife Habitat Management, as appropriate, to manage wildlife-related activities.

Additional Criteria to Alter Quantity, Quality and Timing of Water Yield

Create a mosaic of age classes to increase water yield and stabilize seasonal water yield from watersheds.

Create openings in the forest canopy to allow more light to reach the ground, stimulating understory vegetation and diversifying plant species composition and vertical structure. These improvements will increase rainfall infiltration, snowfall accumulations, and reduce runoff thereby reducing soil erosion and improving water quality and quantity.

Additional Criteria to Increase Carbon Storage

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

CONSIDERATIONS

Considerations for Wildlife and Pollinator Habitat

Consider removing vines from crop trees but retaining vines with wildlife value (e.g., grape and poison oak) on non-crop trees.

Increase quantity and quality of important mast (seeds, catkins, fruits, and nuts) sources for wildlife through crop tree management and other techniques.

Improve horizontal diversity or patchiness (of different age class units) across the forest for a variety of wildlife.

To the extent consistent with wildfire hazard reduction or other silvicultural objectives for commercial harvesting, improve or maintain vertical structure or vegetative layering in treated stands.

Favor declining wildlife species by providing appropriately sized treatment areas or blocks of habitat.

Time forest stand improvement activities to minimize disturbance of seasonal pollinator and wildlife activities, such as nesting, movement, etc. Refer to Tech Note 23 for NRCS process to reduce impacts to migratory birds. Refer to existing ESA consultations for process and measures to reduce impacts to federal listed fish and wildlife species. Refer to requirements of federal permits (CWA 404), and state permits (Streambed alteration permit 1600, Water Quality Certification 401).

Considerations for Improving and Sustaining Forest Health and Productivity

Silvicultural treatments that reduce wildfire hazards and pest risks should be a primary consideration in areas of high wildfire hazards. These include reducing understory tree and shrubs stocking levels, increasing both horizontal and vertical spacing between residual trees and shrubs, and slash treatment.

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

If available use sanitation-salvage and risk-rating criteria to determine trees to remove during forest stand improvement operations (see Thinning and Sanitation in Donaldson and Seybold 1998).

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

Consider enlisting the assistance of a professional forester when seeking to rehabilitate degraded stands that have been repeatedly subjected to exploitative harvesting (high-grading). Often a complex site-specific treatment plan must be developed to overcome repeated exploitative timber harvest.

Successful regeneration of desirable species is usually dependent upon timely application of forest stand improvement and other practices, such as prescribed burning, site preparation, tree and shrub establishment, prescribed grazing, and access control. Use of natural regeneration methods are acceptable when a sufficient quantity, quality and variety of species are found on the site.

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

Consider retaining at least 1/4 to 1/3 of the slash, tops, and limbs after harvest to protect site productivity. When using whole-tree harvesting systems minimize the removal of needles or leaves by

harvesting in the dormant season, retaining fine woody materials onsite, or leaving felled trees onsite to allow for needle or leaf drop.

Consider controlling invasive plants if they are encountered while conducting forest stand improvement. Use NRCS CPS Codes 314, Brush Management; or 315, Herbaceous Weed control, as appropriate.

When available, report the minimum criteria (diameter at breast height, log length, etc.) for commercial forest products (sawtimber, pulpwood, etc.) in order to know when to direct a client to a professional forester.

Consider advising landowners to secure a written contract with a 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.

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.

Considerations for the Harvest of Forest Products

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

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.

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

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, consistent with meadow or aspen forest restoration objectives.

Consideration for Use of Forest Biomass

Utilize excess woody debris (forest biomass) for renewable energy or other commercial uses. Commercial uses of biomass require a timber harvesting permit consistent with the California Forestry Practice Rules issued by the California Department of Forestry and Fire Protection.

Biomass removals, intensity and frequency will be managed to prevent long-term negative impacts on the stand.

The harvesting of 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).

Considerations for Increasing Carbon Storage

Critical to maintaining forests as a carbon sink is to first ensure the forest is resilient to wildfire and pests.

To increase carbon storage, consider shifting from even-aged to uneven-aged management to increase the retention of carbon onsite. Use regeneration methods that encourage advanced regeneration and retention of mature trees, such as shelterwood, to retain carbon onsite for longer periods. Consider retaining snags and downed woody debris for additional onsite carbon storage, and adopt techniques for maintaining soil quality, including organic carbon retention.

To grow trees that can store carbon in durable manufactured products, consider lengthening rotations to retain mature trees longer and grow to larger sizes; also consider using crop tree management techniques (Perkey et al. 1994) to concentrate growth on suitable long-lived species.

Considerations for Visual Quality

When forest stand improvement is being used to improve visual quality consider leaving trees that are attractive in shape and structure or flower and are appropriate to the site, especially around structures, roads, and home sites.

PLANS AND SPECIFICATIONS

Plans and specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, implementation requirements (job sheets), technical notes, and narrative statements in the conservation plan, Forest Management Plan, or other acceptable documentation. Clearly state the goals and objectives of the forest stand improvement. Specific stand-stocking guidelines will clearly document both the pre- and post-treatment stand condition.

OPERATION AND MAINTENANCE

Prepare an Operation and Maintenance plan for the site and review it with the operator. The plan will describe actions that must be taken to ensure that the practice is applied correctly during its design life. As a minimum, include periodic inspections for assessment of insects, disease, and other pests, storm damage, and damage by trespass. Use NRCS CPS Code 655, Forest Trails and Landings, to control erosion on forest roads, skid trails, landings, and adjacent areas by installing/maintaining vegetative and structural practices. Treatments needed for pests—see Additional Criteria to Improve and Sustain Forest Health and Productivity section in this document. Treatments needed for storm damage—use NRCS CPS Code 384, Woody Residue Treatment, to appropriately treat slash and debris. Treatments for damage by trespass: use NRCS CPS Code 472, Access Control, to prevent future damage.

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.^{1/} When chemicals are used, they must be used in accordance with label instructions and state regulations.

^{1/} Chemical application recommendations and application rates will be made by a licensed applicator, farm advisor.

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