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University TRE Nursery Program

# Planting and Transplanting Trees and Shrubs

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## The Plant

Trees and shrubs are major elements in residential and commercial landscapes and will have a long-term impact on the overall beauty and effectiveness of a neighborhood, community or metropolitan landscape. Many factors must be considered when selecting a tree or shrub. Will the plant tolerate the local hardiness zone and the conditions of the site where it will be planted? How big will the plant get, and what shape will it take? How long will it take to reach maturity? Does the plant have the characteristics to provide the benefits intended and can it be integrated into a specific landscape plan? Plants are a lifetime investment of usefulness and beauty; plan for and understand the requirements of plants to obtain their total contribution to the landscape.

### Size

Select plants that will complement their surroundings when full grown. For example, smaller trees should be used if overhead wires cannot be avoided. Small trees will also keep a small yard from becoming overcrowded and a single-story house from being dwarfed. Conversely, a large yard and a two-or-more story house can be complemented by taller, larger trees. One must learn the approximate mature sizes of plants to insure their proper use. Variation in size and shape will exist within species or within varieties due to site and growing conditions.

### Growth

Trees are often planted that grow fast and provide shade in a few years. Trees that grow very fast may be short-lived, have weak branching habits, and shallow or suckering roots that can disrupt turf or pavement. It is important to note that the growth rate of trees and shrubs can vary considerably depending on a variety of environmental factors. The correct amount of light, water, nutrients, etc., can encourage slow growing plants to grow faster. Proper care can make the difference between slow, medium, and fast growth.

### Salt Tolerance

All plants are affected by the de-icing salts used on streets and roads each winter. Some plants, however, can tolerate salt better than others. Salt is leached from snow pushed up along streets, sidewalks, and driveways. It collects in the soil, eventually becoming detrimental to nearby plants. Salt spray from high speed traffic can quickly damage foliage or buds. On heavily salted streets (such as snow emergency routes) plant salt tolerant species. Trees that are more tolerant of salt are: green ash, white ash, ginkgo, honeylocust, Norway maple, Russian olive, Russian mulberry, white poplar, white oak, black locust, and red oak.

### Cold Hardiness

Minnesota winters dictate selecting plant species that grow well in Minnesota and are hardy in Hardiness Zones 3 or 4 (figure 1). Plants native in northern areas are better adapted to withstand Minnesota winters. The hardiness zones, however, are not inflexible. For instance, a Zone 4 plant on an exposed, windward site in southern Minnesota may winterkill; whereas the same tree, if planted in a protected windless Zone 2 location, may survive. Soil, plant vigor, and cultural practices also play a role in a plant's ability to withstand cold conditions.

### The Site

The conditions of the planting site are as important as the plant. Soil type and drainage, available water and sunlight, exposure to drying winds, and other factors must be considered. Attempting to match the requirements of the plant to the site increases the survivability, performance, and longevity of the plant selected.

### Soil Texture and Drainage

The first step in assessing the condition of the planting site is to examine the soil. Is it sandy and well drained? Is it moist with some organic material? Is it heavy clay and, therefore, wet and perhaps com-

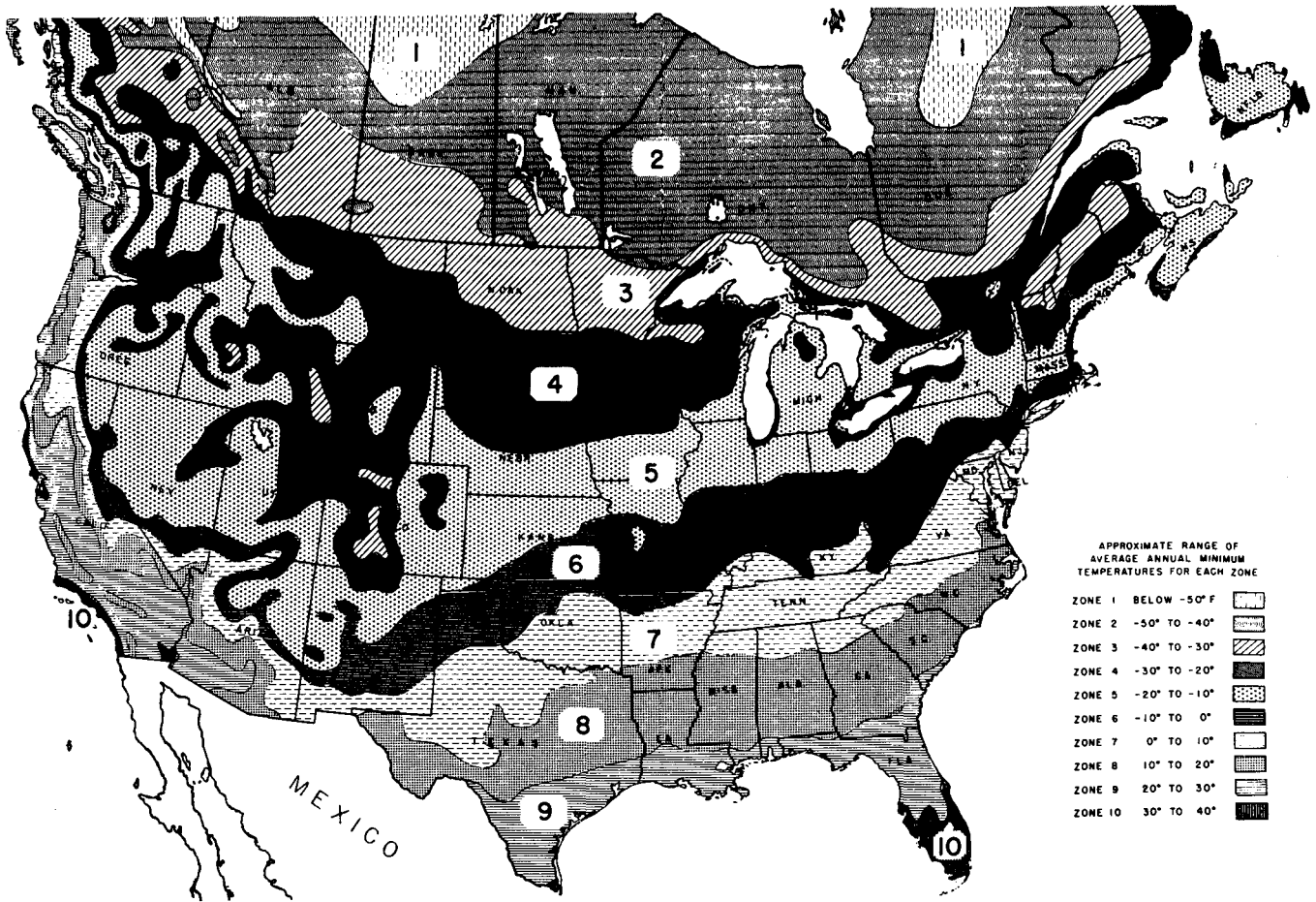
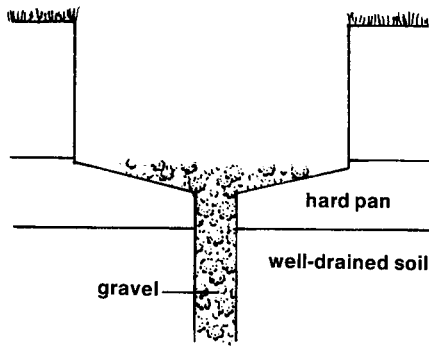


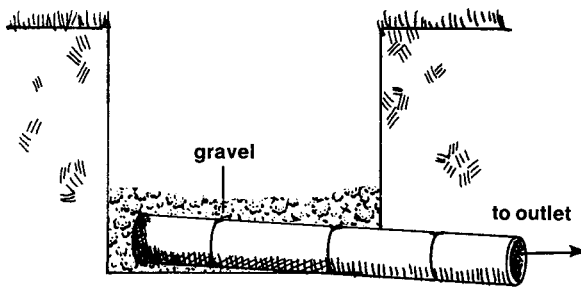
Figure 1. Plant hardiness zone map.

packed? Construction practices such as cutting and filling, installation of underground utilities, and back-filling against foundations can create great diversity in soil structure. This variability can change drastically with depth and between planting locations on the same property—investigate each planting site. Soil texture and drainage are closely related. Sandy soils usually are very well drained, have large pore spaces, and poor water-holding capabilities. They are usually associated with dry conditions. Conversely, clayey soils have much smaller pore spaces, are poorly drained, and can suffocate plant roots. The pore spaces in soil are very important to plant growth because the oxygen that occupies them is essential to healthy roots. Because plant roots require both moisture and oxygen for growth, soil drainage should be checked before planting. A poorly drained soil, high in moisture, but low in oxygen, prevents both proper root development and growth of beneficial soil micro-organisms that are responsible for decomposing organic matter and releasing plant nutrients.

To test for soil drainage, dig a hole 18 inches deep, fill it with water and let it stand overnight. If the water has not drained by morning, there is a drainage problem. (Do not test the drainage in this manner after heavy rainfall or before the ground has thawed in the spring.) A tree planted in poorly drained soil will be slow to establish, lack vigor, and often will slowly die. Plant species that are tolerant of poorly drained soils, or artificially improve soil drainage. This can be done in two ways. If a hard pan is present (a compacted, impermeable layer of soil) with an underlying layer of well-drained soil, a hole can be dug down to the permeable layer to provide drainage for the planting hole (figure 2). If the soil is poorly drained and there is no well-drained layer below, a tile system can be laid (figure 3). This, however, is expensive and requires the assistance of a professional for proper design. Simply adding gravel to the bottom of the planting hole will not provide adequate drainage and is not recommended as it will further decrease oxygen availability to the root system.



**Figure 2. Development of drainage through a hard pan layer.**



**Figure 3. Installation of a drain tile system.**

Organic matter, such as wood chips, peat, and compost, can be added to a clayey soil to increase pore space, and to a sandy soil to improve water-holding capability. When amending the soil, take care not to create a situation where the roots will not grow beyond the amended soil into the existing soil. Mix amended soil with existing soil to create a transition zone into the existing soil profile.

Compaction of the soil by vehicles or people can reduce pore space and restrict water infiltration, as well as cause physical damage to roots of existing trees. In compacted soil, oxygen is depleted and carbon dioxide accumulates. This is detrimental to root growth. Aerating the soil will help correct the problem.

Soil pH is a measure of the acidity or alkalinity of a soil. A pH below 7 (7 is neutral) would indicate an acid soil, and a pH above 7 indicates an alkaline soil. Many plants have an optimal range of pH; some are acid loving, and some may do best when the pH is near 7. Most trees thrive on a pH between 6.0 and 7.0. Soil pH is raised by calcium carbonate or lime. Plant species that will tolerate a high pH should be considered for areas with buried concrete, near foundations, or sidewalks, etc. Plant species considered tolerant of high pH include: green ash, white ash, amur corktree, ginkgo, hackberry, honeylocust, and Russian olive. Evergreens perform best in slightly acidic conditions.

There are some exceptions: arborvitae, ponderosa pine, and Colorado blue spruce can tolerate a wider pH range (6.5-7.3).

### **Water**

The correct amount of water for plants is essential. Select plants that are tolerant of excess water for low areas where water may be standing or very close to the surface, or where a heavy clay soil exists. Standing water or a high water table means low oxygen content in the soil. Therefore, trees and shrubs that can tolerate excessive moisture are often better suited to these poor sites. Trees that are able to tolerate moisture are: green ash, river birch, hackberry, bicolor oak, red maple, and Russian olive. Drought tolerant trees can withstand extended periods with little water and are best suited for sandy soils. They include: green ash, amur corktree, ginkgo, hackberry, Kentucky coffeetree, and Russian olive. Drought tolerant shrubs include amur maple, barberry, caragana, honeysuckle, buckthorn, sumac, alpine currant, elderberry, buffaloberry, spirea, and lilac.

### **Sunlight**

Although some plants can tolerate low light conditions, most require full sun to maintain their vigor and attain their optimum performance. Trees considered to be more shade tolerant include: green ash, white ash, river birch, ironwood, Kentucky coffeetree, American linden, Norway maple, hackberry, red maple, and sugar maple. Some plants may require some protective shade to prevent leaf scorch and desiccation.

### **Location**

The location of the planting site in relation to other trees and objects such as buildings, fences, etc. will have a considerable influence on temperature and moisture conditions. Prevailing westerly winds will have a drying effect on non-protected sites. The south side of a building will be much warmer and drier than the north side. The warming effect of the sun on a cold winter day can cause injury to the bark and may cause the tree trunk to split. For evergreens, this warming can cause water loss and growth activity resulting in needle damage when the temperature is again lowered. Plant hardiness can be greatly affected by the amount of protection provided by individual microclimates.

## **The Planting**

### **Plants**

Take special care when transporting plants from the nursery. The proper vehicle, a truck or trailer, can reduce the possibility of injury from loading and unloading. Often the cost of delivery is well worth the reduced damage to the tree. Protect leaves and needles from the sun and wind by wrapping or covering while in transit. Cushion stems and branches from injury. Always tie the plants down securely and avoid high speed travel.

## Methods of Marketing Trees and Shrubs

1. *Bare Root.* Bare root plants are dug from nursery fields in the fall or spring. Soil is removed from the roots, and plants are held in humidity and temperature controlled storage over winter. They must be planted in early spring before growth begins. Because many roots are cut during field digging, bare root plants suffer severely from transplanting shock. Bare root stock is normally the least expensive, but if handled improperly, can have the highest mortality. When handling or transporting bare root stock, keep the roots moist and protected from sun and wind at all times.
2. *Packaged.* Packaged trees and shrubs are bare root plants with their roots packed in moist material such as peat moss or shingle tow. Plant them in early spring before growth starts. Keep packing materials moist, and the package cool and shaded until planted. These plants should be treated as bare root plants.
3. *Field-Potted.* Field-potted nursery stock are field-grown plants dug with a ball of field soil intact which is then placed as is, in a container. These plants should be sold and planted during the spring, as field soil will not provide good plant growth in a container. It is important that the root ball be disturbed as little as possible during the digging and planting process.
4. *Containerized.* Containerized trees and shrubs are dug from the nursery in the spring or fall as bare root stock, placed in a container with a special growing medium, and sold in the container. If containerized in early spring, most plants will be sufficiently established in the container and can be transplanted in late spring, summer, or fall. Roots must be established in the container and hold the media together before transplanting. Do not completely break up the root ball at planting time, but do cut any circulating roots prior to planting. The tighter the root ball, the more the root system should be disturbed.
5. *Container Grown.* Container grown stock has been growing in a container throughout most of its production. Because the roots of these plants are not disturbed at the time of planting, container grown plants suffer little transplant shock and may be planted at any time during the growing season. Plants that have outgrown their containers may have deformed root systems which can result in girdling roots. Large plants may be root bound in the container. The root ball of these plants must be torn or cut open to eliminate subsequent circling or girdling roots (figure 4).
6. *Balled and Burlapped (B & B).* Balled and burlapped trees and shrubs are dug with a firm ball of soil around the roots, and held securely in place with burlap, twine, and sometimes a wire basket. A broken, damaged, or dry soil ball

can result in serious damage to the roots. The stem should not wobble in the soil ball. Because of the weight of the soil ball, B & B trees can be difficult to transport and plant without special equipment. B & B stock is often the most expensive, but if handled and planted properly, is as reliable as container grown stock. Always lift B & B plants from beneath the ball, never by the stem. Always remove any twine from around the trunks at the time of planting. B & B stock can be planted in spring, summer, and fall.

7. *Tree Spade.* Larger plants are often moved with a tree spade—a machine that digs a mass of soil including the plant and some of its roots. The plant and root ball may stay in the machine until it is planted into a pre-dug matching hole, or it may be placed in a wire basket lined with burlap. The size of the root ball is critical and species dependent. An experienced machine operator can make the difference between success and failure. Matching soils from the digging site to the planting site is also important, as is compaction within the planting hole. Roughing up the sides of the hole can offset some of this compaction. Plants can be moved in most seasons with a spade, although plants dug in summer and early fall should have an oversized ball and receive special attention relative to species, condition, handling, and irrigation. Prior to planting with a tree spade, locate all utilities to prevent cutting through wires, cables, etc. Call the Gopher State utility location numbers as follows:

TWIN CITIES: 454-0002

MINNESOTA: 1-800-252-1166

Make the call at no charge. It's better to be safe than sorry.

## Preparing the Planting Hole

Successful planting starts with proper site preparation. Digging the hole for a new plant is the first step. The hole should be at least 1-2 feet wider than the size of the root system (except for direct tree spade planted trees). A larger hole will allow better root growth, especially in poor soil. Rough up the sides of the hole and make the hole as wide or wider at the bottom than at the top.

Planting depth is critical. For heavy soils, trees and shrubs should be planted at, or slightly higher than, the depth that they grew in the nursery. In poorly drained soils, plants should be planted slightly higher, with soil mounded up to cover the roots. This will improve oxygen availability to the roots. Allow for settling, especially if the hole has been dug deep and backfilled. Air pockets should be eliminated by watering during and after backfilling. Poor soils can be amended with organic material or loamy top soil depending on the improvement needed. Peat is not recommended for poorly drained, clayey soils, as it can act as a sump and draw too much water into the planting hole. Never completely backfill with a soil

amendment; only create a transition zone to the existing soil where the roots must eventually grow. Too much soil amendment can create moisture gradients and cause roots to be confined to the planting hole. Remove rocks and debris from the hole and never put rocks or gravel in the bottom of the hole to improve drainage unless it is connected to a drain tile.

Proper fertilization provides plants with the elements they require for survival and growth. A balanced or complete fertilizer is usually recommended for tree fertilization. Trees and shrubs should be fertilized at the time of planting with a slow-release, complete fertilizer, preferably one high in phosphorus. Fertilizer should not be placed directly on the roots, but should be mixed with the backfill. It is best to use a slow-release fertilizer or fertilizer briquettes, at the time of planting. These will not burn the roots and will have longer-lasting effects. Follow label directions.

## Planting the Plant

**Bare Root and Packaged Stock**—Examine the stock and prune away any diseased or damaged roots or branches. Dig the planting hole and backfill with enough soil to hold the plant slightly higher than the depth it was growing in the nursery. Tamp the soil and center trees with the largest branches facing southwest. Straighten the roots and spread them evenly. Cover the roots with soil, avoiding any clods, rock, etc. Gently raise and lower the plant while adding soil to eliminate air pockets. When the hole is three-quarters full, tamp the soil and fill the hole with water. This should take care of any remaining air pockets. Finish filling the hole with soil, and then water thoroughly.

**Balled and Burlapped (B & B)**—Carefully set the plant in the hole at or slightly higher than it was at the nursery. The root flare and the top of the ball will indicate original planting depth. Take extra care not to loosen or break the soil ball. Fill the hole three-quarters full, tamping to remove air pockets. Cut and remove all twine from around the trunk. Pull burlap away from the trunk and top of ball. Water slowly to saturate the soil ball and to remove air pockets in the backfill. Finish filling the hole with soil. No burlap should remain above the soil surface as it may act as a wick and dry the root ball. Evergreens should not be planted later than October so the roots will have a chance to become established.

**Container Grown and Containerized Stock**—Carefully remove the container at the planting site. Cutting the container may be necessary. Remove all containers, including biodegradable papier-mache' pots. Newly containerized stock may be only slightly rooted; the container must be removed with great care so as not to disturb the root ball. In contrast, container grown stock may be rootbound. If roots are growing in a spiral around the soil ball, the plant is rootbound. These roots need to be separated or they will eventually girdle the plant. Make vertical cuts on the sides of the ball just deep enough to cut the net of roots (figure 4). Also, make a criss-cross cut across the bottom of the ball. Plant the plant the same as a B & B plant. Don't

plant evergreens later than October so the roots will have a chance to become established.

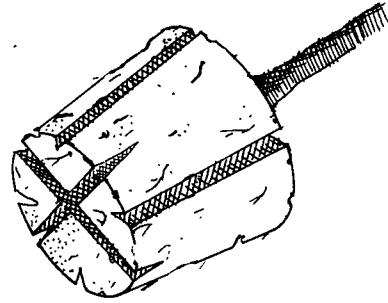


Figure 4. Cutting pattern for rootbound container grown stock.

**Tree Spade**—The use of mechanical tree spades has become a common method of tree planting. Trees should be watered thoroughly before moving to hydrate the plant and to avoid soil sifting out during transport. The sides of the planting holes should be roughed up with a shovel, rake, etc., to break up compaction caused by the spade. Trees should be placed at or slightly higher than the original grade to allow for settling. After planting, work loose soil into the area between the hole and the tree plug, and water thoroughly.

## After-Planting Care

**Watering**—Newly planted plants require routine watering. Soil and weather conditions will dictate how often and how much water to apply. Examine the soil moisture 4-8 inches deep to determine the need for water. If the soil feels dry or just slightly damp, watering is needed. Soil type and drainage must also be considered. Well-drained, sandy soil will need more water, more often than a clay soil that may hold too much water. A slow trickle of the garden hose at the base of the plant for several hours or until the soil is thoroughly soaked is the best method. Short, frequent watering should be avoided as this does not promote deep root growth but rather, the development of a shallow root system which is vulnerable to several environmental stresses.

**Mulching**—Adding a mulch around the base of the plant is a very important part of plant care that is often overlooked. By mulching plants, a more favorable environment is provided for the tree roots. A mulch allows better infiltration of water, holds soil moisture, limits weed growth, and discourages injury from lawnmowers and weed whips.

A 3-6 inch layer of mulch, spread to form a 3-6 foot diameter circle around the plant should be applied. Keep the mulch material from direct contact with the tree trunk. Wood and bark chips are good mulching materials. A porous landscape fabric that allows gas and water exchange can be used as a weed barrier

underneath the chips. Plastic under mulch can cause roots to "suffocate" and is not recommended.

**Fertilization**—Fertilization of established plants should be done every 2-3 years in the fall after leaves have fallen or in early spring before growth begins. It can be applied to the surface or placed in holes around the plants. Beware of burning turf if surface-applied. Surface applications should be watered in. Do not apply nitrogen in late summer unless the plant is nutrient deficient, as this can promote new growth that may not harden off properly and can be damaged by winter weather. Phosphorous and potassium can be applied in the fall as they will enhance winter acclimation.

**Pruning**—Proper pruning is vital to the health and structure of many plants. Any damaged limbs, and crossing or rubbing branches should be pruned when planting. The pruning cut should leave the branch collar without leaving a stub. Improper cuts can lead to disease problems and decay. Prune when trees are dormant, never when leaves are falling. Trees that "bleed" should be pruned in August. Oak trees should not be pruned between April 15 and July 1 due to possible spread of oak wilt disease. If pruning of oaks during this time is unavoidable, or if trees are damaged by storms or construction, apply a non-toxic pruning paint immediately. Pruning paint is not recommended for other pruning cuts or wounds.

**Staking**—Most newly planted trees will do better without staking. Young trees standing alone with their tops free to move will develop stronger, more resilient trunks than those staked for several years. Trunk movement is required to develop strong, tapered trunks.

If however, a tree is unstable in a strong wind or is pushed over, then staking is required. A common problem with staking trees is the girdling effect that the ties can have on the tree. A piece of garden hose around the wire and a loop to allow movement can reduce this damage. Also soft nylon webbing or carpet strips can be attached by grommets to a stake. Often, wire is too tight around the trunk and will effectively girdle and kill the tree. Whatever material is used, be sure to allow for some movement and remove the stakes and ties once the tree is established—usually after one year.

**Winter Care**—Proper winter care begins in the summer. Proper watering and fertilization in spring and summer is required. Watering can be decreased in early fall and increased in late fall to provide water needed to withstand the drying winds of winter. Plants need to go dormant; don't encourage late growth by heavy watering and nitrogen fertilization in early fall. Plants should be thoroughly watered in late fall just prior to the soil freezing.

Sunscald, characterized by sunken, dried, or cracked bark, is caused by the heating effect of the winter sun in cold weather. It usually occurs on the south or southwest side of the tree. In the fall, wrap young and thin-barked trees with commercial tree wrap from the bottom up to the first major branch. Remove the wrap

in spring. Thin-barked species such as maples and honeylocusts may require protection for several years.

Winter browning of evergreens is normally caused by the combined effects of wind and sun. Trees lose water from the leaves (needles) while roots are in frozen soil. To protect evergreens, place a screen of burlap or similar material on the south, west, and windward side of the tree to block wind and sun. Antidesiccant sprays are not very effective in offsetting the drying effects. Water evergreens well throughout the growing season, lightly in September, and then thoroughly again before the soil freezes. Select species and cultivars that tolerate winter conditions. Plant species susceptible to winter injury in areas of minimal exposure to winter wind and sun.

Animal damage can be severe during the winter. To protect individual trees from mice, place a cylinder of 1/4-inch mesh hardware cloth or plastic drain pipe (it should not be black in color) around the trunk. The cylinder should extend high enough to prevent animals from feeding at snow level, and should be firmly anchored in the soil without disturbing the tree roots. Protection from rabbits requires coverage of up to 1 to 2 feet above snow level. Other means of fencing or animal control may be needed. If many trees and shrubs are to be protected, application of a commercial repellent may be more practical. The repellent can be sprayed or painted on the trunks and branches. The effectiveness and duration of the repellent will depend on the severity of the winter and the availability of other food.

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## SUMMARY

This publication provides information on planting trees and shrubs for the professional and amateur. Proper planting involves proper site and plant selection. Factors considered include size, hardiness, salt tolerance, drainage, and light. The plant and planting site must be properly prepared depending on the type of stock purchased. Care of newly planted stock includes watering, mulching, pruning, and winter protection.

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