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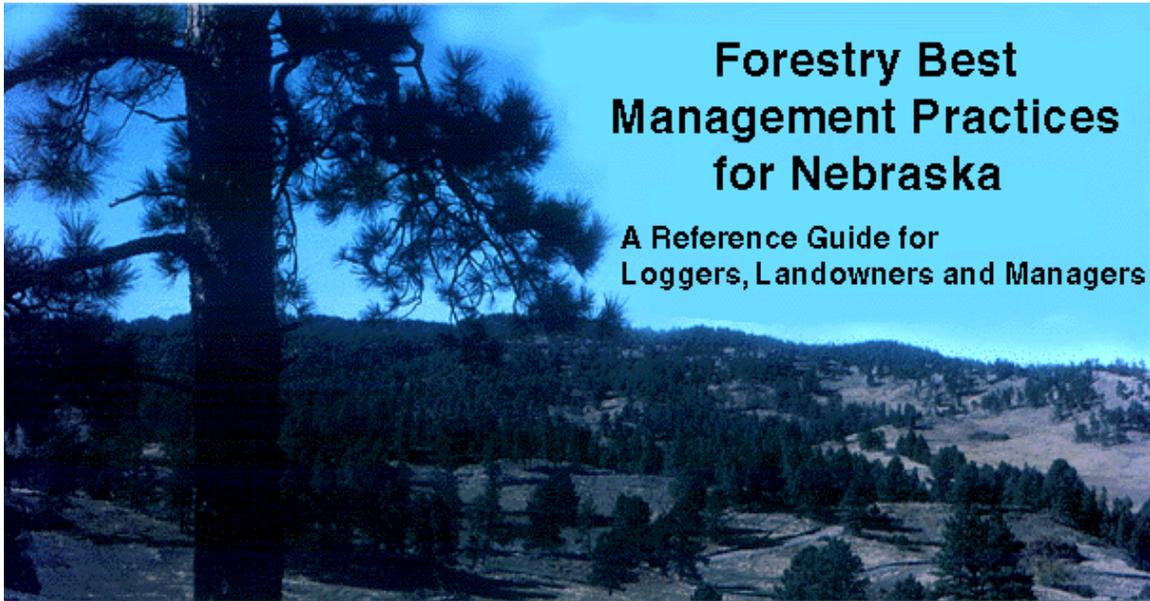


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Forestry Best Management Practices for Nebraska

A Reference Guide for
Loggers, Landowners and Managers

- [Introduction](#)
- [Roads](#)
- [Timber Harvesting](#)
- [Tree Planting](#)
- [Forest Improvement and Protection](#)

[Some of the images have been reduced for on-screen and printing layout. For a clearer image, try clicking on them. Many link to larger, clearer versions.]

Introduction

Nebraska's Forest Resource

Forests cover 947,000 acres in Nebraska. Other land with scattered tree cover, including narrow wooded strips along streams, windbreaks, and wooded pasture lands, occupy an additional 1,252,000 acres.* Managing Nebraska's forest lands can produce significant benefits without negative impacts; however, careless activities in woodlands can damage water resources, soils, wildlife habitat, aesthetic values, and even the ability to produce future benefits.

* Source: Data from Nebraska's third Forest Inventory, 1994, USDA Forest Service.

The Need For Best Management Practices

Some states have adopted specific laws and complex regulations governing forest management activities. Both state and federal laws may apply to some forest land management activities in Nebraska. This is especially true of road construction near waterways. Laws are not covered by this publication. Landowners should contact local authorities about laws which may apply prior to beginning any work.

The Nebraska Forest Service believes voluntary Best Management Practices (BMPs), when carefully applied, will ensure the productivity of our woodlands during timber harvesting, thinning, tree planting, and other forest management activities.

The goal is sustainable production of a mixture of "outputs" with minimal negative environmental impacts. Outputs can mean traditional wood products such as logs or fence posts, but can also include recreation and aesthetic value, water, mushrooms, and other nontraditional products. Not all products can be produced from every acre. Some negative impacts may result from woodland management, as they do from most human activities, but negative impacts resulting from good management are normally acceptable and temporary.

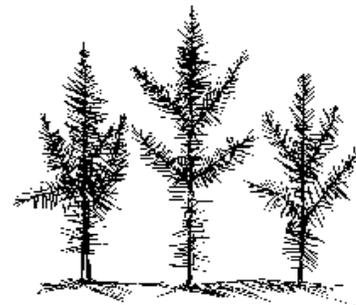
Prepare a Written Plan

The Nebraska Forest Service encourages landowners to prepare Forest Management Plans for their woodland areas. Preparing a management plan is a good way to clarify goals, provide direction, and schedule management activities for the woodland.

Management plans don't have to be long or complex. Even very simple plans are useful when deciding what work needs to be done and when it should be scheduled. In many cases reference to Best Management Practices should be included in the forest management plan. Specific practices can be quoted or simply included as an appendix.

Applying Best Management Practices

Guidelines must be applied to specific sites with common sense and flexibility. These voluntary BMPs are intended to serve as the basis for sound land management decisions, but they are not a "cookbook." Often BMPs can be applied directly by the landowner. Sometimes the field situation will need to be interpreted, and on-the-ground activities designed by a forester or other natural resources professional. Flexibility and the ability to modify guidelines to suit local conditions are needed to effectively apply these practices.



Most activities involving the actual management of forest land are included within these Best Management Practices. Other actions such as land clearing, land leveling, and construction, which might take place in or around forested areas are not included. They are land use conversion rather than woodland management. Nebraska forestry BMPs are described under four broad categories:

- Roads
- Timber harvesting
- Tree planting
- Forest improvement and protection

Roads

Location and Design

Woodland roads provide access for forestry activities as well as other farm and ranch operations. Road layout should not begin until the overall purpose for access has been determined. Minimize the number of roads by using existing roads whenever possible. Poorly located, constructed, or maintained roads can seriously

damage site productivity, lower water quality, degrade wildlife habitat, and reduce recreational value.

Good road design provides the access needed, keeps costs down, and minimizes damage to the area. Grades should normally be kept below 10 percent. Steep grades are very difficult to travel especially with heavy loads, and also result in more erosion. Stream crossings should be kept to a minimum and carefully constructed. Culverts and bridges should be designed to minimize impacts on the stream.



Both permanent and temporary roads need to be located, constructed, surfaced, and maintained carefully. Unsurfaced roads may be useable only when hard and dry or frozen solid. Temporary roads are designed to be closed and revegetated following use. Road construction activities should be limited to dry periods and periods of low or normal stream flows.

Roads and Streamside Management Zones

One of the best ways to protect water quality and other watershed values is to establish Streamside Management Zones (SMZ's) beside perennial streams. Intermittent streams, which may flow only during or immediately after a rain, normally do not require this level of protection. Roads should not normally enter a designated SMZ except where a crossing is needed. Prior to beginning any road construction examine the entire area to determine the SMZ and locate any other especially sensitive areas, such as steep banks or springs. SMZs will vary in width depending on the size of the stream and the steepness of the terrain.

Guidelines For Streamside Management Zones

Stream Width	SMZ Width (minimum)
Less than 20 feet	50 feet per side
20 feet to 40 feet	75 feet per side
More than 40 feet	200 feet per side

Culverts and Fords

Choose the locations for stream crossing before doing a layout for the rest of the road system. The elevation of the stream bed should not be changed when establishing crossings. Excavation and reshaping of stream banks should be minimized, and crossings should be installed at right angles to the stream channel to minimize disturbance.

Culverts should be 12 inches or larger in diameter. Smaller culverts are too easily plugged with branches and small debris. Determining culvert size and location for permanent roads is best done by a professional contractor or engineer. Bridge construction also requires professional design and construction and special permits may be required as well.

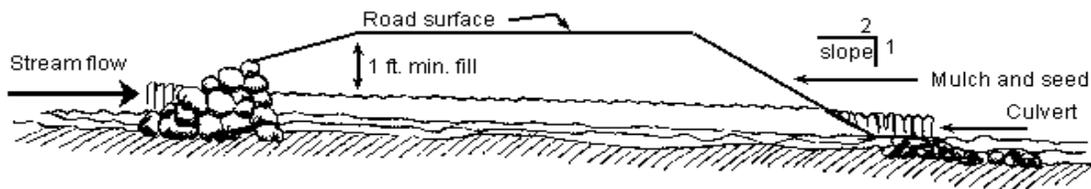
The following is a general rule of thumb for sizing culverts:

Drainage area above culvert acres	Culvert diameter inches	Drainage area above culvert acres	Culvert diameter inches
2	12	27	30
4	15	47	36
7	18	64	42
12	21	90	48
16	24	120	54

Culverts on temporary roads should be designed for easy removal once the road is no longer needed. Other devices, such as portable crossing mats, may be easier to install and remove, and do less damage to the site, than culverts.

Fords may be used for crossing dry or low-flow stream beds where water quality impacts are minimal. Fords should only be used where the stream bed is firm rock or gravel, where traffic will be limited and will not cause degradation of the crossing. In some cases it may be possible to haul rock or gravel and create a shallow water ford. Fords should not be used if significant grading of stream banks would be required.

Culvert Installation

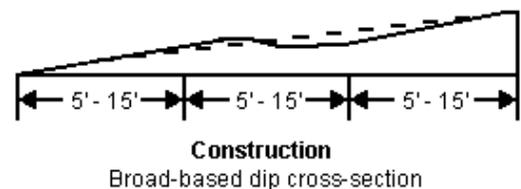


Surfaces

Forest roads may be graded and left unsurfaced. Heavy-duty roads can be surfaced with gravel for all-weather use. Light-duty roads may be graded and seeded to permanent grass cover. Unsurfaced roads and those with a grass surface should only be used when hard and dry or frozen solid. Rutting damages the roadbed and produces large amounts of sediment.

Drainage

Runoff water from roads must be controlled. Road surfaces can be "out-sloped" to disperse drainage or "in-sloped" and ditched. In-sloped roads require structures such as water bars, broad-based dips and culverts to direct and control the water. "Broad based dips" are much easier for heavily loaded trucks to cross than the older "water bar" design. Culverts can handle more water than either design and provide a smooth road surface, but take considerably more work to install. Drainage problems are greatest on steeper slopes, so wherever possible keep road grades to 5 percent or less and do not exceed 10 percent except on very short runs. Road locations requiring grades of more than 10 percent will need extra engineering to properly handle the diversion of water.



Road Grade (%)	Spacing (ft.)
2 - 5	300-500
6 - 10	200-300

Direct drainage water into undisturbed vegetation away from stream channels. Rock rip-rap, or on some temporary roads, logging slash, may be used at locations where drainage water must be diverted onto steep slopes. Culvert and bridge crossings should be slightly higher than the approaches. This prevents drainage water from exiting the roadway at the edge of the bridge or culvert and washing directly into the stream. Spacing between cross-drain culverts or structures depends on the grade of the roadbed. A general rule of thumb for determining the distance between cross drains follows:

11 - 15	100-200
16 - 20	100

Road Maintenance

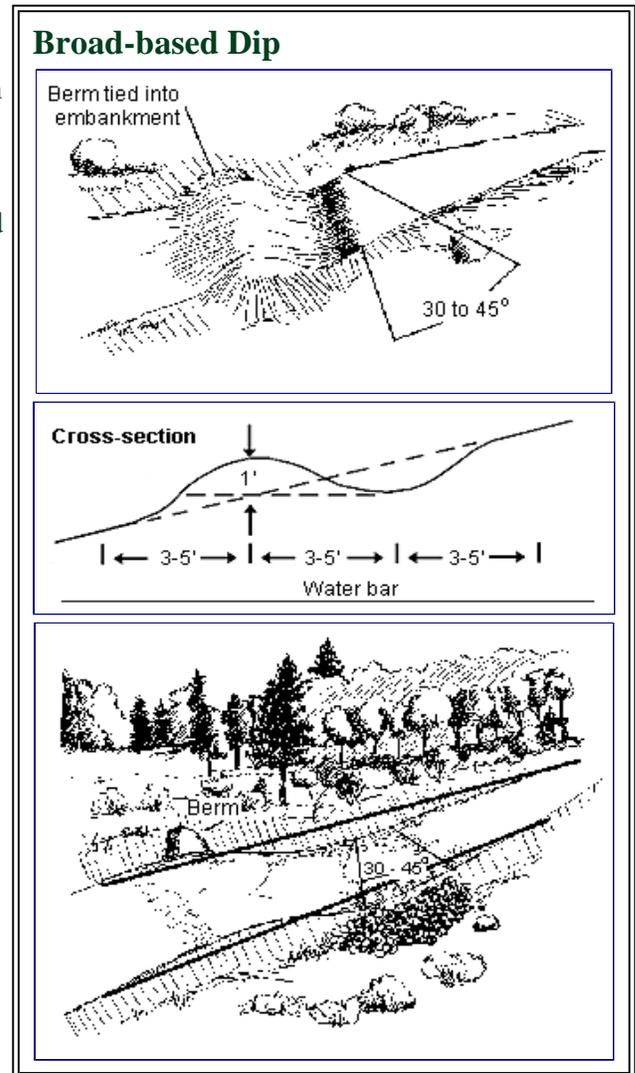
Inspect the road system regularly including inactive and temporary roads. Perform regular maintenance to reduce ruts and holes. Blade active roads periodically to maintain proper crown and drainage. Schedule additional inspections following heavy or prolonged rainfall to look for drainage and siltation problems. Roads should not be used, especially by heavily loaded vehicles, when wet and soft. Resurface roads as needed to maintain the driving surface.

Clear culvert intakes blocked with vegetation or other debris. Culvert outlets should be inspected for erosion around the culvert itself and for down-cutting from the outflow.

Closing Temporary Roads

Close temporary roads as soon as they are no longer needed. A ditch and berm or a gate may be needed at the entrance to prevent damage from unauthorized use. Slopes should be regraded as necessary to stabilize the site and prevent erosion. Water bars and other drainage structures may need to be left in place or established to ensure a stable road grade. Revegetation may occur naturally but, especially on dryer sites, reseeding may be necessary to establish a mixture of plants quickly to protect the site. Even on fertile sites with adequate moisture reseeding may be the best way to quickly establish protective cover.

Many species of grasses and legumes can successfully stabilize closed roadways. Mixtures of several plants are usually preferable to single species plantings. Native species are generally preferred. Natives should normally be used unless a specific condition indicates that an exotic species would be the best choice. Site specific recommendations should be obtained prior to purchasing seed. Landowners can contact their local forester, Cooperative Extension educator, Natural Resources Conservation Service, or Natural Resources District for specific recommendations.



Appropriate timber harvesting methods for Nebraska woodlands range from clear-cutting cottonwood to selective, single tree harvests of black walnut growing in mixed hardwood stands. Many harvest systems can be successful, including group selection or patch cuts, seed tree, and shelterwood methods. The harvesting method should be chosen after considering several factors including economic efficiency, the regeneration requirements of the species, and the characteristics of the site which includes the environmental values to be protected. Steep terrain, for example, must be logged differently than level sites. Harvesting BMPs must be applied with flexibility and with a detailed knowledge of both the species involved and the site. In some cases, harvesting non-traditional forest products such as mushrooms or pine cones or other decorative botanicals may also impact streams or other forest values. While intended primarily for traditional wood product harvesting, some of the guidelines in this publication may be useful for non-traditional product harvests as well.

Timber Sale Contracts

The Nebraska Forest Service encourages all landowners to obtain professional forestry assistance prior to conducting any timber harvest. State service foresters, private consultants, or industry foresters may be able to provide the needed expertise. The forester can help the landowner decide what and when to harvest and can help prepare the harvest plan.

Harvests should be carried out under a written contract between the landowner (seller) and the logger (buyer). The contract should address things such as the exact description of the area to be logged, price, method of payment, time within which the harvest must be completed, performance bond requirements, slash treatment, road construction requirements, road regrading and revegetation after the sale, and other factors related to the harvest. Any timber harvest is a business transaction and a good contract will help ensure that the harvest will be successful for both the logger and the landowner.

Silvicultural Systems

Many different harvesting systems can be successful in Nebraska. The landowner, with the help of a professional forester, will need to decide what type of harvest best suits the site and the species involved.

Most species can be harvested and regenerated using several different harvest methods. Ponderosa pine, for example, can be harvested with several techniques. Clearcutting is possible, as is the use of a seed tree or shelterwood technique that removes the overstory in one or more partial cuts so the area is never without some tree cover. Some species, such as cottonwood, will only reseed in full sunlight, and clear-cutting is the harvest method of choice. Other species, such as black walnut, commonly grow in uneven aged stands, mixed with several other species, and can be successfully harvested and regenerated using a single tree or small group selective harvest. A harvest plan should indicate the silvicultural system to be used, which areas will be harvested, and in what sequence.

Harvests and Streamside Management Zones

Clear-cut harvesting should not normally be conducted within an SMZ. Instead, selectively harvesting individual trees is recommended. *Note:* Harvesting cottonwood along major streams with wider SMZs may require using clear cutting within the SMZ to ensure that the site will reseed to cottonwood. Even where this is required the minimum 50 foot SMZ should be harvested only by single tree selection cutting.

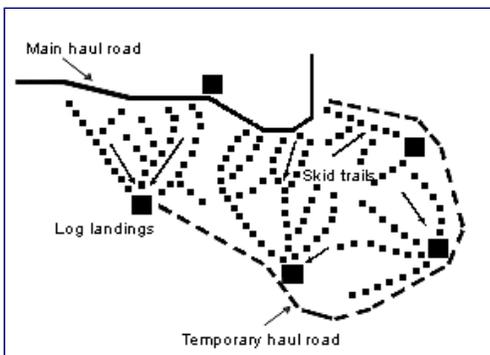
Logs should be cabled, not skidded, out of the SMZ wherever possible to minimize equipment operation within the zone. Trees growing on the stream bank should not be harvested. Tree tops and limbs that fall into the stream channel should be removed.

Wildlife Considerations

Wildlife habitat is impacted by timber harvesting. The disturbance and regrowth following harvests may be beneficial for some wildlife species, but harmful to others. Harvest planning should include consideration for sensitive habitat areas, particularly where threatened or endangered species may be impacted. Species dependant on large older trees may need to be protected by designating and retaining critical habitat areas specifically for them. Harvesting techniques may need to be modified to minimize negative wildlife impacts. Actions can include special management within Streamside Management Zones, retaining snags and den trees, piling slash to create escape cover, and taking special care to retain tree and shrub species to help maintain habitat diversity. When roads, skid trails, and landings are reseeded following harvest, grasses and legumes beneficial to wildlife may be included in the mixture.

Fish in streams or ponds adjacent to the harvest area can be harmed, especially when large amounts of debris or sediment are allowed to enter the water. Stream bank trees, especially those that shade the water, are especially important in protecting fisheries values. As with terrestrial wildlife, fish, and other instream species, will benefit greatly from establishing SMZ's.

Skid Trails, Decks, and Landings



Decks and landings (log concentration and loading areas) should be located as a part of the pre-harvest plan. Skid trails may not need to be individually located in the harvest plan but a general skidding pattern should be established. Basic principles, including prohibiting skidding through stream courses, should be discussed and agreed on before logging begins.

Logs should normally be skidded away from streams to landings located on well-drained, gently sloping soils. Skidding should not be allowed through springs or seeps. For some wetland areas, skidding may need to be limited to the winter when the site is frozen. Skidding must be accomplished carefully to minimize damage to the residual stand. Earth moving with skidder blades should be kept to a minimum. Skid trails should be regraded if necessary, and water barred and reseeded as soon as they are no longer needed.

Landings and log decks are areas where logs are cut to length, limbed, and stacked for loading. Their locations should be agreed upon and made part of the harvest plan. Landings and decks should be no larger than needed for efficient log processing, storage, and loading operations. Treatment of debris following the harvest, and methods for reshaping and revegetating these disturbed areas should be planned prior to beginning the harvest and completed as soon as practical after they are no longer needed.

Slash Treatment

Timber harvests normally produce significant amounts of "slash" including tops, limbs, and defective logs. Slash treatment is an important consideration and should be addressed in the timber harvest plan. Treatment may involve simply "lopping and scattering" the slash evenly over the area. The slash should be cut down to a specified maximum height to help speed decomposition. Following pine harvests, lopped and scattered slash is normally cut until it lies within 18-24 inches of the ground. In some cases following clear cutting, slash is chopped, using dozer pulled roller-choppers, to break it up and put it in close contact with the soil to speed decomposition. Slash can also be burned in place, or piled and burned. If whole tree skidding is used, the cut trees will be skidded—tops and all—to a landing and then processed into logs. In that case nearly all the slash will be concentrated around the landings. Slash piles at landings can, in some cases, be sold as firewood or biomass fuel, burned in place, or simply left for wildlife use and decomposition. Untreated or poorly treated slash left in the woods can be unsightly, may cause elevated fire hazards in the years immediately following the harvest, and can restrict access to the area by livestock or humans.

Slash, while typically viewed as a problem that must be treated, does provide benefits as well. Where it can be treated and left scattered on the site, it will decompose and provide nutrients for future tree growth. Sometimes logging contracts require the logger to protect standing dead trees or to girdle and leave standing a few trees per acre. While those standing trees may appear to be slash, or logging residue, they can provide critical habitat for cavity nesting wildlife. In some cases, especially in hardwood stands, slash can be left to inhibit grazing and browsing damage to new seedlings. Some species of wildlife can also benefit from the protection provided by the tangle of branches and tree tops that result from harvesting.

Reseeding and Replanting

Rapid reforestation of the harvest site is recommended to maintain productivity and protect the site. A harvested area can be naturally reseeded by choosing an appropriate silvicultural system. For example, clear-cuts in cottonwood stands will normally reseed if the areas are large enough to allow full sunlight and if a seed source is close by. In pine, "shelterwood" and "seed tree" harvest methods retain a stand of selected trees to provide a seed source. These seed trees may later be removed after seedlings have been established on the area. For some species harvests may involve removing only a few selected trees per acre. Such selectively harvested sites will always have a stand of timber, composed of trees of many ages.

Manually reseeded or transplanting seedling trees may be desirable. It may be desirable to modify the species composition by planting species that did not previously grow on the site. Species valuable to wildlife may be added or species with greater commercial value may be planted to ensure that they will be present in the stand for the next harvest. Replanting is normally more expensive than natural reseeded but ensures the site is revegetated with the desirable species.

Many species of hardwoods will sprout vigorously from the stump, especially when young. It is possible to reforest these areas by simply removing the products, allowing the stump sprouts to grow, and managing them as the next stand of timber. Stump sprouts are normally quick to grow and the site can be rapidly reforested.



Tree Planting

Reforestation plantings may be carried out following harvesting or other disturbances to reestablish desirable trees on the site. Planting may be supplemented with additional tree and shrub species to increase plant diversity and provide wildlife habitat, to limit soil erosion, to protect stream banks, and for other reasons. Afforestation is the planting of trees on agricultural or other nonforested land to provide desired tree related benefits.

Tree planting is nearly always viewed as a positive activity and will rarely cause negative impacts if a few guidelines are kept in mind. Whether reforesting a site following a harvest or fire or afforesting an area, consider the possible impacts on the native flora and fauna. Use caution with exotic species which may "escape" and become a management problem. Afforestation of remnant tracts of native prairie, or other rare vegetation types, can cause degradation of the tract and may not be desirable.

Planning a Planting Project

Even the simplest of tree plantings will benefit from good planning. Trees are very long-lived and grow to be very large. Correcting design mistakes can be costly and time consuming. It's best to get the right species

planted in the right place, the first time.

When planning a tree planting:

1. Determine the objective(s) for the planting.
2. Evaluate the site to determine its ability to support the planting.
 - What kind of soils are present?
 - What is the topography?
 - What is the potential for erosion?
 - Is the water table so shallow that it will limit root growth?
 - How will the plants and animals already present on the site be impacted by the planting?
3. Choose species for the planting that meet the objective(s) and are compatible with the site.
4. Measure the site and complete the design details, including deciding on the spacing between plants and between rows, and calculating the number of each species needed.
5. Decide what kind of site preparation and follow-up weed control will be needed to ensure a successful planting project.

Keep in mind the "big picture" as you design a layout for the plantings. If rows are being used, inspect the site and determine if they will run up and down hills and, if so, how erosion will be prevented. Evaluate the site for current wildlife use and determine the effects of the planting on those species. Remember that new species may be attracted to the area after the planting is established.

When inspecting the planting site, consider the impacts in all seasons of the year, such as the location of snow drifts in the lee of the planting; could the trees block a desirable view when mature or possibly block cooling breezes needed by livestock in the summer? A detailed knowledge of the site during all seasons is important to planning a successful tree planting.

In Nebraska successful tree plantings are the result of *careful design, good site preparation, and follow-up, including weed control and replanting* if needed. Make sure all three elements are included in the planting plan. If replanting is needed it can take three years, or in the most difficult sites even more, to fully establish the stand of trees. Some designs, especially wildlife habitat plantings and some kinds of "block" plantings, can be intentionally over-planted to allow for normal mortality.

Site Preparation

Planting sites usually require some site preparation before tree planting. Reduce competition from existing vegetation so that newly planted seedlings have the best chance for survival. Heavy sod makes it very difficult to plant properly, either by hand or with a planting machine. Sod also makes it difficult to completely close the planting hole or slot after the tree is planted. On some sites large woody debris must be cleared before mechanical planters can work successfully.

Types of site preparation:

Clearing with a dozer or tractor

Some sites may contain logging slash or the remnants of an old windbreak that must be removed to allow replanting with a planting machine. Clearing with a dozer is very effective, but costly. The debris may be piled and burned in the winter when there is snow cover to prevent any chance of the fire escaping. *Note:* A burning permit must be obtained from the local Fire Chief for any open burning in Nebraska. Often it is best, and least expensive, to pile or windrow the debris and simply let it decompose over time. In some cases, planting spots or rows can be cleared instead of clearing the entire area. In other cases, it may be possible to hand plant right into the debris and completely avoid the cost of clearing.

Chemical site preparation

Existing vegetation in planting rows or spots can cause serious competition for new seedlings and should be controlled. Chemicals, normally contact herbicides, can eliminate or greatly reduce heavy stands of grass or weeds on the planting site. Chemicals must be used in accordance with the label directions. In most situations only rows or planting spots should be treated. Vegetation between rows or surrounding planting spots should normally be left in place to protect the seedlings and help limit erosion.

When planning for chemical site preparation remember that chemicals take some time to work. In many situations it will be necessary to apply the chemicals the fall or summer prior to the planned tree planting. This is especially true if warm season grasses are present on the planting site. Warm season plants cannot be effectively controlled by contact herbicides in the early spring. They do not begin active growth until late spring and early summer – *after* tree planting season has passed. If both warm and cool season grasses are found on the planting site, such as a warm season grass pasture that has been invaded by smooth brome grass, chemicals to control the warm season plants may need to be applied in the summer and chemicals to control the cool season grasses applied later, in the fall.



Tillage for site preparation

Existing vegetation can also be removed by discing, plowing, rototilling, or using some other form of mechanical tillage. Normally only the rows should be tilled to minimize the area subject to erosion. Where rows must run up and down hills, it may be necessary to periodically lift the tillage equipment and leave a gap of undisturbed vegetation to help control potential erosion problems. On slopes of 10 percent or more, tillage of rows is not recommended although individual planting spots may be cultivated. Tillage works best when it's done during the summer or early fall before planting, with a light follow-up tillage just prior to planting. On very dry sites, summer fallowing, by keeping it weed free for the entire growing season prior to planting, will help to conserve moisture and provide the best possible start for the new seedlings.

Other Site Preparation Considerations

Site preparation on sandy soils

Extensive site preparation is not normally recommended on very light or sandy soils since the potential for erosion is so great. Chemical control of the grass may be needed where the site is covered by a dense sod. Mechanical tillage opens the site to immediate erosion and should normally not be done. Tree planters designed for use in sandy soils are equipped with scalper blades which scrape away the surface vegetation as the planter moves along. The scalping action greatly reduces the competition for the new seedlings while minimizing the erosion risks.

Planting into crop residue

When windbreaks or other plantings are established in cropland it is sometimes possible to plant into the stubble from the previous year's crop. Milo, corn, and wheat stubble all make excellent planting locations and should not be disturbed prior to planting. Some cropland may contain significant amounts of carry-over herbicide residue and, in some cases, may need to be tilled and fallowed for a year to reduce the amount of herbicide. If "weed barrier" mulch is to be used it may not be possible to retain the crop stubble in the planting rows where the mulch material will be placed. Even when the rows must be tilled it may be possible to leave the stubble between the rows.

Weed Control

Nearly all tree plantings in Nebraska will require follow-up weed control to ensure their success. Some plantings such as under-planting into an existing stand of trees, or establishing a block of trees and shrubs for wildlife cover, where varying levels of seedling survival could still provide acceptable benefits, might be successful without weed control. Most plantings will benefit from weed control and many will fail without it.

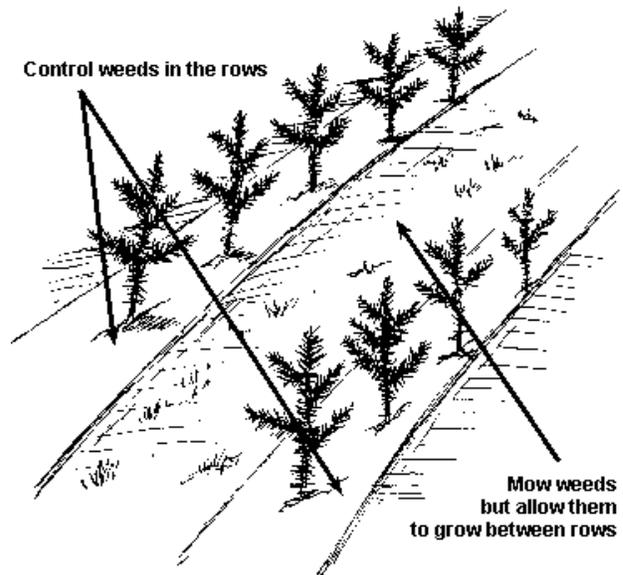
Chemical weed control

After the planting operation is complete (*note*: some chemicals are intended to be applied before planting) weeds in the tree rows or planting spots can be controlled by applying chemicals labeled for that purpose. Pre-emergent herbicides intended to prevent the establishment of weed seedlings near the trees are perhaps the most commonly used. Contact herbicides can also be used to control weed seedlings after they emerge. Chemicals must always be used following label directions. If used carelessly weed control chemicals can harm or kill the seedling trees or other desirable vegetation.

Mechanical weed control

Limit cultivation to the minimum needed to control weeds. Excess cultivation makes the area more susceptible to erosion and may damage the trees and shrubs. A variety of tillage equipment and cultivators can be used to control weed growth around trees. Discs, rototillers, and sweeps or other farm crop cultivators can be adapted to cultivating near tree rows. Specialized equipment designed for cultivation around trees can also be purchased.

Whenever mechanical methods are used to cultivate near trees be careful to prevent damage to the above ground and below ground parts of the trees. Even small nicks are potential entrance points for disease. Since cultivation normally is conducted several times each season, and may be done over several years, even seemingly minor damage can add up to a serious problem. Cultivation equipment should be kept shallow to minimize disturbance and damage to tree root systems.



Mulch

Both artificial and natural mulches can provide effective weed control. Mulches offer the advantage of providing long-term weed control with only one application. Organic mulches may be effective for a season or two and products such as plastic "weed barrier" may last for five years or more. Applying any type of mulch must be done carefully to prevent damage to the seedlings. Organic mulches should be applied no more than 3 to 4 inches in depth. Deep beds of mulch can provide habitat for voles, or other rodents, that may feed on bark and damage or kill trees.

Forest Improvement and Protection

Growing tree crops involves using many techniques to improve and protect the forest. Thinning, pruning, pest

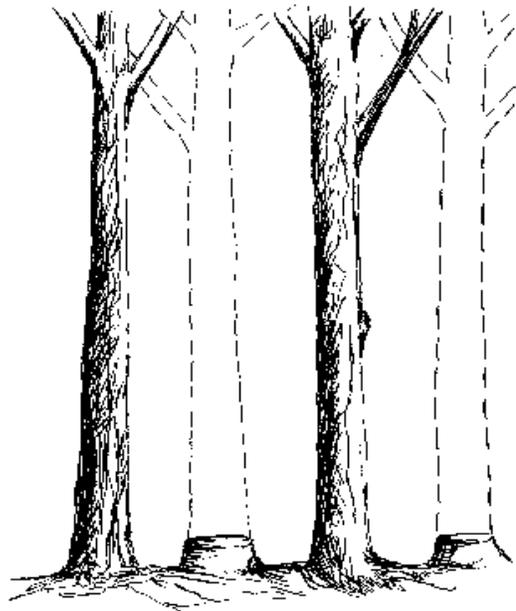
control, prescribed burning, fire control, and weed control are all techniques that can improve and protect the forest. Such land treatments need to be planned and carried out carefully to reduce or eliminate negative impacts. Potential impacts on soils, wildlife, air and water quality, and aesthetic values need to be considered when planning woodland operations.

With good planning, many positive impacts, in addition to basic silvicultural goals, can result. Some wildlife species benefit significantly from small openings and brush piles that result from thinning operations. Roads, established to allow equipment to enter an area for a thinning operation, can also provide access to control wildfire or permit recreational activities.

Tree Cutting for Woodland Improvement

Intermediate cuts are made before the actual harvest cut to improve the growth and quality of the timber stand. The cuts include:

1. *Thinning* reduces competition by removing some trees in the stand. Thinning operations closely resemble natural mortality, especially if the thinned plants are simply left to decompose on the site. Thinning, like all woods work, should establish SMZs to protect stream banks and waterways.
2. *Weeding* means removing less desirable trees that are competing with the desired stand. Removing trees is expensive and only trees competing directly with desirable ones should be removed. It is important to consider species diversity wherever trees are removed.
3. *Sanitation* cuts are used to remove trees infested with insects or diseases that could be spread to healthy trees. Normal, endemic levels of insect and disease occurrence are not reasons to attempt sanitation cuts. Only specific conditions such as the professional diagnosis of oak wilt should be used as an indication that sanitation cutting may be helpful.



Pruning, or removing selected branches to improve the quality of potential crop trees, is relatively expensive and is used only on high value species such as a black walnut. Little or no negative impacts should result from pruning operations.

Special considerations during woodland improvement

1. Give special consideration to protecting and enhancing wildlife values:
 - Create or protect water supplies for wildlife
 - Pile brush from thinning or pruning for habitat
 - Create and protect "snags" or den trees
 - Include under-planting in the overall management of an area to improve species diversity.
2. Keep access roads for forest improvement and protection to a minimum and carefully construct and maintain them.
3. Consider water quality impacts when planning any woodland activity and establish SMZs for woodland improvement and protection activities.
4. Grazing livestock is generally detrimental to hardwood stands. Low to moderate levels of grazing may be incorporated into the management of pine stands in most cases.

Pesticides

Pesticides can be used safely and economically to control a variety of damaging pests in woodlands. Proper use requires that the pest causing the damage be correctly identified and that label directions are carefully followed. Pesticides, if used carelessly, can cause very serious problems, both on and off site. Damage to surface and groundwater and damage to wildlife values can occur. If the wrong chemicals are used, or if the correct chemicals are used improperly, significant damage to non-target plants and animals can result.

When a problem is observed and a pest is known to be the cause, the next step should be to determine if the pest is present at the right time, and in sufficient numbers, to cause damage worth controlling. Spraying chemicals to control small insect populations that will not cause significant damage, is both costly and unnecessarily damaging to the environment. The mere fact that insects are present in a woodland does not mean they are causing significant damage. Many insects are beneficial and may actually help to control other damaging species.

When it's determined that pesticides are needed, determine the safest, most effective method. Managing woodlands to maintain healthy vigorously growing trees will significantly reduce the damage caused by insects and diseases. Chemicals and biological controls change frequently, and only the most current information should be used. Chemical suppliers will have current labels on hand.

General Guidelines for Pesticide Use

1. Follow label directions governing storage, handling, application, and disposal of all pesticides. When contract applicators are employed the landowner should discuss label compliance with the contractor. Only certified commercial pesticide applicators should be employed.
2. Special precautions will be required around sensitive areas including surface waters and drainages, critical wildlife habitat, and areas used for recreation or other human activity. Label directions may indicate that some chemicals are not suitable for use within SMZs or in areas designated as wetlands.
3. Biological controls, including silvicultural treatments intended to reduce the severity of pest infestations, and an overall integrated pest management approach that includes chemicals but does not rely on them exclusively, should be followed.

Fertilization

Fertilizers are not normally used or recommended in forest management in Nebraska. If sources of inexpensive fertilizers are available, such as livestock waste, they may be applied to woodland areas where lack of nutrients are known to limit growth and production. Heavy rates of fertilizer may cause contamination of groundwater and are unlikely to benefit forest trees. Nitrogen rates should normally be kept to 100 pounds of available nitrogen per acre or less in one year. Phosphorus, potassium, and trace elements should be added only in small quantities as indicated by soil tests. Generally it isn't economical to fertilize forest trees. Providing high levels of nutrients may only improve the growth of weeds and increase the risk of contaminating groundwater or nearby surface water.

Forest protection

Grazing

Fencing to exclude livestock can be beneficial. The trees as well as stream banks, springs, and other sensitive areas can be protected. Grazing in hardwoods is nearly always damaging even when low numbers of livestock are present. In addition to eating seedling trees and shrubs, livestock compact the soil which can reduce tree growth, increase runoff rates, and contribute to silt loading in streams and ponds. Grazing impacts are greatest during the active growing season. If hardwood areas cannot be protected from grazing, deferring the use until winter will help to reduce the impacts. The relatively

open stands of ponderosa pine can, on most soil types, withstand the low levels of grazing that are typical of the area. Both wood, and other woodland products, can be produced in combination with livestock in those areas.

Wildfire

Fire is a natural force and it can be used by the forest owner to help control fuel load build ups and even to thin overly dense stands. However, uncontrolled wildfires can destroy valuable trees and cause a significant loss of other woodland values. The first step in protecting woodlands from wildfire is to be careful with the intentional use of fire in and near the woodlands themselves. Campfires, trash burning, and equipment operation all start many preventable wildfires. Good access roads to allow fire fighters to reach fires at an early stage can help reduce losses to fire. In some situations fire breaks can be located and maintained to protect woodlands against known hazards such as railroads or other potential sources of wildfires. A forest management plan is a good place to list the actions that will be taken to prevent, and if necessary to suppress wildfires.

Insects and diseases

Under most conditions, trees are well adapted to the endemic insects and diseases found in their native range. Trees that are under stress from natural factors such as drought, or from human caused factors such as damage suffered during careless logging, tend to be more susceptible to certain insects and diseases. Take care to avoid unnecessary damage to trees during any woodland activity. Soil compaction caused by equipment operation or grazing and herbicide damage cause additional stress. Frequent inspection of the woodlands is the best way to become aware of the condition of the trees. Normal, low-level, endemic insect populations or disease occurrence do not require treatment and, while individual trees may be damaged or killed by these factors, the woodland in total will not be harmed. Exotic pests or very high levels of native organisms may require treatment. Any use of chemicals in the woodland environment must be done with care. Not only are the costs often high but the possibility of harming nontarget species can be a serious problem. Also, whenever chemicals are used, beneficial insects, including parasites that may actually be helping to reduce the populations of damaging insects, can also be killed.

- Nebraska Forest Service Districts
- Nebraska Forest Service Internet Site

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