NATURAL RESOURCES CONSERVATION SERVICE

FOREST STAND IMPROVMENT DESIGN PROCEDURES

(666DP)

HARVEST, THINNING AND STAND IMPROVEMENT METHODS FOR WOOD PRODUCTS AND OTHER USES

A. Species to Favor

1. Refer to Field Office Tech Guide, Section II-Forestland Interpretations or/ Section II-Windbreak Interpretations, to select desirable species for the forestland site.
2. Priority shall be given to improving sites having site indices of 55 (refer to Section II-Forestland Interpretations) or greater for the species selected.
3. In general trees to favor in Nebraska include: Ponderosa pine, Black walnut, Eastern cottonwood, Green ash, Hackberry, Bur oak, Northern red oak, hickories, Silver maple, Eastern redcedar, and Basswood.

B. Improvement Methods (TSI - Timber Stand Improvement)

1. Weeding - Weeding is the partial or complete removal of overtopping and strongly competing trees, brush, or other undesirable growth from stands of desirable species (small to mid-sized trees). Included with weeding is liberation cutting (removal of wolf trees) and vine removal.
   a. Weeding will be specified only if there are a sufficient number of desirable species present to result in an adequately stocked stand, approximately 150-200 desirable seedling/sapling sized trees per acre or 50-150 mid-sized trees.
   b. To protect the soil and train the trees, remove only the growth immediately surrounding the crop trees and leave desired vegetation (i.e. desired species of seedling/sapling sized trees) not directly interfering with crop tree growth. In a space of 2 feet surrounding the crop tree, cut all growth that is one-third or more the height of the crop tree and, in a space of 4 feet, all vegetation taller than the crop tree.
   c. Liberation cutting is recommended when there are large excessively limby “wolf” trees in the stand, which are overtopping desirable seedling or sapling tree species. There should be a sufficient number of desirable trees underneath to benefit from this type of release.
2. Methods for Weeding
   a. Cutting and treating with a herbicide: Cut and treat the stump with a chemical herbicide best suited to kill the species. Apply chemical immediately after cutting in accordance with directions given on label. In some stands stumps may be allowed to sprout back where low habitat is lacking or desired.
   b. Girdling: Girdle the tree about breast height, being careful to cut clear through the cambium layer all the way around the tree. Another girdling 4-6 inches below the first cut can be done to be sure of an effective kill. Girdling is an alternative for killing a few large weed or wolf trees larger than 12 inches in diameter (usually done with chain saws).

c. Frilling and treating with a herbicide: Frill with an axe at a convenient height above ground. Make cuts all the way around tree then immediately apply chemical herbicide in accordance with directions given on label. All trees frilled should be treated with a herbicide. December 15 to March 15 is best period for frilling and herbicide treatment. Large trees may be girdled 2 inches deep with chain saw and treated.

C. Thinning (Pre-commercial)

Thinning is cutting trees from an overstocked stand composed of desirable species not of commercial size to increase the growth rate of the remaining trees. Proper space varies depending on species, purpose of management, and quality of the site.

1. Types of trees usually removed in improvement thinning are as follows:
   a. Dead/dying, insect or disease infested trees.
   b. Deformed (crooked), fork topped, or damaged trees (fire, lightning, porcupine).
   c. Suppressed and co-dominant desirable trees to attain proper spacing.
2. Ponderosa Pine Stands - Western NE
   a. For pine stands less than 6 inches diameter, thin to 10-12 feet spacing. For pine stands over 6 inches diameter the D+9 spacing rule is used as shown below, D being the average stand diameter.

Ave. Diameter	D+9 feet spacing
6	15
8	17
10	19
12	21

   b. If forestland grazing is considered, add 1-3 feet to the spacing for site indices below 55.
   c. Time of year - For pine stands, when possible, thinning should be done in the fall and early winter months to avoid buildup of Ips (pine engraver) beetles in the slash and subsequent damage to the residual stand by beetles killing “leave” trees. If thinned at other times of the year, the slash should be lopped and scattered to a maximum of 18 inches off the ground and left to decompose on the forest floor.
3. Hardwood Stands
   a. For stands under a 6-inch diameter, thin to 12 feet. One general rule-of-thumb for hardwood stands is to leave 5-8 feet of open space in at least two sides of the crown of the remaining trees. For black walnut stands, allow 10 feet growing space between crowns.
   b. In addition, the woodland information stick (contact your local forester to receive one) has spacing for types of hardwood stands. Another method if the stand is uniform in diameter is the “diameter-times-two” rule. With this method, the average diameter in inches is multiplied by two; this is the number of feet to leave between the stems of the remaining trees.
   c. Pruning is also considered to be a timber stand improvement practice on selected high value crop trees to increase the quality of wood produced for sawlogs, veneer, etc. Black walnut, for example, will need pruning to get a desirable veneer log. Flush pruning is no longer an accepted practice. Refer to Tree/Shrub Pruning Standard 660 for guidelines on pruning.
   d. Heavy accumulation of thinning slash should be lopped and scattered close to the ground, piled for wildlife, or burned away from crop trees that are left. Check local and state laws when slash is burned or is near a public road.

D. Timber Harvesting

Timber harvesting is done in two categories: intermediate cuttings and regeneration cuttings.

1. Intermediate Cuttings - removing merchantable trees to improve the growth of the residual stand or protect the stand from insect and disease outbreaks. Types of intermediate cuttings are discussed below.

    a. Commercial thinning - Merchantable trees are removed from an immature stand (pole size) to achieve optimum stocking levels. The best-formed and most vigorous dominant and co-dominant trees will be left as crop trees for a future harvest. Crooked, forked, damaged, or wolf trees should be removed first. Then space out the better crop trees by removing adjacent co-dominant trees. Crop trees should be free from visual defect, have at least 40 percent live crown and have good form class (diameter:height ratio). Crop trees will be spaced at about D(average diameter)+8 to D+12, depending on species and site index. Use management guide on woodland information sticks (available from local forester). A professional forester should be consulted in crop tree selection.

    b. Salvage cutting - removing trees damaged by wind, hail, ice, or snow to prevent insect and disease infestation. After severe weather it's recommended that the forestland owner walk through the forest and look for merchantable trees that were badly damaged. Harvesting these trees quickly will prevent disease and insects from deteriorating the value of the tree and protect the remaining stand.

    c. Sanitation cutting - removing diseased or insect infested trees within the stand to reduce the potential for spreading into healthy trees. Bark beetles, woodborers, leaf defoliators, parasitic mistletoes, needle blights, and canker diseases proliferate in overmature and stressed immature trees. Identification of the signs or symptoms of these attacks is necessary and prompt removal is important to protect valuable crop trees. Contact your professional forester for on-site insect and disease identification.

2. Regeneration Cuttings - A silviculturally sound systematic harvest of merchantable trees to start a new forest of desirable seedlings. Planning considerations on this harvesting category should consider the objectives of the landowner in accordance with the following:

    a. Inventory of stand including tree species, age, size, density, natural regeneration in understory, and condition (crown vigor of dominant and co-dominant trees).

    b. Competing understory vegetation and undesirable tree species in stand.

    c. Site factors such as soil, slope, streams or other wetlands. These factors affect equipment operability, erosion hazard, and wildlife.

    d. Wildlife survey of den trees, snags, and nut-producing trees.

    e. There are several regeneration cutting methods for pine and hardwood stands. Natural regeneration will be used whenever possible and practical.

    f. Selection, seed tree, shelterwood, and group selection are harvesting methods used for the ponderosa pine type

        i. Selection - Individual mature trees are selected throughout the stand for cutting in relation to the product desired. Care should be taken not to cut all of the best dominant and co-dominant trees while leaving only suppressed or inferior trees. The selection system should contain many size/age classes of trees to ensure a good selection of immature trees for future harvests. Thinning (pre-commercial or commercial) may be done after this method.

ii. Seed Tree - Three to four good quality mature seed trees per acre are left for seeding in the future stand. This produces an even aged stand. Soil should be lightly disturbed to expose mineral soil (duff layer disturbed) for better seed germination. This system would be used on the better pine sites with deep soils (bottoms, north slopes).

iii. Shelterwood - Mature stand is harvested in two to three stages to seed in new stand and protect seedlings from hot, dry conditions. This method is used on droughty soils and on south aspects. Overstory seed trees should be removed when understory pine seedlings are established to prevent suppression during sapling stage.

iv. Group Selection - Similar to the selection method except groups of mature trees are harvested creating small patch cuts. Size of patch cut is usually less than one acre. Natural regeneration from the surrounding trees is expected. This method would produce an uneven aged stand.

g. The methods used for hardwoods are selection, group selection, and clearcutting.

i. Clearcutting would be used in situations where the desired tree species are not in adequate supply for natural regeneration or when only undesirable species are present.

ii. Clearcutting on large forest tracts should be limited to areas/blocks that are less than 10 acres each.

iii. All the trees in a designated part of the forest stand are removed and the desired tree species are planted (e.g., Black walnut, Bur oak, Red oak, White oak, Hickories, Basswood, etc.).

iv. Clearcutting is also appropriate for other hardwood species and situations, e.g. cottonwood or where coppicing can be relied upon to regenerate the stand.

v. The species planted must be able to produce the product desired in the sites that are clear-cut. Selection and group selection have been described above.

3. General Requirements For Timber Harvest

a. The natural beauty of the site will be considered during logging.

b. If needed, natural screens may be left to cover unsightly areas. For example: Slash will be lopped and scattered, piled and burned or broadcast burned to reduce fire and insect hazard.

c. The logging and slash disposal job will be of sufficiently high standard to leave the cutover areas in a condition that will maintain acceptable aesthetics and will be compatible with other acceptable uses of the area.

d. Trees shall be cut so that stumps are no higher than 12 inches on the high-ground side.

e. Trees will be utilized to the smallest top diameter acceptable to the buyer whenever market conditions permit, and it is economically feasible.

f. In selective cutting operations, care will be taken not to damage the residual stand during falling and skidding operations or to cause excessive soil damage.

g. Streamside buffer strips of 50-100 feet should be left on both sides of water sources when clearcutting bottom land forest stands. A few trees may be removed in buffer strips as long as shade is maintained over the stream and there is no threat of erosion.

h. Steep skid trails should be waterbarred every 100-300 feet. Minimize the number of random skid trails in a logging operation. Stay on designated skid trails and yard logs to trail rather than driving skidding equipment next to felled tree. This prevents soil compaction and root damage to the residual stand.

i. In selective cutting, leave some den trees, tall snags, and keep a variety of tree species in the residual stand, particularly along forest edges and streams. This will help maintain the diversity needed for many wildlife species.

j. A management plan shall be developed and the cooperator will be encouraged to contact a professional forester for technical assistance on planning and marketing. The forest stand improvement plan should be incorporated into the landowner's conservation plan.

k. Grazing - For hardwood stands grazing should be excluded or strictly monitored. Livestock grazing in valuable hardwood stands can cause extensive damage. Soil compaction from sharp hooves, browsing or physical damage of desirable young hardwoods, and grazing of understory plants allowing grass to invade all reduce the productive capacity of the site for wood production. If the landowner's objective is to produce and maintain quality hardwood timber, keep livestock out of the woods. For pine stands refer to Field Office Tech Guide, Section II-Forestland Interpretations.

l. "Diameter limit" timber sales are discouraged, as they tend to leave the timber in a "hygraded" condition. The definition of a "diameter limit" timber sales is where a minimum DBH (diameter breast height) is set for cutting timber (i.e., 10"), and all trees 10" and larger are harvested. If "diameter limit" timber sales are used, designate a higher diameter limit (i.e., 12-14") to be cut. This applies to ponderosa pine in the Black Hills, Pine Ridge, and inter-mountain areas.

E. Wildlife Considerations

1. Leave a selected few older cull trees for wildlife "den" trees. Leave brush piles for wildlife such as quail.
2. The edge or border between the forest and field should be irregular, rather than straight, again saving den trees, tall snags, shrubs, and vines that bear nuts and fleshy fruits. A 50-foot strip could be left untreated on the edge of the stand.
3. Leave vines, nut trees, and shrubs throughout the stand when they are not interfering with the growth of trees with commercial value.
4. For additional guidance refer to Upland Wildlife Habitat Management (645) and Wetland Wildlife Habitat Management (644).

References

University of Missouri AG Guide, Increase Woodland Products through TSI.

Top of Ozarks RC&D, Woodland Resource Guide, 1988.

Pennsylvania State Extension Bulletin, Timber Sales & Wildlife, 1981.

Colorado State Forest Service, Landowner Guide to Thinning.