

# CHAPTER 6

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## *Planting and Pruning of Woody Plants Protecting Existing Trees from Construction*

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## CHAPTER 6

# *Planting and Pruning of Woody Plants Protection Existing Trees from Construction*

## *Introduction*

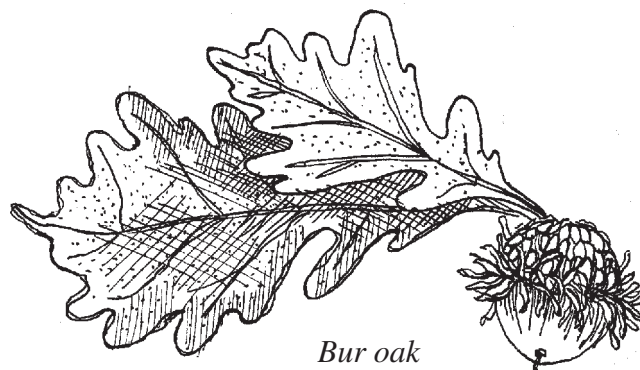
This section of the guide addresses general practices for planting and pruning of woody vegetation.

**Planting of woody vegetation** is primarily done for the following reasons:

- To serve as a windbreak
- To act as privacy plantings upon request from adjoining landowners
- To landscape newly constructed trail and water access sites and rest areas

**Pruning of woody vegetation** focuses primarily on the following objectives:

- Keeping trees and shrubs from encroaching into the path of travel
- Pruning selectively for aesthetic reasons to enhance scenic diversity
- Providing a safe user experience by removing hazard trees (Hazard tree removal is addressed in Operational Order #97.)



## *Guiding Principle*

To plant and prune and protect woody vegetation along state trails and on water access sites as needed to provide a safe, enjoyable and aesthetically pleasing recreational experience.

**This guiding principle can be achieved by:**

- Planting woody plants that are landscape appropriate and native** to Minnesota.
- Choosing species whose mature form and size will be suitable** for the available space, to avoid extensive pruning later.
- Treating plant material with care** before and after planting to assure the greatest rate of survival and future enjoyment for recreational users.
- Pruning trees and shrubs to provide safe user experiences.**
- Pruning trees and shrubs to enhance their health and beauty.**
- Protect existing native trees from construction impact.** whenever possible.
- Providing necessary training** for field personnel involved in planting and pruning.
- Providing appropriate tools,** so that needed care can be done efficiently and without damage to vegetation.

# Conducting a Comprehensive Site Analysis

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A site analysis must precede the planting of any given site and should include the following steps:

**Analyze soil types and characteristics.**

- Refer to *Soil Surveys by County: NRCS in Cooperation with Minnesota Agricultural Experiment Station*, from the U.S. Department of Agriculture.
- Conduct a soil sampling onsite.
- Determine soil compaction or disturbance.
- Determine content of organic matter and nutrient levels.
- Determine pH factor.

**Determine soil moisture** gauged on a gradient from dry to mesic to wet.

- Determine drainage patterns. For example, sandy soils and hilltops are dry; depressions and clay soils hold water and therefore are more moist.

**Consider topographic features**, such as slope and aspect.

- Determine whether the site is hilly or level; identify degree of exposure to the sun (south, north, east or west).

**Consider the microclimatic conditions** of the site, within the regional context.

**Select the appropriate plant species** according to site conditions and the specific landscape unit.

- Consult *Vascular Plants of Minnesota*, by G.B. Ownbey and T. Morley (1991).
- Consult the County Biological Survey database.
- Consult *Restore Your Shore* CD Rom (includes an encyclopedia of 400 native plants).

## IMPORTANT!

Be sure to locate all buried utility lines before preparing a site by calling:

**GOPHER STATE  
ONE CALL  
800-252-1166 or  
651-454-0002**

# Planting

## Site Preparation and Weed Control

A thorough site preparation will assure healthy growing conditions for trees and shrubs, allowing plants to compete for nutrients in the soil. Complete site preparation consists of eliminating weed competition over the entire planting site.

If undesirable vegetation is present, the site should be tilled 8-10 inches deep and disked in the fall before planting the following spring. A non-selective herbicide should also be applied prior to tilling if rhizomatous plants, like quackgrass and reed canary, exist on the site.

In areas where site disturbance has to be restricted, such as erodible slopes, strip site preparation is the preferred method:

- Mow identified 4-foot to 6-foot planting strips in the fall; treat emerging undesirable vegetation with a non-selective herbicide, such as glyphosate; then till the strip.

- Plant seedlings the following spring in the center of the tilled strips. Vegetation left between planted rows serves three purposes:

- It acts as a screen to prevent the soil from drying out during hot summer winds.

- It helps to lower soil temperatures.

- It increases the relative humidity level near the seedlings.

## Planting Methods

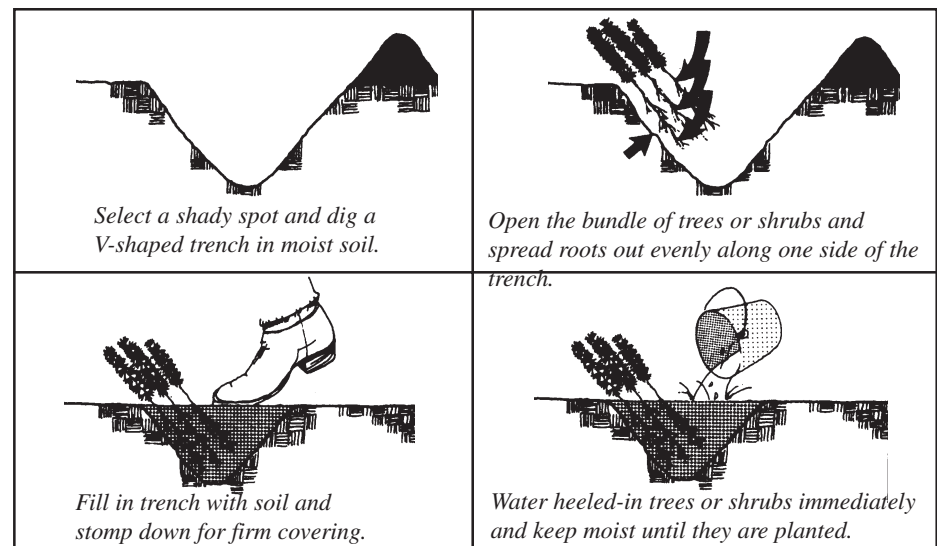
### General Guidelines

When planting bare-root plants, it is very important not to let roots be exposed to air and sun. Roots should always be covered with soil (heeled in) or tarps, or they should be submersed in water (tubs or pails) until they are planted. (See Figure 1, page 5.)

**Planting methods** depend on the size of the root mass of the bare-root plant:

- Bar-slit planting works well for small bare-root plants with little to moderate root mass.

- Hole-planting applies for all other bare-root plants, including containerized plants, as well as balled and burlapped plants.



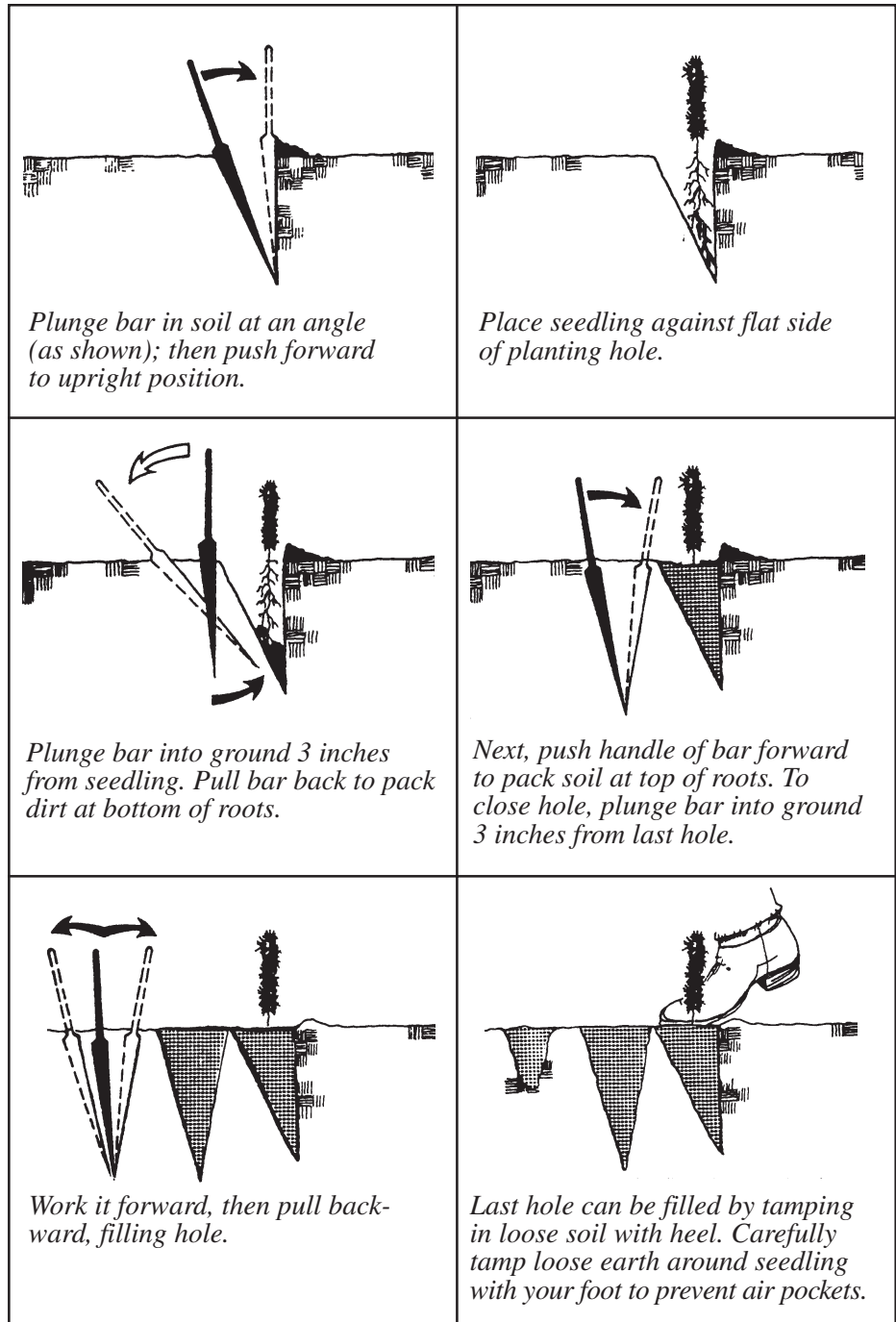
**Figure 1: Heeling in to protect roots**

- ❑ **Planting in the spring** gives the best results, because plants will have the entire season to take root. Planting may be started as soon as the ground is free of frost and can continue as long as the bare-root plants have not started new growth.
- ❑ **Plant bare-root plants within 24 hours of receiving** except plants that need to be sweated. If this is not possible, place packaged plants under refrigeration. The ideal temperature is 40-50 degrees Fahrenheit. If you must postpone your planting operations for a week or more, it's best to heel in the bare-root plants, which means spreading plant roots out in a trench, so that soil can filter down through and be in contact with all roots. Be sure to keep bare-root plants well-covered with soil and water thoroughly.
- ❑ **Sweating nursery stock.** Buds on birch, hackberry, oaks, hawthorn and ironwood become very dormant during winter storage (in the nursery plants are dug in the fall and put in cold-storage). They need high humidity and warm temperatures to break bud. This is best accomplished by placing the plants in a building or in the shade outside for a few days, and covering them with wet straw and a sheet of plastic. Buds will swell in a few days at temperatures between between 45 and 75 degrees. Plants should then be planted around the mid to end of May when temperatures remain above freezing.
- ❑ **Protect bare-root plants** at the planting site. Exposing roots to sunlight and drying winds for 3 to 5 minutes can cause plant mortality.
- ❑ **Planting depth is one important aspect** for the future health of a tree or shrub. A properly planted or established tree or shrub will have its root collar flare at or slightly below (less than 1 inch) the soil or mulch level. This transition area between the stemwood and first main order roots has to be visible or be only slightly covered with mulch.

Tree roots need oxygen and water in order to survive and grow. When main order roots are buried too deep, they will move upward toward the soil surface and, in the process, often girdle the buried stem. As roots and stem (trunk) grow, they compress each other, creating weak points, and the exchange of water and nutrients will be compromised.

## Bar-Slit Planting

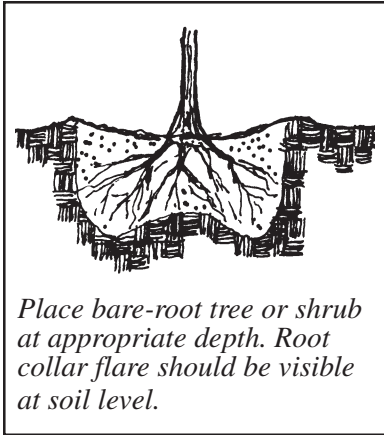
- ❑ Using a planting bar or spade, make a slit in the soil, deep and wide enough to accommodate the roots loosely. (See Figure 2.)
- ❑ Insert the bar behind the plant, and push the bar back and forth to push soil around the plant.
- ❑ Use your heel to close the second hole, firming soil around the plant.



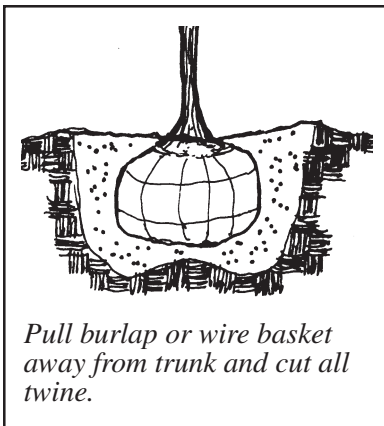
**Figure 2: Using a planting bar**



## Hole-Planting Bare-Root Plants



**Figure 3: Planting bare-root trees and shrubs**



**Figure 4: Planting balled and bur-lapped trees and shrubs**

- Dig the hole slightly deeper than the size of the root system, to allow backfill with enough soil to hold the plant slightly higher than the depth it was grown in the nursery. The planting hole should be wider than the size of the root system. Make sure that the root collar flare is visible at soil level or slightly below. (See Figure 3.)
- In poorly drained soils, plants should be placed higher, with soil mounded to cover the top roots, which will improve oxygen availability to the roots. Another method in poorly drained soils is to modify the planting hole, creating a pedestal for the plant to rest on, allowing water to collect below the root mass.
- Examine the roots before planting, cutting away diseased, damaged or girdling roots.
- Straighten roots and spread evenly; then cover with soil and tamp it.
- Always use original soil from the site for backfill. In general, soil amendments need not be used; instead, choose the appropriate plant species for the site.
- Eliminate air pockets as much as possible by gently raising and lowering the plant while adding soil and tamping it.
- Finish filling the hole with soil, creating a depression around the plant as you tamp down. Then water thoroughly. Water will also help fill air pockets with soil.

## Hole-Planting Balled and Burlapped or Containerized Trees and Shrubs

- Make sure that the root collar flare is visible on containerized and balled and burlapped trees and shrubs, and plant them with the root collar flare visible at soil level or slightly below. (See Figure 4.)
- In poorly drained soils, plants should be placed higher, with soil mounded to cover the top roots, which will improve oxygen availability to the roots. Another method in poorly drained soils is to modify the planting hole, creating a pedestal for the plant to rest on, allowing water to collect below the root mass.
- Remove all twine, and pull burlap or wire basket away from the trunk. No burlap should show above soil surface, as it could act as a wick and draw moisture away from the root ball.
- Container-grown plants may be rootbound. If so, separate or sever roots to avoid strangling.
- Always use original soil from the site for backfill. Soil amendments need not be used; instead, choose the appropriate plant species for the site.
- Create a depression around the plant as you tamp down.

It is best to plant evergreens only where they naturally occur, primarily in the northeastern part of the state. Most evergreens planted in the non-forested landscape will suffer winter browning caused by exposure to wind and sun.



*White spruce*

All plants, including shrubs and trees, will benefit greatly from a 3- to 6-inch layer of organic mulch.

## For Evergreens Only: When and Where To Plant

Fall planting of evergreens should not be later than October, as roots will not become established.

It is best to plant evergreens only where they naturally occur, primarily in the northeastern and northcentral part of the state. Most evergreens planted in the non-forested landscape will suffer winter browning caused by exposure to wind and sun.

## Mulching

All plants, including shrubs and trees, will benefit greatly from a 3- to 6-inch layer of organic mulch: 3 inches when using fine-textured mulch, 6 inches when using coarse-textured mulch.

Mulch is beneficial because it:

- Holds soil moisture, allowing better infiltration of water.
- Moderates soil temperature. (Roots like cool, moist soil.)
- Suppresses weed growth. Grasses especially compete more strongly for water and nutrients than broadleaf weeds.
- Provides added protection from mowers and weed whips.

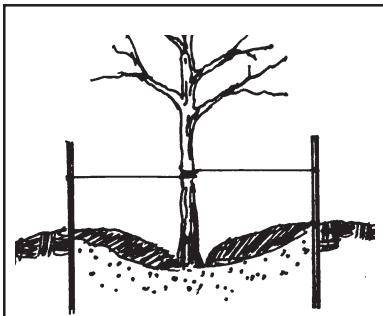
On level ground, organic mulch works best. On slopes, landscape fabric may be the better choice. On small sites, cardboard or several layers of newspaper weighted down will suppress weed growth for 2 to 3 years, giving small seedlings an advantage.

## Using Landscape Fabric

Landscape fabric is available in rolls 2 to 8 feet wide or in mats 3 feet by 3 feet. Fabric should be breathable and photo-degradable, and it should provide at least 3 years of weed control.

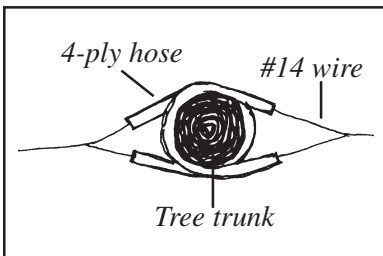
### Method:

- Stake the fabric down with metal or plastic stakes, so that it will not wash downslope in heavy rains.
- Be sure to remove weeds before installing fabric.
- Make a compound slit (X-shaped) in the fabric for the trunk, and sufficiently secure the mat or roll.



Stake larger trees with two metal stakes, 4-ply hoses and #14 wire for guying. Spread 4-6 inches of mulch; keep mulch away from trunk.

**Figure 5: Staking and mulching trees**



**Figure 6: Guying detail**

**Keeping trees well watered for at least 2 years is the single most effective treatment for helping them recover from planting shock.**

## Mulching Around Trees

- Spread mulch out to a minimum 18-inch radius from the base of the tree.
- Keep mulch away from the trunk, to aid plants in winter hardening and reduce damage by rodents. Keeping mulch away from the trunk is also important because a constant wet environment around bark promotes disease. (See Figures 5 and 6.)
- Replenish mulch regularly to maintain a 4-inch depth, which will keep competing weeds to a minimum.

## Watering

Routine watering is necessary during the first growing season. Weather and soil makeup determine the need for watering.

A thorough watering just before the soil freezes is especially important, so that newly planted trees and shrubs can withstand dry winter winds.

Avoid short and frequent watering, because it promotes development of a shallow root system and makes plants much more vulnerable to environmental stress situations.

Water supplied to the drip line of a tree will be the most beneficial, because the majority of water intake occurs there.

## Protection of New Plantings

**Preventing animal damage:** Animal damage can be severe in new plantings, depending on the availability of other food and the severity of the winter. The following methods exist for protecting new plantings from animal damage:

- Tree shelters:** To protect seedlings from being girdled by mice at ground/snow level and being browsed by rabbits and deer, place a tree shelter (cylindrical plastic tubing) around the trunk. (See Figure 7, page 10.) Tree shelter design has been perfected over the years to give optimum protection to newly planted tree and shrub seedlings.



**Figure 7: Tree shelters**

**A newly planted site needs to be inspected on a regular basis.**

Besides giving protection against animal damage, these shelters capture moisture by protecting from drying winds. Shelters create a greenhouse effect, which enhances faster growth.

Trees in shelters may be more susceptible, however, to frost damage, because the slightly warmer temperature inside the shelters delays the hardening-off period before winter.

Set the cylinder firmly into the ground, without damaging the roots, so rodents cannot girdle the trunk at ground level. The cylinder should be at least 4-5 feet high to also protect seedlings from deer and rabbit browsing.

- Budcapping:** Budcapping of tree seedlings is one method to protect the terminal bud from wildlife. This procedure is done each fall after leaf drop for the first couple of years, until the seedlings have grown above the animals' reach.
- Wildlife deterrent:** Tree Guard™ with Bitrex™ or Plantskyd™ are browse deterrents that are sprayed on leaves, needles and stems. Both products form a protective layer that resists dew, snow and rain for 4-6 months. If applied in the fall, it will protect plants through winter, when browsing damage is most severe.

**Temporary fencing:** Young plantings can be destroyed in one winter season. Small seedlings are difficult to see, especially by fast-traveling motorized recreation vehicles. Temporary highly visible fencing may be a solution during the winter months.

## ***Monitoring***

A newly planted site needs to be inspected on a regular basis:

- Check rate of plant survival and replace dead plants.
- Water thoroughly and regularly, especially during drought conditions.
- Add organic mulch to keep weeds suppressed.
- Re-apply browse deterrent in the fall.

# Pruning

## Pruning Tools

- Pruning shears (Felco)
- Pole pruners
- Lopping shears
- Hedge shears (mechanical or motorized)
- Pruning saws, “pull-stroke” with tempered metal blade
- Chainsaw (to be operated only by qualified individuals, with required safety precautions)

All tools must be maintained in good working condition. They should be sharpened and regularly sanitized to prevent the spread of disease.

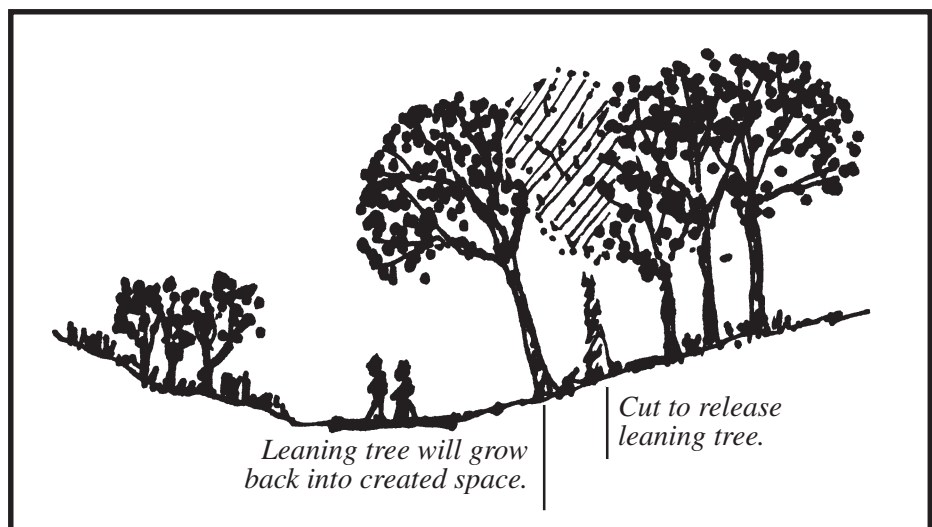
Proper pruning of trees and shrubs is as important as keeping a site mowed or litter free. It is an aesthetic treatment, as well as an essential necessity to the health of woody vegetation. Incorrect pruning work reflects poorly on resource management and presents an unprofessional image to the public.

**Every tree or shrub is a living organism and has a unique natural shape. It is essential to first understand its growth habit before attempting to prune.**

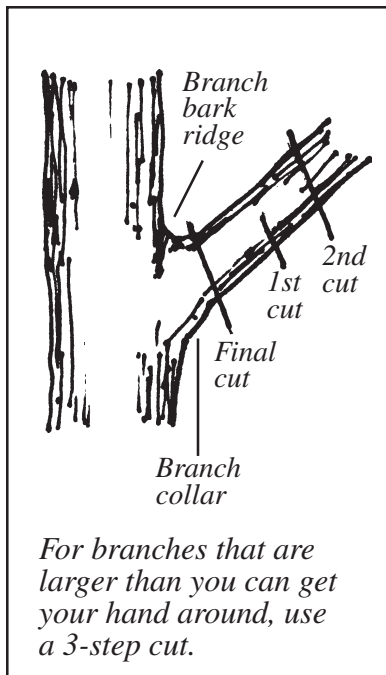
## *The Purpose for Pruning Deciduous Trees and Shrubs*

Pruning work consists primarily of:

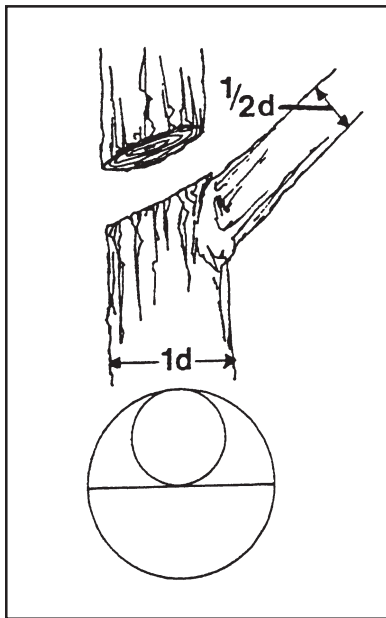
- Pruning to provide proper clearance
- Creating space around leaning trees to prevent further leaning. Providing sunlight from above will eliminate the need for these trees to continue to lean into the trail to reach sunlight. (See Figure 8.)
- Removing hazardous trees
- Thinning and corrective pruning of individual trees and shrubs as needed
- Pruning of damaged trees and shrubs during and after construction
- Controlling shrub willows, and balsam poplar in particular, within 6 feet of the trail treadway. Suckers growing through asphalt create a hazard to trail users (rollerbladers in particular).



*Figure 8: Creating a space to prevent further leaning*



**Figure 9: Cutting of larger branches**



**Figure 11: Selective heading**

## How To Prune Deciduous Trees and Shrubs

**A tree or shrub should never be topped; instead, it should be thinned.** Thinning retains and promotes the natural shape of a woody plant, while radical heading or topping destroys it. Topping will stimulate a lot of thick regrowth at the tips of branches and is not an appropriate way to control size. To remove a tree, cut as close to the ground as possible.

**Methodic thinning** includes the following steps:

- Remove dead wood and stubs first.
- Then remove deformed, old or crossing branches.
- If small branches need to be cut back, cut near a bud, to avoid creating dead stubs. Larger branches should be removed as shown in Figure 9.
- Branches with U-shaped angles of attachment should be retained. These are strong, healthy attachments. (See Figure 10).

**Codominant branches** with a narrow V-shaped angle are prone to split. On young trees, removing lateral branches of one of the codominants will weaken it enough to allow the other branch to dominate. (See Figure 10.)

**Selective heading** reduces height while maintaining the natural shape of a tree. This method involves heading a branch or leader back to another smaller branch below (but no smaller than 1/2 of the diameter of the wood that is cut). This reduces height while maintaining the natural shape of a tree. (See Figure 11.)



**Figure 10: Types of branch unions**  
U-shaped strong union (left) and V-shaped weak union (right)

## *When To Prune Deciduous Trees and Shrubs*

When to prune depends to a large extent on what results are expected. It also depends on the susceptibility of plants to disease at certain times during the growing season.

Light pruning and the removal of dead wood can be done anytime, except for species requiring special attention as listed below.

Pruning should not be done in wet weather, which promotes fungal and bacterial growth. Cankers and rots are easily introduced at this time.

### **Summer: Pruning for Clearance Only**

Pruning in June and July, after seasonal growth is complete, is most advantageous in this situation. Reducing the total leaf surface reduces the amount of food manufactured and sent down to the roots to be stored for next year's growth. Although this time is stressful for trees in particular, it helps to retard growth and therefore reduces the need for frequent pruning, because plants will not grow back as fast as they would after a winter or spring pruning.

Pruning in summer with leaves still on the plants also helps to identify species. Exotic species should be eliminated first before cutting any native species.

### **Late Fall and Winter**

Pruning during dormancy is the most common practice, especially for trees. It results in vigorous growth in the spring. Start winter pruning in November and finish by April 1. Some species of trees, such as maple, walnut, butternut, birch and ironwood, may "bleed," because sap begins to flow early and profusely in these trees. This is not harmful to the tree and will cease when the tree leafs out.

Corrective pruning during the dormant season is most advantageous for most trees and shrubs, because:

- Dead, cracked or broken branches, weak forks and other structural defects are easy to see when trees are without leaves.
- Woody plants can adapt to the loss of branches by adjusting size or number of leaves the following spring.
- Callus tissue develops much faster around cuts during the spring growth spurt.
- Infectious diseases don't spread as easily in winter, because pathogens are dormant.
- The use of heavier equipment is less damaging to frozen soil.
- Leafless branches, when chipped, make a high-quality mulch.

**Pruning during dormancy is the most common practice, especially for trees. It results in vigorous growth in the spring.**

## Fall and Early Spring

Avoid pruning live wood from trees when leaves are falling or forming. During those times, the tree is either storing starch and growing new roots or growing spring wood and new leaves. Less energy is available to respond to pruning wounds than during other times of the year.

## Early Summer

Early summer is the best time to radically reduce hedges. New growth will come back fastest and produce a healthy-looking hedge. Any other pruning at that time may not be effective and useful.

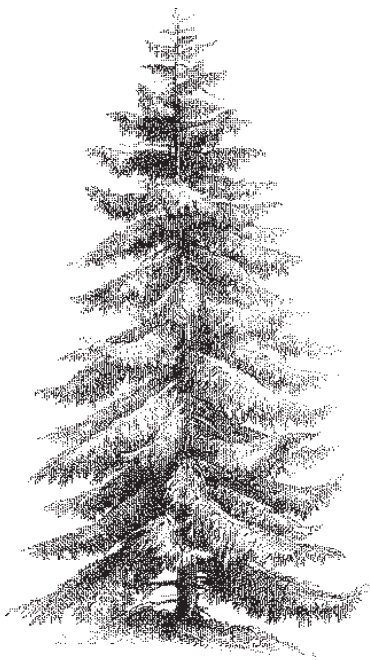
## Special Precautions

☐ Elms and Oaks are two species that should only be pruned at certain times of the year namely from September 1 to April 1. Both trees are susceptible to fatal diseases which have killed many trees in Minnesota. Dutch-elm-disease and Oak wilt are caused by two different fungi which move from affected trees via grafted root systems or via insects during the growing season.

☐ The Dutch-elm-disease carrier of the fungus is primarily the European elm bark beetle which feeds on young twig crotches of living elms. Beetles also burrow into the bark of dying or dead elmwood to lay their eggs creating a vicious cycle. Overwintering larvae emerge as adults about the time elms break dormancy in the spring. Spring and early summer feeding by beetles spreads the fungus into springwood vessels of the tree.

Proper disposal of diseased elmwood consists of either stripping the bark off immediately after cutting and using it for firewood, or chipping for mulch.

☐ The oak wilt disease carriers are various sap beetles which feed on the spore mats of the fungus between bark and wood of oak wilt-killed trees. These mats are produced between April and late June on red oaks that wilted during the previous summer. That time of the year red oaks produce large springwood vessels and are very susceptible to infection. The same beetles are attracted to fresh wounds on healthy oaks in the spring.



**Because the natural form of an evergreen is usually the most desirable, limit pruning to correcting growth defects only.**

## *Pruning Evergreens*

**Because the natural form of an evergreen is usually the most desirable, limit pruning to correcting growth defects only.** As with deciduous trees, pruning should not be done in wet weather, which promotes fungal and bacterial growth. Cankers and rots are easily introduced at this time.



## When To Prune

**Red cedar, white cedar, yew and hemlock:** These evergreens grow continuously through the growing season and may be pruned at any time, but early in the growing season is usually best.

**Spruce and fir:** The time for pruning is not critical, although they do not grow continuously. Best time for pruning is late winter, before growth starts.

**Pines:** Pines put on a single flush of growth per year and then stop. They must be pruned at the candle stage of growth, before the new candles become woody. Pruning at other times will cause dead stubs.

Up to two-thirds of the new growth can be removed. Pruning should not go into last year's growth. Along trails, there may be a need to take off whole lower limbs at the trunk for clearance, rather than candle-stage pruning. Generally, there is no need to do candle-stage pruning. Candle-stage pruning is done in the horticulture business to make pines look like "Christmas trees" (spruce or fir trees).



*Fly honeysuckle*

## Protecting Existing Trees from Construction Impact

### **Mark construction zone boundaries**

With construction plans at hand mark all structures determined for the site. Determine cut and fill areas and where heavy equipment will be used.

### **Inventory the site and determine which trees should be saved**

Record location, size and health of each tree to be saved. Mark trees that need to be pruned to make room for building and construction equipment.

Select the healthiest trees. Young trees survive disturbance better than mature trees. Improve tree survival by saving groups of trees rather than individual trees. Smaller trees may be saved by transplanting.

### **Protect the trees that are to be saved.**

Install orange fencing around the Protected Root Zone (PRZ) and post "off limit". Have builders and contractors sign a landscape protection contract.

Soil compaction is the largest killer of trees, grade changes within the PRZ are detrimental as well, especially if the fill is more than 24". Cutting soil away destroys feeder roots and nutrient-rich topsoil. Excavation or trenching should take place outside the PRZ. Tunneling under the tree may be the choice if the trench has to be close to the tree. Healthy trees are an asset and enhance the health and aesthetic quality of a site.

## *For Further Information*

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*Forest Pest Diagnosis Sheets.* Minnesota Department of Natural Resources, Division of Forestry, St. Paul, Minnesota.

*How to Detect, Assess and Correct Hazard Trees in Recreational Areas.* Minnesota Department of Natural Resources, St. Paul, Minnesota, 1993.

*How To Prune Trees.* NA-FR-01-95, USDA Forest Service.

*Minnesota Shade Tree Advocate* (quarterly newsletter). Minnesota Shade Tree Advisory Committee, Jan Hoppe, 1151 Green Hall, 1530 Cleveland Avenue North, University of Minnesota, St. Paul, Minnesota 55108.

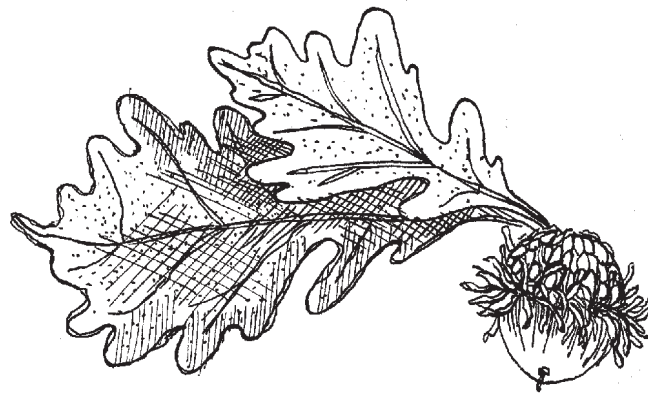
*Preventing Stem Girdling Roots.* A video presented by the Minnesota Society of Arboriculture.

*Protecting Trees from Construction Damage,* by Nancy L. Miller, David M. Rathke and Gary R. Johnson. University of Minnesota Extension Service, St. Paul, Minnesota, NR-FO-6135-S, 1993.

*Pruning Trees and Shrubs,* by Mervin C. Eisel. University of Minnesota, AG-FO-0628, Revised 1989.

*Tree City USA Bulletin,* Bulletin #1, James R. Fazio (editor).

*Tree Owner's Manual,* AG-MI-3898, University of Minnesota, St. Paul, Minnesota.



*Bur oak*