

FOREST STAND IMPROVEMENT (666)

SPECIFICATION GUIDE FOR PLANNERS

USDA, Natural Resources Conservation Service—Practice Code 666

FOREST STAND IMPROVEMENT

Forest stand improvement involves the manipulation of forest species composition and structure by cutting or killing selected trees and understory vegetation

PRACTICE INFORMATION

This practice applies to forestland where competing vegetation interferes with the growth of preferred tree and understory species. Preferred plants are identified and retained to achieve the desired composition and structure of the forest stand.

Specifications for this practice include defining the spacing, density, and number or area of preferred plants. Timing of treatment and retaining dead or dying trees will help minimize impacts on nesting birds and other wildlife. Food and cover for desired wildlife species may be enhanced by modifying tree and understory composition and spacing.

Conservation benefits may include but are not limited to:

- improved plant health and productivity,
- reduced susceptibility to pests and moisture stress,
- reduced wildfire hazard,
- improved wildlife habitat,
- increased water yield, improved water quality, or beneficial timing of flows,
- increased carbon storage.



Common Associated Practices

Forest Stand Improvement (666) is commonly applied with practices such as: Woody Residue Treatment (384), Integrated Pest Management (595), Brush Management (314), Herbaceous Weed Control (315), Access Control (472), Critical Area Planting (342), Firebreak (394), Fuel Break (383), Forest Trails and Landings (655), Access Road (560), Prescribed Burning (338), Tree/Shrub Pruning (660), Upland Wildlife Habitat Development (645), Early Successional Habitat Development/Management (647), Restoration and Management of Rare and Declining Habitats (643), Wetland Wildlife Habitat Management (644), and various erosion control practices.

For further information, contact your local NRCS field office.

Existing (Benchmark) Condition:

What is the Current Management System for the field or stand of trees: Even-aged and single storied, Even-aged and two storied, Uneven-aged and multi-storied, or transitioning from even-aged to uneven-aged.

Estimate the Average Annual Precipitation using either a local weather station, Web Soil Survey or Geodata layer. Document your data source.

Determine soils from the Web Soil Survey. Document the Site Index for each soil within the planning unit from the Forest Productivity soils interpretation and report. Document all the soils interpretations and reports that are helpful to provide the limitations and risks associated with the proposed treatments. Water table and soil depth is important for determining potential for stem breakage and windthrow post treatment.

What is the approximate age of the forest stand? What method did you use to estimate the age (harvest records, old aerial photos, field sample with increment borer...)?

What is the average crown ratio? Crown ratio is the % of the entire tree height that has green branches going at least 2/3 around the bole. You may choose to insert height to live crown instead. This average height to live crown is measured to the first whorl that has green branches going around at least 2/3 of the bole.

What Inventory method did you use to determine the stocking and dominate species of your forest stand? Determine the average Trees per Acre and from there determine the average spacing between trees. Also, estimate the Average DBH and general DBH Range. Estimate the average height of each cohort (story). Height to Diameter (H/D) ratio is helpful in determining potential for windthrow.

Document the stocking level of each forest stand covered by this specification. Based on Forestry Technical Note 10 (if it is a species covered by Forestry TN 10) establish if the stand of trees (or field) is over-, under- or appropriately stocked.

Name the species (s) (common or scientific name or use plant code) that represent at least 10% of the stocking. Minor species that have significance to the project may be named as well but their status of minor species will be stated.

Attach supporting documentation such as: plot cards; photos; inventory maps; which tools were used for analysis; and so on. List those attached documents here.

Purposes:

Check all purposes that treat an identified resource concern and meet the participant's objectives.

Desired conditions:

Establish the desired future conditions of the forest stand or field based on purpose for treating the resource concerns and participant's objectives. Estimate the target average spacing of the crop trees and the distribution. What should the forest stand look like?

From estimated average spacing calculate the target average trees per acres. After the "Trees per acre" target, define the operational acceptable range or tolerance. Example: Stay within 15% of target TPA or Acceptable TPA range 258 to 360. You can also make the range the target TPA without an operational tolerance.

State the preferred crop tree species that treats the resource concern and meets the participant's objectives.

If understory species are of interest to the goals and objectives of the participant then define the structure and /or desired species composition of the future understory.

Treatment Technique:

Check whether this specification is for a Stand Release or Thinning. Thinning could be done on any size timber but it will most likely be applied on young pre-commercial sized trees. If thinning is to be done on conifer trees, whose average DBH is greater than 10" then contact your Area or State specialists.

Check the method or methods to be used for treating the stand of trees (field). Supply additional information that will help clarify the treatment method, such as: Best Tree selection; rigid spacing; variable density thinning to buffer the windward edges; or variable density thinning with skips and gaps; for uneven-aged stand or multi-storied stand, which cohort is being treated and so on...

Practice implementation will be done in which seasons and between which dates. Avoid thinning in the spring because of the increased sap flow the tree boles are particularly susceptible to damage during this season. Time treatment to avoid insect and disease populations. Provide an explanation of treatment timing.

Additional Treatment Information and Instructions

For PCT:

- 1) Best Tree Selection vs. adherence to rigid spacing. For operational PCT, it is recommended that that the Participant use Best Tree Selection with a maximum of $\pm 50\%$ variation in spacing between individuals but with the overall average trees per acre for the stand to be within the spacing range in table one of Forestry Technical Note 10 or a maximum of $\pm 15\%$ of the prescribed TPA ("*Desired number of trees per acre*"). **[This is specific to an even-aged management regime]**
- 2) The crop trees (or leave trees) in a "Best Tree Selection" technique are those which have the tallest height, largest crown, straightest stem, largest DBH, and are well formed trees with good vigor, color, and with no damage or least amount of damage. When transitioning to uneven-aged management or for uneven-aged management separate the forest stand in to cohorts (canopy stories based on height ranges) and apply the above crop tree criteria to the target cohort.
- 3) All competing hardwoods within 10' of crop tree shall be cut or girdled. Hardwoods are competing if at the time of thinning, they are at least 50% as tall as the crop trees and reach the live green crown of the crop trees. Competing hardwoods can be cascara, elderberry, crabapple, big leaf maple, willow, vine maple, or any tall woody shrub species. These trees are serious competitors with the main canopy for growing space, nutrients, and other needed resources. Plus, at the time of harvest, these other hardwood species can add to the slash loading, and increase site prep costs.

If wildlife habitat is a consideration then treating these species as a crop tree or retaining groups of them in specified areas like small openings are appropriate options.

- 4) If no undamaged tree is available for a crop tree, leave the tree with the least amount of damage. In Silviculture, damage is usually defined as forked tops, broken tops, dead tops, rot, animal damage where over 50% of the circumference of the bole is debarked or more than 3' in length of the bole is debarked, excessive lean over 15 degrees, mistletoe, chlorotic needles, sweep, defoliation and any other insect and disease symptom.
- 5) All cut trees will be completely severed below the lowest live limb or at 12" above the ground whichever is lower. If a natural obstruction prevents cutting the tree below a 12"

stump height, the tree must be completely severed within 12" of the top of the obstruction. Tree with large spreading crowns that are difficult to cut down without damaging other crop (leave) trees maybe physically or chemically girdled. If physically girdled cambium must be severed all the way around the tree for a width of ½". Trees may also be girdled to retain snags for wildlife habitat.

- 6) Do not damage the bole of the crop tree during thinning.
- 7) Do not leave cut trees leaning against the crop tree.
- 8) All thinning debris will be removed from roads, cut banks, ditches and buffer strips and will be piled or redistributed within the area at the end of the day or activity.
- 9) Cut trees will be felled away from streams and wetlands for one tree length.

For Stand Release:

- 1) Competing shrubs and hardwoods will be cut so that no live limbs are present on the stump or less than a 6" stump, whichever is lower.
- 2) All cut stems will be dropped away from the crop tree. Crop trees should not be buried, bent, leaned against, have the slash rubbing against its bole or damaged by the operator in any way.
- 3) All debris, created from the stand release, will be removed from drivable roads, ditches and buffers and will be redistributed within the released area, chipped or piled.

For fire protection on a forest road in high fire danger areas, you may consider pulling slash away from road for at least 25' or more. Check for slash disposal regulations for state or county roads.

- 4) Keep all release debris out of streams and wetlands.

Check for state or local regulations regarding no cut buffer requirements for Riparian Management Zones (RMZs) along streams and wetlands. Landowners may not want to invest in the RMZs because they may not be able to cut the crop trees at rotation due to stream protection regulations. However, conifer release in the RMZs can prepare the trees within the RMZ to be more windfirm at the time of harvest and provide larger trees faster for wildlife, fish and stream habitats and bank stability. All stems will be felled away from streams, ponds and buffers. Do not use chainsaws within the ordinary high water mark of any surface water.

Additional Criteria for the purposes of Forest Health, Wildfire Risk Hazard, Wildlife Habitat, Water Yield or Carbon Storage.

These purposes have additional criteria beyond the general criteria. If these purposes are checked under the Purpose section, then review the standard and address the additional criteria here.

Improve and Sustain Forest Health and Productivity:

Provide any additional site specific information to aid the participant with their decisions whether or not to treat the slash (woody debris) created from the use of this practice and any responsibilities they may have due to additional fuel loading. If 384 Woody Residue Treatment is an associated practice then reference the standard, implementation requirements and/or planner's guide here.

Reduce Fire Risk and Hazard:

Stocking rates may need to be reduced lower than what Forestry Technical Note 10 Table 1 recommends in order to minimize the risk of spreading fire from crown to crown. The use of Forestry Technical Note 10 Table 2 for spacing guidance is appropriate for this purpose. Both 384 Woody Residue Treatment and 660 Tree and Shrub Pruning may be associated practices, if so, then reference the standard, implementation requirements and/or planner's guide here

Improve Wildlife and Pollinator Habitat:

Refer to Biological Technical Note 14, Stream Visual Assessment Protocol (SVAP2) or Xerces Pollinator Habitat Assessment tool to identify habitat elements that are below planning criteria and then adjust the implementation requirements to address those elements.

Alter Quantity, Quality and Timing of Water Yield:

Utilization of variable density thinning/partial cut options such as skips and gaps, group selection, and patch cuts may be necessary to achieve this purpose.

Increase Carbon Storage:

For crop trees, give preference to species with faster growth rates and/or species whose boles are commonly processed for structural lumber or other products that can provide long term carbon storage.

Considerations and Mitigations:

Based on the standard provide any additional site specific considerations.

For Example:

- 1) Is there a maximum DBH above which the participant does not want the tree cut even if it is heavily damaged?

Depending on local markets, some landowners will choose not to cut trees >8" DBH because they are potentially merchantable for pulp, fiber, chips or may have attributes beneficial to wildlife.

When releasing conifers, some hardwoods have commercial value—such as Red Alder, Black Cottonwood or Big Leaf Maple. If these species out compete the conifers and reach a certain size, the landowner may find benefit in managing for these hardwood species instead of the conifers.

- 2) Does the landowner want to leave extra trees along openings (natural or man-made) or in areas with heavy damage (for example heavily bear damaged areas) or do they want to wider spacing between trees to promote wildlife habitat.

Some landowners choose to leave extra trees along opening in order to make up for the reduced land in production. There is extra growing space due to the opening, however, leaving too many trees will reduce DBH growth. If there is a maximum DBH restriction on cut trees, some landowners will choose to leave extra stems where there are pockets of damaged trees with DBH greater than the maximum allowed for cutting. Bear foraging often creates this scenario.

More widely spaced trees around small openings can help to maintain or increase sunlight to a group of mast producing shrubs, or increase the abundance of cover for wildlife.

- 3) Use Height to Diameter ratio along with species, presence of bole or root rot, soil information, crown ratio, and topography (exposure to wind) to determine if mitigation is needed to reduce windthrow and wind caused stem breakage. Mitigation might include: 1) using Table 2 of Forestry Technical Note 10 and leaving more crop trees; 2) having

additional thinning entries as part of the O & M plan in order to reduce the stocking gradually; 3) leave a 50 to 100' buffer on the windward side of the stand thicker than the rest of the stand; 4) Don't thin or lightly thin ridges or other areas within the stand that are exposed thus with an increased vulnerability to wind.

- 4) Will there be a no cut buffer along streams or wetlands? (Riparian Management Zones or RMZs)

Check for state or local regulations regarding no cut buffer requirements for precommercial thinning. Plus landowners may not want to invest in the RMZs because they may not be able to cut them at rotation. However, thinning RMZs can prepare them to be more windfirm at the time of harvest and provide larger trees faster for wildlife, fish and stream habitats and bank stability. All stems will be fallen away from streams, ponds and buffers for one tree length. Do not use of chainsaws within the ordinary high water mark of all surface water?

- 5) Is there a need for no cut buffers along roads for aesthetics (visual, noise or odor) wind, fire or wildlife protection?

For fire protection on a forest road in high fire danger areas, if you choose to thin to roads, then you may consider pulling slash away from road for at least 25' or more (see 384 Forest Slash Treatment). Check for slash disposal regulations for property adjacent to state or county roads.

Roads can sometimes act as a boundary to a clearcut or corridor for wind. When the road is acting as a corridor for wind, the wind will sometimes accelerate and when the road turns the trees at the turn have a significantly larger risk of blowing down.

A no cut buffer along roads can act as cover for wildlife.

- 6) How does the participant want trees forked below DBH handled?

In inventory procedures, trees forked below DBH are considered two trees. However, for the purposes of pre-commercial thinning, trees forked below DBH are often treated as one tree with both stems either cut or left. For certain species such as Douglas-fir, you could cut one stem and leave the other as the crop tree without a high risk of rot from the cut stem entering the leave stem. On the other hand, species like Western hemlock, do have a high risk of the rot from the cut infecting the leave stem. If you are performing the PCT yourself then this item can be decided on a species by species basis. If you are hiring a contractor, it would be easier operationally to cut both or leave both.

- 7) How does the participant want to treat whips (trees <20% the height of the main canopy)?

These trees are serious competitors with the main canopy. Creating a structural diversity by maintaining multiple canopy layers within stand improves wildlife habitat. On the other hand, whips will add to the slash loading at final harvest and may increase the slash disposal or site prep costs.

- 8) Are there any special trees, shrubs or other plants that need protection?

For example- the participant has a favorite tree or species of tree or shrub for aesthetic reasons, for wildlife habitat reasons or for its value as a specialized forest products.

- 9) Monocultures vs. species diversity and the use of "species preferences" in PCT. Monocultures potentially could have marketing advantages and reduced sorting costs either on the landing or at the log yard. However, it has increased risk with regard to the plantation

as an asset or investment. The plantation is at higher risk of loss due to damage or mortality by pests, weather or fire. Normally, at least some level of species diversity is recommended. Usually, species preference within a PCT specifications (implementation requirements) is used as the final factor in crop tree selection, if all other physical criteria are the same or close to the same. For example: If your species preferences were 1) Red alder; 2) Douglas-fir and 3) all other commercial conifers or hardwoods, and you have two potential crop trees that are healthy and of similar heights and crown ratios but the Red alder is only 2" in DBH and the Douglas-fir is 4", you would choose to leave the Douglas-fir. However, if the Red alder is 3.5"DBH and the Douglas-fir was 4" then you would probably choose to leave the Red alder.

In addition, species diversity is an important factor in quality wildlife habitat.

Associated Practices

Check all of the practices that are part of the conservation system treating the resource concern. Refer to the standards of the other practices to ensure compatibility of specifications.

Operation and Maintenance (O & M) Plan

Fully complete Operation and Maintenance requirements for the practice. Choose the practice treatment and associated methodology and complete the associated O & M plan. You may remove or X out the other plan options on the page. Use plan D for any additional notes or requirements for O & M Plans A through C, or use Plan D O & M plan development for a unique situation.

Practice Specifications, Design Review and Installation Certification

These are two different signature sections. These sections also documents the planner's Job Approval Authority (JAA) or the TSPs TechReg Category Certification in comparison to the project size (ac) and slope (%). The Planner (or TSP) will sign and date each section as appropriate. If the planner does not have appropriate JAA for the size and slope of the project area by category then a Reviewer with an appropriate amount of JAA will check the planning, implementation requirements and/or practice certification and sign and date under "Checked By" in the appropriate section. It is recommended that both the Reviewer and Planner include their JAA for the category (design or certification).

If the TSP is not certified for a practice, then the TSP may only include the planned amount, the fields (forest stands) where the practice is to be applied, and planned year of application. The TSP may create a draft implementation requirement in order to get and document the experience and product quality so eventually they can get certified for that practice.

There is a section for the client to sign and date. With their signature the client is accepting the specifications (implementation requirements), indicates the planner reviewed the specifications with them, agrees to install according to the specifications and that they are responsible for the permits and notifying the appropriate governmental agencies or utilities prior to implementation of practice.

Documentation Requirements

The Implementation Requirements (IR) form will be filled out completely. The documentation requirements for the practice are found on the front page of the form in the Index box.

Ensure the basic header information is complete: name of the owner and operator, farm and tract numbers, fields in which the practice will be installed, project name or contract number, and the County or Counties within which the project resides.

Mandatory Documentation within the Plan (See Index Box on first page)

Check box of each item that is present within the file and properly completed.

The following additional data/documentation needed for this practice:

Include benchmark inventory, data summaries and assessment tool (usually Forestry Technical Note 10) results that support the presence of the resource concern and are consistent with landowner objective in the file or documented within the Assistance notes.

Also include the checkout and certification required documentation that is attached and supports the verification of extent, and that the practice was installed according to the standard and specification. Please include clarification notes on the As-Builts or within the Assistance notes.

NRCS CONSERVATION PRACTICE EFFECTS - NETWORK DIAGRAM

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