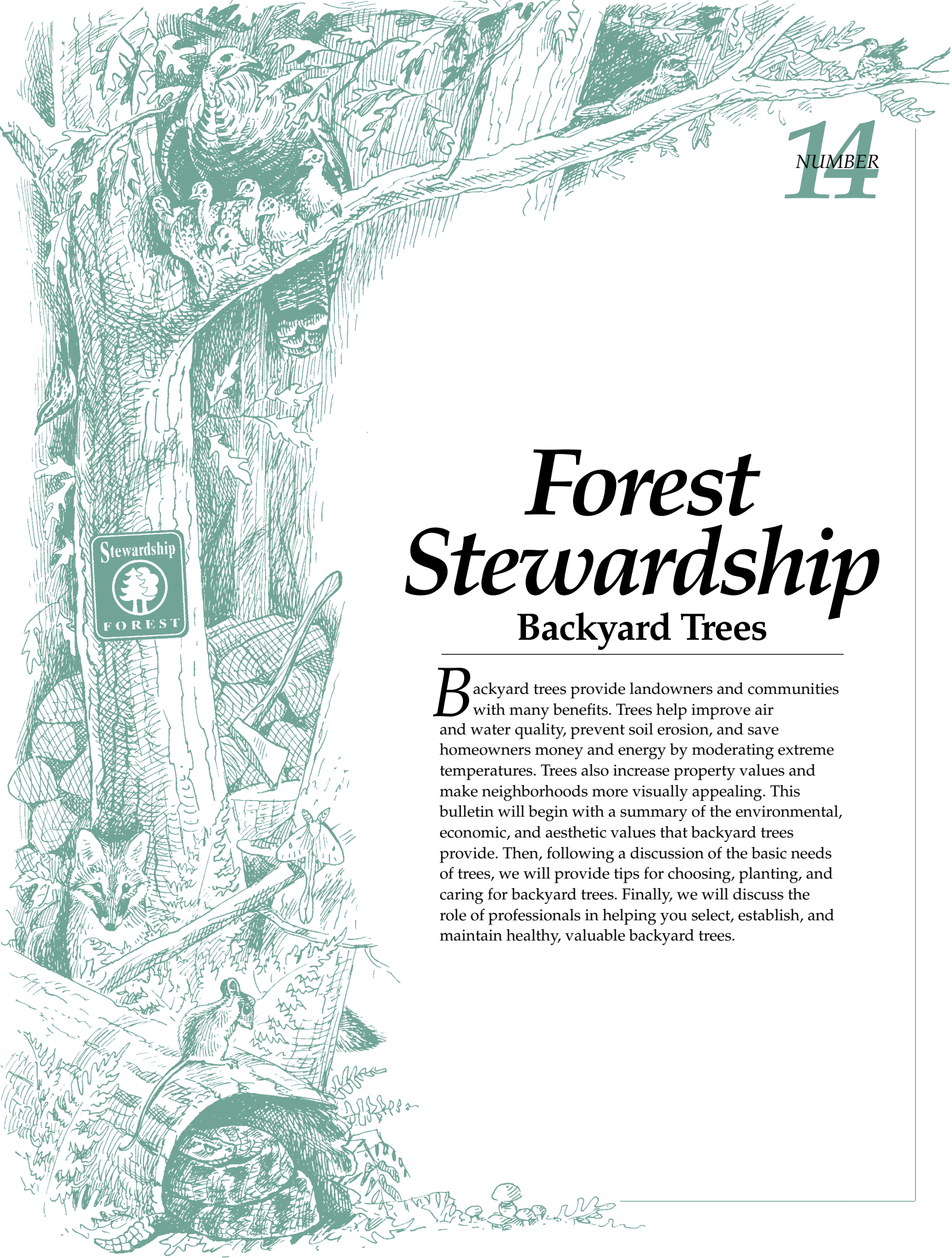


NUMBER 14

Forest Stewardship

Backyard Trees

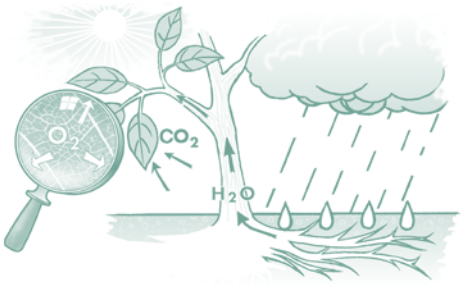
Backyard trees provide landowners and communities with many benefits. Trees help improve air and water quality, prevent soil erosion, and save homeowners money and energy by moderating extreme temperatures. Trees also increase property values and make neighborhoods more visually appealing. This bulletin will begin with a summary of the environmental, economic, and aesthetic values that backyard trees provide. Then, following a discussion of the basic needs of trees, we will provide tips for choosing, planting, and caring for backyard trees. Finally, we will discuss the role of professionals in helping you select, establish, and maintain healthy, valuable backyard trees.

The Values Provided by Backyard Trees

We often think in terms of environmental, economic, and aesthetic when classifying forest values. Although they are usually not part of a forest, our backyard trees provide us with the same benefits as forest trees. For this reason, we will discuss the values of backyard trees in terms of environment, economy, and aesthetics.

ENVIRONMENTAL VALUES OF BACKYARD TREES

Backyard trees provide numerous environmental benefits. They help improve air and water quality, prevent erosion, and moderate temperatures. People who nurture trees on their own property improve environmental conditions for their neighbors, as well as themselves; a municipality that nurtures trees is an environmentally healthier place to live and work.



Plants facilitate carbon dioxide (CO_2) and oxygen (O_2) exchange and play an important role in the water cycle.

Air quality

Carbon dioxide is a gas that naturally occurs in the air. The level of carbon dioxide in the atmosphere is increasing. Many scientists believe that the increase in carbon dioxide may lead to global climate change, because of carbon dioxide's ability to trap heat that is radiated away from the earth's surface. Trees absorb carbon dioxide from the atmosphere. In the process of photosynthesis, trees (and other plants) convert carbon dioxide and water into oxygen and sugars that contain carbon. The trees can then use the sugars for energy or convert them into wood or other substances. A single, healthy young tree stores approximately 13 pounds of carbon each year. An acre of trees can store about 2.6 tons of carbon each year!

Not only do trees benefit us by absorbing and storing carbon dioxide; they also can make our air cleaner by trapping and holding dust particles. Thus, every tree in your yard can improve the quality of the air you breathe. But the environmental benefits of trees are not restricted to improving air quality. In the next section, we will look at the value of backyard trees in sustaining healthy water supplies and soil.

Water flow, water quality, and erosion

When water moves over the earth's surface, it often takes soil particles with it; soil fertility is often compromised because valuable topsoil is stripped from the land. The soil-laden water often ends up in waterways where it can harm aquatic organisms by degrading habitat and increasing water temperature. Trees help combat soil erosion when their leaves and limbs intercept rain drops, decreasing their impact on the ground surface. Also, tree roots help hold soil particles in place, and trees help slow winds that can cause erosion.

Trees and other plants also play a vital role in our planet's water cycle. Plant roots absorb water from the ground; then cells and tissues transport the water through the plant. Excess water that reaches the leaves is released into the atmosphere through tiny pores, in a process called transpiration. The water released by transpiration is in the form of water vapor, a gas. Evaporation from leaves and other surfaces is another way that water vapor enters the atmosphere. Much of the water vapor from transpiration and evaporation rises into the atmosphere where it cools, condenses, and eventually falls back to the earth as precipitation. Thus, through the process of evapotranspiration, trees help regulate precipitation rates and quantities.

Leaves and woody debris that fall to the ground help create a loose, porous organic layer at the soil's surface. This layer allows water to percolate down through the soil, rather than running along the surface. As water percolates through soil particles, many impurities are removed. Eventually, much of the water that percolates through the soil enters the groundwater. On the other hand, water that falls on asphalt, roofs, and other impervious surfaces has no chance to percolate through the soil. During storms, waters from impervious surfaces can cause flooding by overwhelming storm sewers and streams.

Without trees, green spaces, and porous, erosion-resistant soils, municipalities must increase stormwater and wastewater treatment capacities to handle the increased water runoff from paved surfaces and unprotected, compacted soils.

Climate and energy

Did you know that the average daily temperature in cities is often three to ten degrees hotter than in the surrounding countryside? That's because unshaded steel, concrete, and asphalt surfaces—the stuff that cities are made of—collect and store heat from the sun, turning these areas into "urban heat islands."

Trees can help cool your home in summer and protect it from the chilling winds of winter. When you plant the right species of trees in the right places around your home, you can reduce your air conditioning use by 30 percent and energy use for heating by 20 to 50 percent! Energy savings provide not only environmental benefits, but economic benefits as well. The next section explores more of the economic advantages of planting and caring for backyard trees.

ECONOMIC VALUES OF TREES

Recent studies by the U.S. Forest Service show that healthy, mature trees increase property values by up to 15 percent. They also increase home salability and subsequent municipal tax revenue. That's three direct economic benefits of trees. There are many more subtle, but equally important, economic benefits to both you and your community.

Visually appealing, mature landscapes are an asset to the economic stability of municipalities by helping them attract and retain progressive people and businesses. Trees and green landscapes are among a visitor's first impressions of a place; they help improve the image and reputation of neighborhoods and business districts. People are drawn to, and spend more time on, tree-lined streets. Homes, apartments, and offices rent and sell faster in wooded communities. Tenants and owners tend to stay longer.

The aesthetic values of trees also can translate into economic benefits. An aesthetically pleasing property has "curb appeal"—that is, increased salability and market value.

Trees also can improve health by reducing the psychological stress associated with living in metropolitan areas. Research studies show that patients with views of trees and greenspaces have shorter hospital stays and less need for pain medication. If you have trees in your yard, you already understand the feelings of relaxation and well-being they can inspire. Trees and green spaces can help reduce violent crime in neighborhoods. An abundance of healthy trees in your neighborhood or community is a symbol of community spirit, pride, and togetherness, especially if volunteers plant and maintain them.

Increased property values and economic stability, improved health and sense of well-being, reduced crime, and improved community spirit all contribute to quality of life. The next section will explore another factor that enhances quality of life—the beauty, or aesthetic value, of trees.

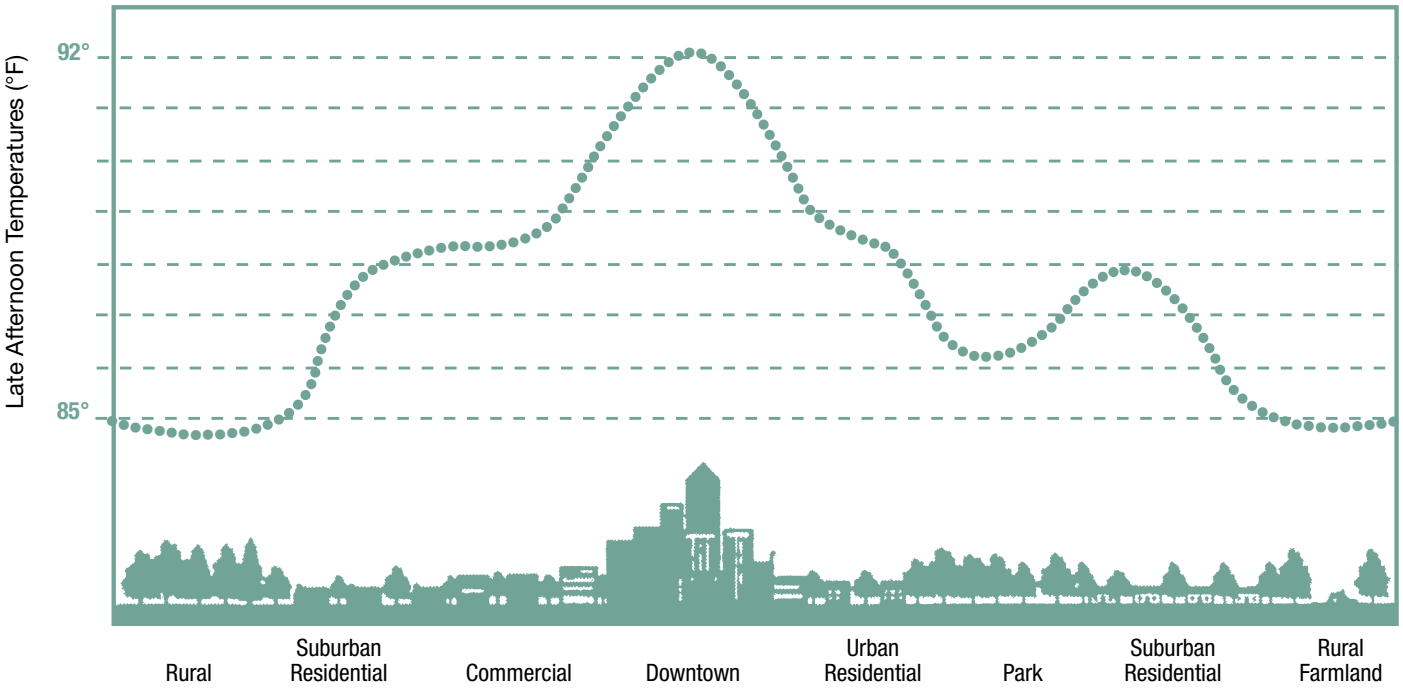
AESTHETIC VALUE OF TREES

Trees add beauty by softening the appearance of the hard surfaces and straight lines prevalent in the human-built environment. Trees also provide greater privacy and a connection to nature for urban and suburban dwellers. Along with other plants, trees create natural areas for birds and other animals. Natural areas provide food and shelter for animals, and animals provide a sense of pleasure for those who enjoy seeing nature up close.

Trees also enhance aesthetic quality by reducing noise pollution; trees absorb, reflect, and mask unpleasant sounds.

We have illustrated the many aesthetic values of trees—ability to soften harsh lines, privacy, connection to nature, and reduced noise. In previous sections we explored the environmental and economic values of trees. We hope we have piqued your interest, and you are eager to start planting new trees or taking a greater interest in those you already have. Soon we will provide tips for choosing, planting, and caring for backyard trees, and the role of professionals. But first we will examine what trees need to grow and survive.

SKETCH OF AN URBAN HEAT-ISLAND PROFILE



Trees and green space can reduce the average temperatures of urban areas during hot, summer days.

Basic Needs for Growth and Survival

Trees, like all living organisms, require certain conditions to establish, grow, and survive. These basic requirements include an appropriate amount of fertile soil, enough space for root and canopy growth, air for both roots and leaves, an appropriate amount of water, suitable sunlight and temperature conditions, and protection from disease, insects, and injury. The sections that follow explore each basic requirement in more detail.

SOIL

Trees depend on soil for many things: nutrients, air, water, stability, protection from temperature extremes, and a natural recycling system. Tree roots acquire nutrients such as nitrogen, phosphorus, potassium, and calcium from the soil. For respiration (where sugars are converted to energy) to take place, tree roots must be able to acquire oxygen and get rid of carbon dioxide. A network of spaces, or pores, between soil particles allow plant roots to exchange gasses with the surrounding soil. Soil also has the capacity to store water, making it available to plants when they need it. Roots help anchor and support the entire tree, and soil is the medium that supports the root system. Soil helps moderate temperature extremes and protects roots from the severe hot or cold temperatures that can occur at the soil surface. Soil also plays a key role as a recycler of natural materials. As plants and animals die and are decomposed, soil organisms and processes convert wastes into forms that plants can use for growth.

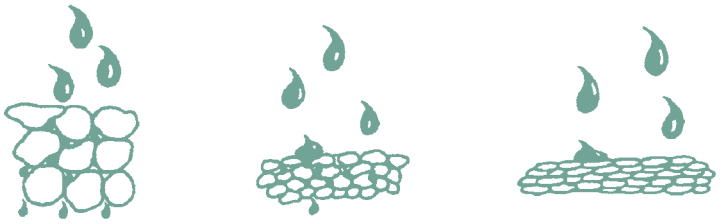
A soil's acidity or alkalinity (pH) is a key factor in determining which trees grow best on a given site. Most tree species prefer neutral or slightly acidic soils. Soils that are extremely acidic or alkaline are not suitable for the growth and development of most trees. Pines tend to be most tolerant of acidic soils (and associated aluminum levels); spruces are a little less tolerant; and the hardwoods tend to be the least tolerant. Elm, poplar, and honey locust are trees that do not grow well in acidic soils. On the other hand, tree species such as pin and red oak, red maple, sweet gum, and river birch do not tolerate alkaline or limestone soils. It is important to consider the acid/alkaline conditions of your soil when selecting trees for planting.

Soil structure also plays an essential role in a soil's ability to support plant life. Soils that are composed of relatively large and stable aggregates are most desirable for plant growth. Aggregates occur when tiny soil particles pack together to form masses or clumps. Soils composed of large, stable aggregates tend to allow relatively large pores, or spaces, to form between particles. These pores allow air and water to move easily through the soil and nourish plant roots. Small roots can easily push their way into the large pores, facilitating growth. Soils with large, stable aggregates tend to feel loose and crumbly.

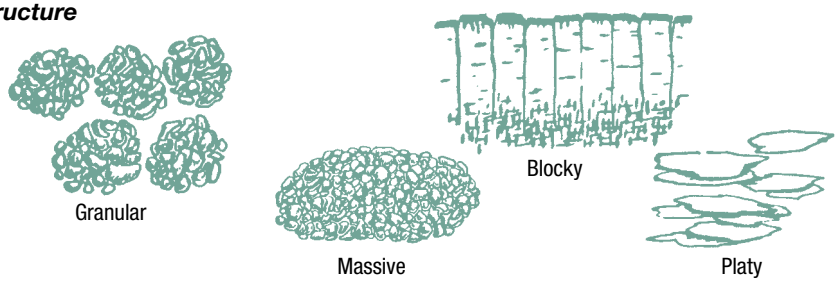
On the other hand, in compacted soils, individual soil particles are pressed tightly together. Compacted soils feel firm and generally not as crumbly. Soil compaction leads to poorer growing conditions for plants. Compaction inhibits root growth by deforming soil structure and decreasing pore size. Compacted soil is a poor medium for root growth because the tightly packed particles resist root penetration, slow the passage of water and nutrients, and inhibit the free movement of oxygen and carbon dioxide.

Sandy soils are composed of coarse particles and have large pores. Water drains quickly through the abundant pores; hence, sandy soils retain lots of air, but not much water. Clay soils, on the other hand, are

Soil texture



Soil structure



composed of small, fine particles and have small pores. Sometimes they hold too much water and too little air for trees to survive. Optimal tree growth usually takes place in "loam"—a mixture of sand, silt, and clay.

Certain human activities can inhibit tree growth and survival. Activities that apply pressure to the soil surface, such as heavy equipment operation and repeated foot traffic of humans or animals, can cause soil compaction. Paved streets, sidewalks, driveways, house foundations, and rocks can hinder root growth. Asphalt, concrete, and limestone gravel can raise the alkalinity or pH of nearby soils. Adding or removing soil around existing trees and digging trenches for underground utilities can damage trees. Certain substances, including road salt and some herbicides, can be toxic to trees.

Fertile soils are rich in organic matter from decomposing plant and animal material and microorganisms that live in the soil. Organic matter plays an important role in the formation and stabilization of soil aggregates by providing energy to sustain fungi, bacteria, and soil animals, and by yielding sticky substances upon decomposition that help maintain soil structure. Organic materials increase aeration, provide nutrients, and enhance the water-holding capacity of soils. A top-quality soil teems with life—literally billions of organisms per handful. Soil organisms such as centipedes, mites, algae, mosses, plant roots, earthworms, insects, bacteria, and fungi interact and contribute to the cycles that make life possible. Thus, it is important to retain the natural mulch under native trees and to apply mulch around planted trees.

SPACE

If a tree doesn't have enough space, both above and below ground, it won't thrive. The amount of soil available for root growth is one of the most important factors in tree growth. Roots help anchor a tree in the soil, but they also are essential for absorbing nutrients and water. Roots grow like branches. That is, they grow from their tips and grow in thickness as well as length. Roots restricted by soil compaction or obstructions, such as concrete, cannot spread through enough soil to gather the food and moisture they require. As a result, tree growth will be impaired

Space is also important for the tree's upper leaves and branches, or canopy. Do not plant a potentially large tree in a confined space. When growing under utility lines, large trees will need pruning, and incorrect or repeated pruning can be highly stressful.

AIR AND WATER

Air transports important gasses such as carbon dioxide and oxygen, but it also may contain harmful substances, such as ozone. Some trees, such as white pine, do not tolerate ozone and other air pollutants well. Avoid planting pollution-sensitive species if you live in an urban area or near a lot of traffic.

An improper amount of water, either too much or not enough, can inhibit the growth of the entire tree by limiting the roots'ability to anchor the tree and absorb nutrients. Trees can be harmed by flooding or excess watering, or by drought or underwatering. Some trees, such as willow, white cedar, red maple, river birch, and sycamore, can withstand wet soils. However, saturated soil deprives roots of oxygen and impedes root function and growth in all trees. The symptoms of overwatering are similar to those of drought: wilting, defoliation, poor growth, and branch death. In both cases, stress impairs root function and growth.

SUNLIGHT

Sunshine provides heat and the energy that drives the process of photosynthesis. Photosynthesis provides sugars to fuel all of a tree's physiological processes, which include the maintenance of existing live tissues; bud, leaf, and wood development; water and nutrient uptake and transport; defense against decay; and flower and seed production. Some trees need full sun to grow, some do well in shade, and others can tolerate a range of light conditions.

TEMPERATURE

Extreme heat and cold, as well as rapid temperature changes, cause stress, dieback, and even death in trees. A tree's ability to withstand extreme temperatures is known as its "hardiness." It is important to match a tree's hardiness with the planting location. Earlier we mentioned that materials such as asphalt and concrete absorb and hold heat. Near impervious areas, plant trees in groups and plant shrubs and ground covers under the trees. This strategy helps offset temperature extremes.

Don't do this to trees! Without a tree protection zone, trees and soils can be severely damaged by construction activities. Damage can lead to either fast decline in health or a very slow decline and eventual death.

PROTECTION FROM INJURY

The best defense a tree has against disease and insects is a good offense —that is, good health and vigor. However, you cannot simply ignore infestations, even in hardy trees. A qualified arborist can help you manage disease and insect problems. Injury, especially in backyard or residential trees, often results from human error or carelessness. "Topping" and other improper pruning practices damage and kill many trees. (We'll talk about proper pruning later in this publication.) Hitting tree trunks with your lawn mower or weed whacker can, over time, cause damage, as can gardening or construction activities near trees. Injuring a tree's roots, trunk, or limbs causes problems with both health (growth) and decay (structure). Fatal root damage is often caused by soil compaction by machinery and repeated foot traffic and pollutants from fuels and organic cleaning solvents. Such root damage often occurs in areas where lawn work and construction activities take place.

Animals can damage trees, too. Animal waste, especially urine, adds harmful compounds to the soil. Repeated animal traffic compacts soil. A host of animals, both pets and wildlife, inflict injuries on tree bark: birds peck at it, cats shred it, and rodents chew it. When tied to trees, dogs or horses can be particularly destructive; they can harm both the trees and the soils that support the trees.

Although it is not often apparent, tree roots grow near the surface, most within the first 26 inches of soil. Hence, they are particularly vulnerable to damage from surface activities such as compaction and rototilling. Sometimes you will not notice root damage until the tree visibly declines or dies back. By then, it often is too late to correct the problem.

Selecting, Planting, and Caring for Backyard Trees

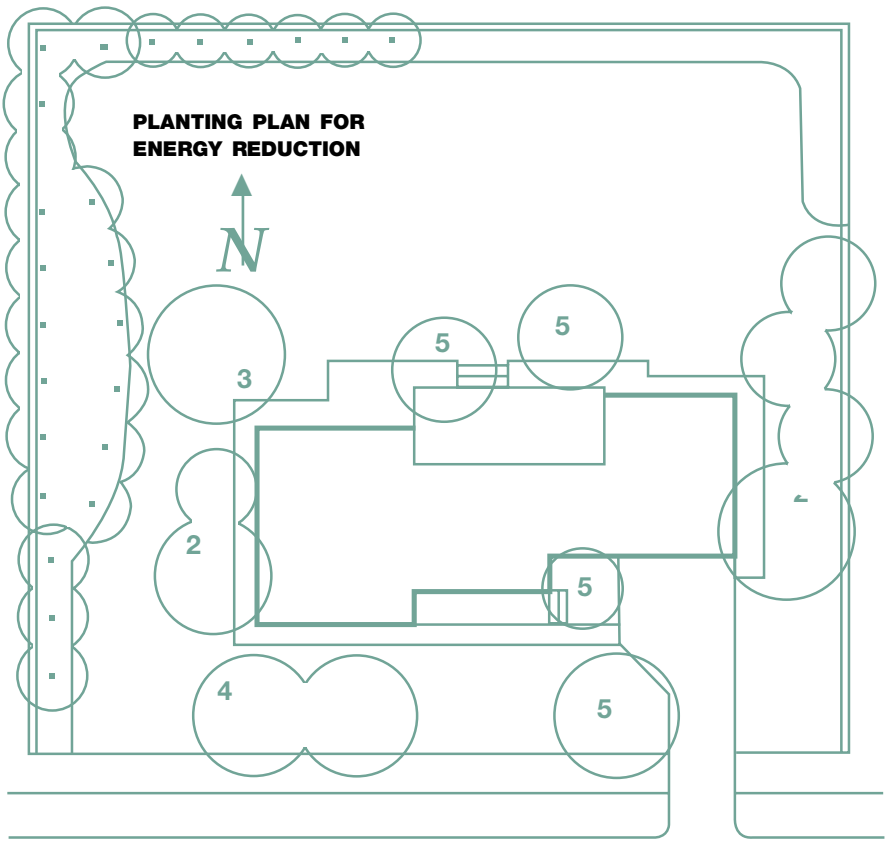
If there is one thought to remember as you begin to plant and care for trees in your yard it is this: Plant the right tree in the right place. To plant the right tree in the right place, first ask yourself two questions: 1) What do I want to do? and 2) What do I have to work with? We will explain those two questions by exploring some examples.

WHAT DO I WANT TO DO?

Do you want trees to provide shade, create a windbreak, establish privacy, create wildlife habitat, or add natural beauty; or do you have other reasons to plant trees in your yard?

If you consider what you want to do first, it will be easier to proceed to the next step in the selection process —narrowing down the list of possibilities. For instance, if you want to provide shade, choose large, leafy trees with horizontal, rather than vertical, branching patterns. Examples of such trees are red oak, white oak, and sugar maple. Evergreens are better than deciduous trees for wind-breaks and privacy because they retain foliage year-round.

Many birds, small mammals, and other wildlife eat tree seeds, fruits, and nuts. A good assortment of tree species will make different foods available in spring, summer, and fall. If your primary objective for planting and maintaining trees in your yard is to add beauty, consider species that produce showy flowers (redbud, serviceberry, dogwood, cherry, crabapple, or ornamental pear) or have colorful fall foliage (white ash, red maple, or ginko).



key

1. Coniferous windbreaks to the north and west block winter winds.
2. Trees on the east and west sides provide summer shade.
3. A tree here will provide shade as the sun sets in midsummer.
4. A varity of deciduous trees to the south should grow tall and permit pruning of lower branches so that lower winter sun will strike the roof, walls, and windows uninterrupted.
5. The year-round effect of foundation and driveway planting seems never to have been measured, but they would be expected to be energy savers if they do not shade windows in the winter.

WHAT DO I HAVE TO WORK WITH?

If you choose the right tree to meet your objectives, but plant it in the wrong place, you have wasted your time, energy, and money. It is important to become familiar with the available resources you have to work with.

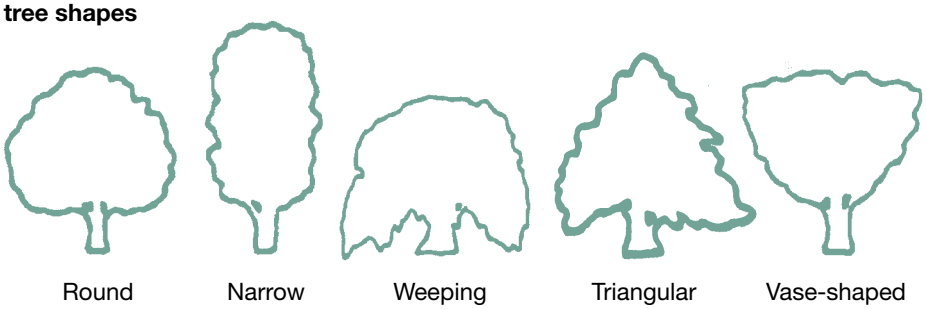
To begin, determine the orientation of your property. To provide sun in the winter, shade in the mornings and afternoons, and summer cooling, plant large deciduous trees on your home's east and west sides. Conifers, planted sufficiently close together along your property line's north and west sides, will block winter winds. Orientation also helps determine which parts of your property tend to be colder, warmer, drier, moister, sunnier, and shadier than other areas.

Other resources on your property also are extremely important. The first, and most fundamental, is soil. The nature of the soil in the location that you intend to plant will have a significant effect on your trees. The more you know about the type and quality of the soil, the easier it will be to select the proper species to plant. Because soils in developed areas often are unknown mixtures, it's a good idea to have your soil tested. Check with your county Cooperative Extension office for details. It is important to pay attention to the pH of your soil and plant only tree species that are tolerant of your soil's characteristics.

Another important thing to keep in mind is the size and health of the planting space beneath the soil surface. Consider the amount of soil available to roots and any potential problems such as soil compaction, poor drainage, or pollution. A professional arborist or landscaper can help you identify possible insect or disease problems. In general, large trees like oak, ash, and sycamore need a lot of soil and space.

When pondering potential site problems, don't limit the search to natural causes—many potential problems, especially when it comes to planting and maintaining backyard trees, have human sources. Some human-created obstacles to growing and maintaining healthy backyard trees can be as great as natural ones. When deciding what to do, consider air pollution, neighboring landscape conditions and designs, utility clearance and other overhead space restrictions, the amount of nearby pedestrian and vehicular traffic, and the proximity of impervious surfaces (including your house's foundation).

tree shapes



THE RIGHT TREE PLANTED ON THE PROPER SITE LIVES LONGER, GROWS TO BE LARGER AND MORE BEAUTIFUL, AND NEEDS LESS MAINTENANCE.

Here are some examples to help you avoid making the wrong selection:

- Pin oak, red maple, black gum, and red oak cannot tolerate high pH or limestone soils and will not grow well in them. These species grow much better in acidic soils.
- The roots of large trees such as oak and tulip (yellow) poplar need large amounts of soil. If planted in restricted areas, such as near sidewalks and parking lots, these species grow poorly, never reach a normal mature size, and cause damage to paved surfaces. Think twice before you plant large trees near your house or driveway.
- Trees such as ornamental cherry are tender and will not tolerate soil compaction or poor drainage.
- Silver maple, red maple, Norway maple, and willow trees develop structural problems as they grow old. They should not be planted near your home or any other area where safety is an issue.
- Sugar maple cannot withstand road salt, compacted soils, and other conditions typically found near streets and parking areas.
- If you are thinking about planting trees around your newly built home, remember that soils around homes often are compacted and of poor quality. Consider improving soil conditions; replace compacted or infertile soils with fertile topsoil and apply mulch around newly planted trees. These steps may help ensure that the time and money you invest in tree planting will yield healthy, attractive trees.

Here are some examples to help you match the right tree to the right site and ensure its successful growth:

- White ash, sugar and red maple, and ginko offer attractive fall color. Redbud, serviceberry, dogwood, cherry, crabapple, and ornamental pears offer spring flowers.
- Sycamore, urbanite green ash, honey locust, ornamental pears, crabapple, and hedge maple can withstand a variety of urban stresses—poor and compacted soils; air pollution; and poor, harsh, or otherwise unreasonable pruning.
- Smaller trees, such as hedge maple, Japanese tree lilac, and ruby red horse chestnut are suitable for planting under utility lines and in other confined spaces.
- Native tree species are good candidates for successful planting, survival, and growth. Trees from local seed stock tend to be more tolerant of local temperature extremes and moisture conditions than non-native species. When planted on the appropriate site, native trees also tend to require less maintenance. Because they have evolved in the same area, native plants and animals are often adapted to and dependent upon one another. Consequently, native trees tend to be more useful than non-native trees for providing native wildlife species with food, shelter, and nesting sites.

The right tree has:

- a strong, straight trunk
- a trunk that is not cut or damaged
- evenly spaced branches along the trunk
- branches that are not split or broken
- a full canopy of leaves
- mostly green and healthy leaves
- no diseases or harmful insects
- a root ball that is wrapped with fresh burlap
- a root ball that is firm and round
- no roots growing out of the bottom of the container
- no roots circling the top of the container
- no weeds growing in the container
- moist soil in the root ball

SELECTING INDIVIDUAL BACKYARD TREES

As you proceed with your plan to enhance your property with trees, you probably will be buying some young trees for planting and choosing to maintain existing, more mature trees. Here are some tips to remember when shopping for young trees. Buy a high-quality tree. It is important to buy a tree with good form and structure, healthy new growth, a healthy root system, and leaves of a good size and color. Avoid trees that show signs of damage, disease, or pests. Even without much prior experience, you should be able to tell a healthy, young tree from a sickly one. When selecting young trees, keep in mind the suggestions provided on page 8 for determining good form and structure in more mature trees.

People often choose balled-and-burlapped trees, but containerized trees are gaining popularity. The size of the root ball on a balled-and-burlapped tree should be in reasonable proportion to the size of the tree trunk (see Table 1). On balled-and-burlapped trees, also look for a fresh, moist burlap covering. If you choose containerized trees, be aware that, if their roots grow in a circle in the pot, the tree may end up being girdled. Girdling is like strangulation; it can kill the tree. If you see a containerized tree with roots circling the top of the container, choose another tree.

There are certain characteristics you can use to determine a young tree's future structural strength and integrity. Tree crowns are composed of twigs, branches, and leaves. The crown must be able to withstand the force of wind and the weight of ice and snow. When you are selecting young trees, look for the following traits.

- **Limb spacing along the main trunk**
  Look for limb spacing typical of the species. Some species, such as the Bradford pear, have inherently poor limb spacing, making them susceptible to limb and branch breakage. A tree with limbs that are evenly spaced along the trunk generally has better structure than one with limbs growing too close together. Avoid trees with limbs that all originate from one area.
- **The presence of a dominant leader or main trunk**
  A dominant leader, or main trunk, is the basis of a strong framework—called a scaffold—that supports lateral limbs. Trees with several trunks, or competing leaders of similar size, often have weaker scaffolds. Even round, oval, and vase-shaped trees, which commonly have more than one leader, should show a clear hierarchy of trunk and limb sizes.
- **The angle of attachment between trunk and limbs**
  In general, considering what is typical for a tree species, limbs that have a wide angle of attachment are stronger than those with sharp angles of attachment. Limb attachments on a tree that are much narrower than others indicate a higher probability of breakage.

These three indicators of structural integrity are also useful traits for examining trees already growing in your yard.

QUICK CHECKLIST FOR CHOOSING SPECIES

- ❑ mature size (Will it fit in your landscape?)
- ❑ canopy form (Is it wide or narrow, tall or short?)
- ❑ flowers and fruit (Seasonal timing? A problem with cleanup?)
- ❑ fall color (Early or late in the season?)
- ❑ growth rate (Fast- or slow-growing?)
- ❑ longevity (Long-lived?)
- ❑ rooting characteristics (Deep or shallow?)
- ❑ limb and trunk strength
- ❑ tolerance to insects
- ❑ tolerance to diseases
- ❑ tolerance to soil compaction
- ❑ tolerance to poor drainage
- ❑ tolerance to air pollutants
- ❑ drought tolerance
- ❑ shade tolerance
- ❑ heat tolerance
- ❑ cold hardiness
- ❑ native species
- ❑ best species for site

Table 1. Typical Sizes and Weights of Balled-and-Burlapped Deciduous Trees

Caliper	Ball Diameter	Approximate Weight	Typical Height
1 ½ to 1 ¾"	20"	225 lbs.	10 to 12'
1 ¾ to 2"	22"	260 lbs.	11 to 13'
2 to 2 ½"	24"	300 lbs.	12 to 14'
2 ½ to 3"	28"	600 lbs.	13 to 15'
3 to 3 ½"	32"	750 lbs.	14 to 16'

After you select the best specimens of the tree species you want to plant in your yard, remember to move your tree from the nursery or garden center to your home gently. Pick up young trees by their burlapped root ball or container, not by the trunk. Load and unload the tree carefully. If it will be exposed to the wind on the ride home, drive slowly and cover it with a tarp. Whipping winds can cause leaves to dry out, a condition that can be fatal for a young tree.

PLANTING BACKYARD TREES

Once you get them home, plant your trees as soon as possible. If you can't plant them immediately, remember to keep them in the shade and keep their root ball or containerized soil moist.

Here are 12 pointers to remember when you begin to plant trees in your yard.

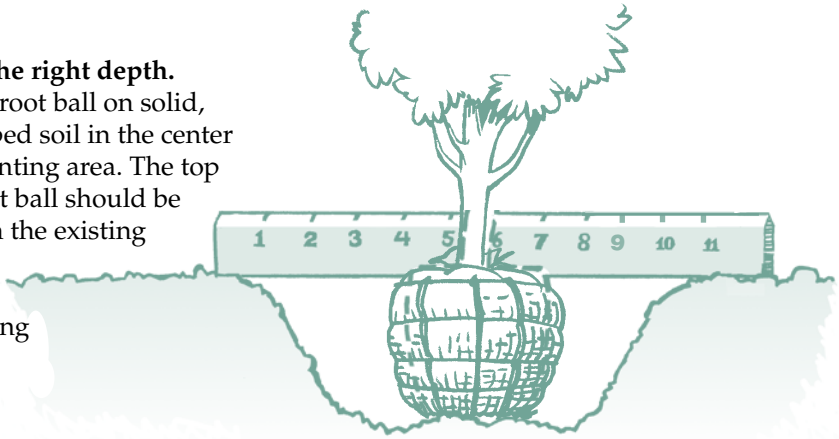
1. **Give trees enough space.** The mature size and life span of a tree depends mainly on the volume and quality of the soil accessible to its roots. Large trees need large areas and lots of soil; small trees require less (see Table 2).

2. **Plant at the right time.** The best time to plant is spring—as soon as the ground thaws and any excess moisture drains away. You can plant some species in autumn after deciduous trees drop their leaves, but before the ground freezes. Fall planting is not recommended for some species, including oaks, zelcova, and all stone fruits, such as pears and peaches.

3. **Check drainage.** Before you plant, check the site for drainage problems. If standing water does not drain from the planting hole you have dug, either modify the site by using French drains (trenches filled with coarse gravel), or move the planting site.

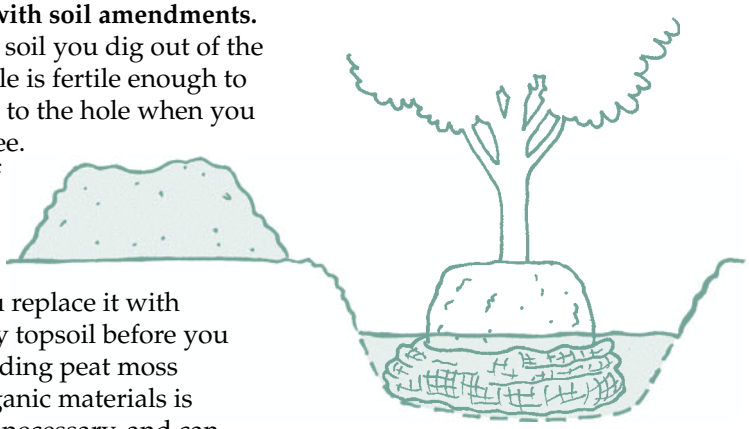
4. **Disturb as much soil as you can.** Abrupt changes in soil texture and fertility at the edge of a planting hole can inhibit root establishment and growth. Unless the soil in your planting area is already quite homogeneous and loose, you should dig a hole that is at least five times the diameter of the root ball and as deep as the root ball. Loosen and mix the soil from the hole before you put it back.

5. **Plant at the right depth.** Place the root ball on solid, undisturbed soil in the center of the planting area. The top of the root ball should be level with the existing surface around the planting hole.



6. **Remove twine, rope, and wire.** Cut any twine holding the branches together. Cut and remove any rope holding burlap in place. If a tree comes in a wire basket, cut at least the top two tiers of wire and remove, or bend the wire down into the planting hole. Peel any burlap halfway down the root ball and shove it into the planting hole. Remove all artificial burlap. Check the tree from at least two sides to make sure it's straight.

7. **Be careful with soil amendments.** Usually the soil you dig out of the planting hole is fertile enough to be returned to the hole when you plant the tree. However, if the soil is extremely poor, we suggest you replace it with high-quality topsoil before you backfill. Adding peat moss or other organic materials is usually not necessary, and can be counterproductive: peat moss acts like a sponge and can hold water in a planting hole instead of aiding drainage, especially in clay or compacted soils.



8. **Backfill, mulch, and water.** Hold the tree straight while you backfill the planting hole. Pack the soil gently as you backfill around the roots. Water occasionally as you fill to help settle the soil. These steps will help eliminate major air pockets around the root system. Once you have covered the root root ball with soil, rake the soil evenly over the entire planting area, and cover the area with three or four inches of composted mulch. Keep the mulch a few inches from the tree trunk, and water the entire area slowly and deeply. You should give your newly planted tree enough water to penetrate the soil to the bottom of the root ball.

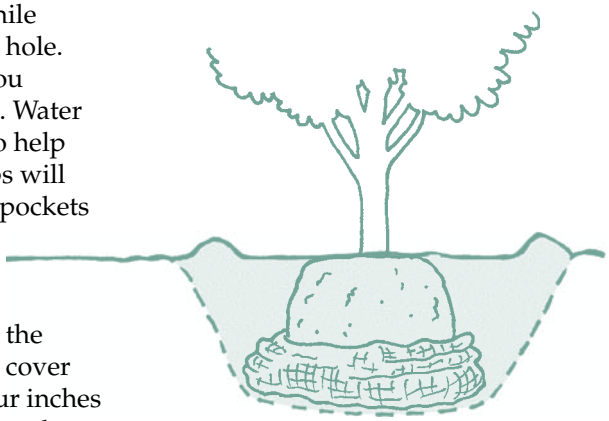


Table 2. Size and Space Guidelines

(Here are some general guidelines to help you decide which species will fit well in the space you have available.)

Available planting space	Tree size	Height at maturity
less than 2 feet		not advisable to plant trees
2 to 4 feet	Short	under 30 feet
4 to 6 feet	Medium	between 30 and 45 feet
more than 6 feet	Tall	over 45 feet

9. **You don't need fertilizer.** During the first year, newly planted trees need, more than anything else, water. Fertilizer won't hurt, but it won't help, either. You might want to lightly fertilize your newly planted trees after the first year in their new location.

10. **Not all trees need to be staked.** Many balled-and-burlapped trees are so heavy that they don't need additional support. Use staking only if a tree is a bit flimsy or needs protection against vandalism or bumping.

11. **Water young trees.** Water young trees at planting and periodically during the growing season. During drought conditions in the first three growing seasons, we recommend watering young trees weekly. Allow the soil around a newly planted tree to dry out between waterings.

12. **Avoid compensatory pruning on young trees.** Some people think you should keep a tree's canopy trimmed back until its root system grows larger, but this is a destructive practice. Young trees bring their own canopies and root systems into balance without pruning. Also, young trees need as much leaf surface as possible to absorb the sunlight and carbon dioxide necessary for photosynthesis. Photosynthesis, in turn, provides the energy for additional root growth. Less efficient leaves, twigs, and branches will die naturally as a young tree grows. Prune only broken, damaged, poorly attached, or malformed branches from newly planted trees.

Maintaining Backyard Trees

Pruning and an annual inspection for signs of stress or infestation are two ways that you can help promote and maintain healthy trees in your backyard. You can do some of the work yourself, but for certain types of work we recommend that you hire a certified arborist.

PRUNING TREES

Young trees

Pruning young trees slowly during the first five years is a sound investment that can decrease future tree damage and maintenance costs. Pruning young trees leads to a balanced and well-spaced branch structure while maintaining the species' typical form. Removing low branches that can interfere with people and equipment will, over a period of years, promote root growth, trunk growth, and trunk taper. Encourage a single leader, or trunk, by pruning back or removing competing leaders. During the first year, prune only broken or dead branches. Don't remove more than 35 percent of a young tree's foliage in any one year, and prune uniformly. Don't use wound dressings; they are unnecessary and can actually cause damage.

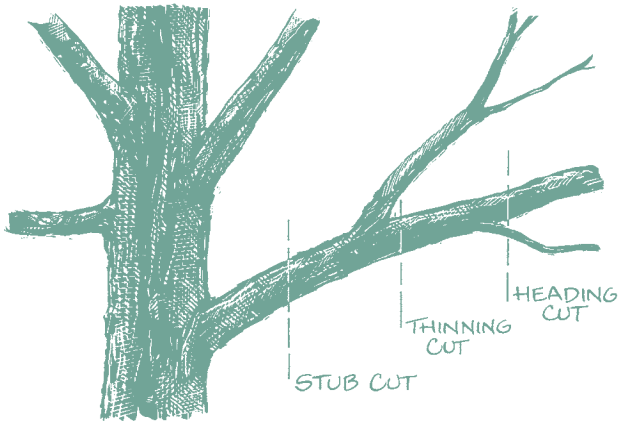
Mature trees

Pruning mature and older trees is complicated and dangerous. We strongly recommend that you hire a qualified arborist and ask for references. The basic guidelines are as follows:

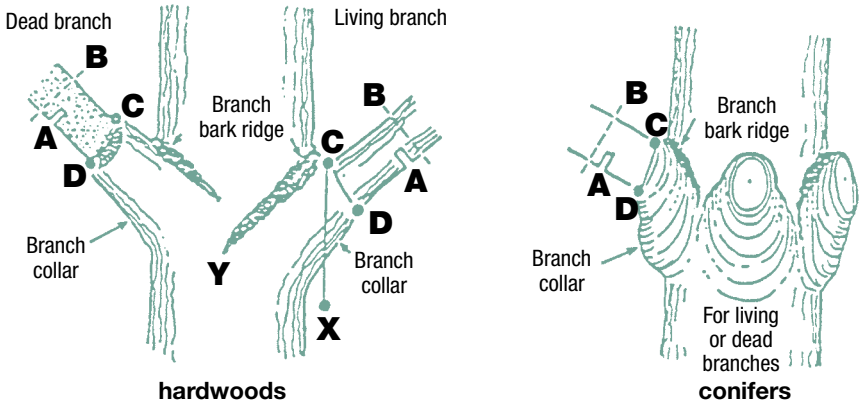
- Always use thinning cuts, which prune a limb back to the trunk or back to a limb large enough to assume growth. Limbs should be pruned back to a limb that is at least one-third of the size of the limb being pruned.
- Don't remove more than 25 percent of a mature tree's foliage in a year.
- Don't remove more than 20 percent of the foliage or branches larger than 8 inches from older trees.
- Leave root pruning to a certified arborist.
- Never use stub or heading cuts to top trees. Such mistreatment induces a high level of decay and stress. Repeated or improper toppings mutilate a tree's structure; induce maximum stress; create large, open wounds prone to decay; and, ultimately, kill a tree.

ANNUAL INSPECTION

Not many people know how to heal sick or injured trees, but we all can learn how to spot problems. One of the best ways to keep track of your trees' health is to look at them! As you become familiar with the trees in your yard, you will become aware of dead or dying limbs, limp or yellowing foliage, insect infestations, fungal growth along the trunk, swellings along the trunk or limbs, and injury sites. The telltale signs of stress, injury, or disease can alert you to the need for intervention. The earlier you detect problems, the better chance you have to remedy them. Once you spot a problem, it's a good idea to call in your arborist to help you decide how to combat it.



When using thinning cuts, always remove or shorten a branch to a side branch that is at least one-third the size of the one being cut. A branch that is 3 inches in diameter would be pruned back to a side branch that is at least 1 inch in diameter. Do not remove more than 25 percent of a mature tree's foliage in any year.



Natural target pruning properly removes a branch while protecting the branch collar, which is essential for woulnds to heal. First cut A, second cut B, and third cut C–D.

To promote closing of a pruning wound by wound wood, always use the tree-step or natural target pruning method when removing a branch. This pruning method protects the branch collar (the shoulder rings and swollen base of a branch) and prevents the tearing of bark. Do not leave a stub when you prune a branch, and do not cut flush against a trunk. Thinning cuts should be made with sharp tools and should be kept as small as possible, clean and smooth.

Forming a Tree Commission

It's a small step from backyard trees to street trees and other community trees. Many cities, towns, and townships are recognizing the many values of trees and putting tree planting and preservation high on their list of priorities. Tree commissions can use the information in this bulletin to help them select, plant, and care for public trees.

Forming a tree commission is one step that people can take to create and maintain their community forest. In fact, Pennsylvania law not only allows, but also encourages municipalities to form tree commissions. Inventorying, pruning, choosing appropriate species, and removing hazardous trees are all duties that a tree commission can oversee or influence. Tree commissions also can help prepare street-tree ordinances and simple public-tree management plans, and help settle disputes over tree pruning and removal.

Tree commissions can have a significant effect on a community's appearance, image, and reputation, as well as its safety and comfort. Commissions provide long-term, stable management for a valuable, long-lived asset. By forming or supporting a tree commission in your municipality, you can improve the environment, beauty, and quality of life in your community.

Sources of Assistance

There are numerous places to get information, advice, and planting stock. We'll outline some of them for you briefly below. Because backyard trees can develop into such a beneficial asset, we recommend that you rely on the services of a certified arborist for technical assistance.

CERTIFIED ARBORISTS

You will find arborists listed in the yellow pages of your telephone book, under "Tree Service." Look for the words "certified arborist." They indicate a level of education and expertise that you should expect from someone who is going to help you take care of your trees. Certified arborists can help you with pruning; insect, disease, and damage control; and tree and stump removal if necessary. They also can recommend appropriate species to plant and reliable sources of healthy specimens. You should choose your arborist carefully, just as you would a doctor or auto mechanic. Ask for references, and choose someone with whom you are comfortable. Word of mouth is often a good way to find a qualified arborist.

COOPERATIVE EXTENSION

Your county Cooperative Extension Office is a good source of information about residential trees. In addition to a horticultural agent who is available to give advice and assistance, Cooperative Extension produces free or low-cost publications, including this Forest Stewardship publication. You also can get assistance from trained volunteers who belong to Cooperative Extension's Master Gardener Program.

For larger-scale tree planting and environmental enhancement projects, you can find information and assistance from the following sources:

URBAN EXTENSION FORESTERS

In Pennsylvania, Penn State Cooperative Extension employs two faculty members and four urban extension foresters who specialize in providing information about trees in residential and urban settings.

University Park
Penn State School of Forest Resources
108 Ferguson Building
University Park, PA 16802
(814) 863-7941

Northeast
Luzerne County Extension
16 Luzerne Avenue, Suite 200
West Pittston, PA 18643
(570) 825-1701

Northwest
Crawford County Extension
13400 Dunham Road, Suite A
Meadville, PA 16335
(814) 333-7460

Southeast
Montgomery County Extension
1015 Bridge Road, Suite H
Collegeville, PA 19426
(610) 489-4315

Southwest
Washington County Extension
100 West Beau Street, Suite 601
Washington, PA 15301
(724) 228-6881

BUREAU OF FORESTRY

The Pennsylvania Department of Conservation and Natural Resources Bureau of Forestry maintains district offices throughout the state. In each county, service foresters are assigned to work with private landowners. Although they work primarily with forestlands, they can also provide good information about many backyard tree species and how to take care of them. Consult the blue pages of your telephone book under "State Government."

CONSERVATION DISTRICTS

Each county has a Conservation District Office that can be a useful source of information about trees and tree planting. In addition, most Conservation District offices have a seedling sale each spring. You can buy two- and three-year-old bare-root seedlings of various species, including fruit trees, for very reasonable prices (usually $5 or $6 for a bundle of 10 seedlings).

Additional References

Bazan, Eugene, Bill Elmendorf, and Henry Gerhold. *Fundraising for Community Tree Projects.* University Park: The Pennsylvania State University, 1997. (A 31-page book that provides information and examples about completing grants and other funding tools.)

Council of Tree and Landscape Appraisers. *Guide for Plant Appraisal.* Savoy, Ill.: International Society of Arboriculture, 1994. (Guide for appraising the value of trees and other plants.)

Dirr, M. A. *Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation, and Uses*, 4th ed. Champaign, Ill.: Stipes Publishing Company, 1990. (Detailed characteristics of many trees.)

Elmendorf, Bill, and Henry Gerhold. *A Guide for Municipal Tree Commissions* . Mechanicsburg: Pennsylvania Forestry Association, 1996. (A 47-page booklet that provides guidance on a tree commission's duties.)

——— . *Planting and After Care of Community Trees.* University Park: The Pennsylvania State University, 2001. (A 30-page publication primarily for people who plant and maintain trees in public landscapes, such as streets and parks. The publication also provides useful information for homeowners.)

——— . *Pruning Landscape Trees.* University Park: The Pennsylvania State University, 1997. (Describes proper methods of pruning young and mature landscaping trees.)

Elmendorf, Bill, and Sanford Smith. *Planting Trees in Your Community Forest*. University Park: The Pennsylvania State University, 1999. (A booklet for children and adults that describes proper tree planting and care.)

Gerhold, Henry, Willet Wandell, and Norman Lacasse. *Street Tree Fact Sheets.* University Park: The Pennsylvania State University, 1993. (A practical publication that describes the tolerances and characteristics of hundreds of tree species and cultivars.)

Hightshoe, G. L. *Native Trees for Urban and Rural America: A Planting Design Manual for Environmental Designers*. Ames: Iowa State University, 1978. (Characteristics and uses of native plants.)

Hock, W. K., G. A. Hoover, and G. W. Morman. *Woody Ornamental Insect, Mite, and Disease Management.* University Park: The Pennsylvania State University, 2000. (Practical advice about tree pests.)

International Society of Arboriculture. *Arborists Certification Study Guide.* Savoy, Ill.: International Society of Arboriculture, 2001. (Comprehensive study guide about tree maintenance for the certified arborist test.)

——— .*Plant Health Care for Woody Ornamentals: A Professional's Guide to Preventing and Managing Environmental Stresses.* Savoy, Ill.: International Society of Arboriculture, 1997. (A professional's guide to preventing environmental stresses and pests of trees.)

——— .*Tree Pruning Guidelines.* Savoy, Ill.: International Society of Arboriculture, 1995. (Guidelines for correctly pruning landscape trees.)

——— .*Trees in Developments.* Savoy, Ill.: International Society of Arboriculture, 1998. (A professional's guide to preserving trees in developments.)

National Arbor Day Foundation. *Tree City USA Bulletins.* Nebraska City, Neb.: National Arbor Day Foundation, n.d. (A series of informative brochures on a variety of topics including preserving trees in developments, proper pruning techniques, hazardous trees, and topping trees.)

Shigo, A. L. *A New Tree Biology.* Durham, N.H.: Shigo and Trees, 1986. (A guide to better understanding of trees, their problems, and proper tree care.)

Shigo, A. L. *Modern Aboriculture: A Systems Approach to the Care of Trees and Their Associates.* Durham, N.H.: Shigo and Trees, 1990. (Innovative and practical book about tree care and maintenance.)

NOTES

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College of Agricultural Sciences

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Pennsylvania Forest Stewardship Program

Forests for Life

The Forest Stewardship Program is administered nationally by the USDA Forest Service and is directed in Pennsylvania by the DCNR Bureau of Forestry with assistance from a statewide steering committee. The Forest Stewardship Program assists forest landowners in better managing their forestlands by providing information, education, and technical assistance. For more information about program services and publications contact: The Pennsylvania Forest Stewardship Program, DCNR Bureau of Forestry, P.O. Box 8552, Harrisburg, PA 17105-8552. Phone: (800) 235-WISE, or (717) 787-2106.

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