Authors:
Susan Barton, Extension Specialist
University of Delaware

Gary Schwetz, Program Manager
Delaware Center for Horticulture

Charles Newlon, Adjunct Forestry Professor
Delaware State University

Easy Reference:

Miss Utility	1-800-282-8555
ISA	www2.champaign.isa-arbor.com.
Delaware Center for Horticulture	658-6262
Delaware Cooperative Extension	
New Castle County Garden Line	831-8862
Kent County	730-4000
Sussex County	856-7303
Delaware Department of Agriculture, Urban Forestry	800-282-8685

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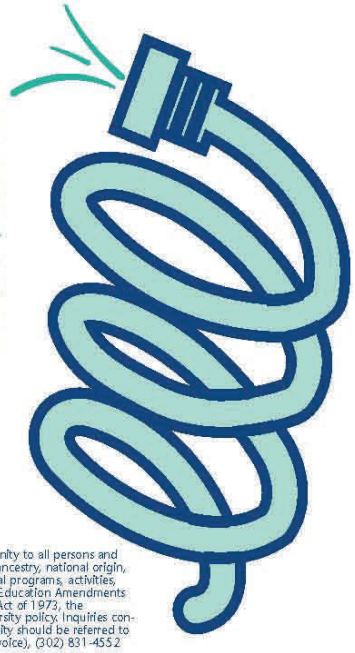

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TREES ARE IMPORTANT TO PEOPLE

Trees are important to people. Research shows that access to nature plays a significant role in life satisfaction. The most preferred scenes are ones in which nature is dominant, where there is a smooth ground texture and where trees help define the depth of the scene. Patients recover more quickly when the view from their hospital window includes trees, and trees in apartment courtyards promote social interaction.

Trees also improve the physical environment. They improve air quality by trapping dust particles and replenishing oxygen. Trees save energy by cooling during summer and providing wind breaks in winter. Trees can reduce air conditioning needs by 30 percent and save 20 to 50 percent on fuel costs for heating. Trees improve water quality by reducing the impact of raindrops—resulting in less runoff and erosion.

Trees provide habitat for animals and birds add beauty to the environment and soften the harsh lines of the urban and suburban world.

Ecosystem refers to all of the organisms in a given place (including people) and their interactions with each other and the environment. Ecosystem-based management is new to urban and community forestry, shifting the focus from individual street trees to entire communities. With an ecosystem-based management approach, we can appreciate how trees reduce storm water runoff.

Plant trees to:

- Provide oxygen and help settle dust and other air pollutants
- Screen undesirable views
- Frame attractive views
- Reduce noise pollution
- Control storm water and reduce erosion
- Cool the environment
- Reduce energy use
- Enhance wildlife diversity
- Increase property value
- Provide four-season beauty with flowers, leaves, fruit and bark
- Reduce mental fatigue
- Build community values
- Improve life satisfaction

TREES AND CITIZEN RESPONSIBILITIES

Tree ordinances exist to define the authority for the care of public trees. Tree legislation can formalize the relationship between citizens and municipalities to implement tree care in the best interest of the community.

The reasons to enact a tree ordinance are many, including to:

- Ensure appropriate trees are planted in appropriate areas
- Increase safety of the community
- Minimize liability
- Minimize storm damage mitigation and storm cleanup
- Lessen damage to sidewalks, sewers and streets
- Avoid obstruction of motorist views and signage; to ensure continuous and reliable electricity
- Reduce tax burden created from deferred maintenance

Ordinances can include the following provisions:

- Establish a process, possibly permitting, for tree removal, pruning and planting
- Ensure that people who perform work on the trees are well-qualified
- Require developments and parking lots to have trees and landscaping
- Protect trees during development and construction;
- Establish a municipal tree commission

Example ordinances and tree plans from other communities are available from the Delaware Department of Agriculture Urban Forest Coordinator.

Responsibility for care of trees varies. Some ordinances place responsibility for right-of-way trees on property owners (e.g., Wilmington.) Some developments and municipalities in Delaware assume the care responsibilities of the street trees in their community.

Check with your local authority to determine citizen responsibilities in your community. Understand the legal requirements and obtain the necessary permissions before beginning a tree project. Be particularly cautious in cases in which utilities are involved. Law requires that before any digging for planting trees takes place, you call "Miss Utility" (1-800-282-8555) so that underground utilities can be marked.

COMMUNITY INVOLVMENT

The entire community will benefit from a well-managed community forest. Maintaining a healthy and safe community forest requires the support of informed, involved citizens. Many citizens and leaders do not recognize the importance of trees and are not willing to pay (taxes) for a community tree program. Public involvement in decision-making, educational activities and volunteer projects help people understand the importance of a community's trees. A tree commission is a great way to foster community involvement.

A tree commission can:

- Provide a vehicle for citizen involvement in municipal tree programs
- Control all tree-related matters in a municipality or serve as an advisory body (or something in between)
- Develop a street tree ordinance
- Conduct a tree inventory
- Formulate a community tree plan

Information on community involvement is available from many professional sources of assistance, including Delaware Cooperative Extension, Delaware Center for Horticulture and Delaware Department of Agriculture Urban Forestry Coordinator (a specific list of publications and resources is available).

PLANT SELECTION

DIVERSITY

A wide diversity of trees in an urban forest is essential to give scenic beauty and variety, to provide food and habitat for wildlife, and to protect

against exotic pest disasters. To avoid disasters caused by introduced pests such as the Dutch elm disease:

- Never use a single species in mass plantings in a park or neighborhood.
- Never allow one species to dominate a shopping mall or corporate campus.
- Never line a long street on both sides with one species.
- Group species in multiples of 3, 5 or 7. Urban wildlife health and diversity depend on a variety of tree species.
- A good guideline is to plant no more than 20 percent of a single species.

CLIMATE

It is important to select species that will survive in your USDA Cold Hardiness Zone. Southern Delaware is in cold hardiness zone 7, while northern Delaware is right at the border between zones 6 and 7. Deodar cedars grow well in southern Delaware but are considered borderline in the northern part of the state. Cold hardiness is not the only important climatic factor. You must also consider warm hardiness, or the southern-most range of a species. European white birch is a fantastic tree in New England, but is below its southern climatic range in Delaware and suffers many disease and insect problems. Warm hardiness is harder to quantify than cold hardiness because it is a chronic problem, weakening trees rather than killing them immediately during a low-temperature event. Plants that are grown at the southern end of their range become weak and gradually succumb to disease or insect problems.

Native trees have evolved with an adaptation to the climate of Delaware, so they will be both cold- and warm-hardy. However, many non-native trees and shrubs are also well adapted to Delaware's climate.

- Follow USDA Cold Hardiness Zone guidelines when selecting plants.
- Refer to the recommended plant list in this publication for guidance.

MICROHABITATS

Many microhabitats exist within a climatic region. While the overall temperature range fits the hardiness zone, the microhabitat may provide extra warmth, moisture, wind, salt or a host of additional characteristics. Some microhabitats are by human creation such as buildings, and walls in the form of angles, edges, hot reflective surfaces, cool shadows, and wind tunnel effects. Select trees for their ability to withstand conditions of the individual planting site.

Look for the following possible microhabitat extremes:

- Very wet or very dry conditions
- Unusually high soil temperatures
- Soil compaction and lack of oxygen availability
- Deep or day-long shade from structures or other trees
- Heat reflected from glass, light colored walls, concrete or other structures
- Ocean salt spray or heavy salt from ice and snow treatments
- High winds tunneled between buildings
- Possibility of damage from car doors, bumpers, mowers and string trimmers
- Likelihood of vandalism
- High probability of buried construction materials or other rubble
- Natural gas, water, sewer, or buried electrical and communication lines
- Likelihood of consistently high auto exhaust and smog levels

APPROPRIATE SIZE

Little trees can grow into very big trees. Never plant medium-height (30 to 50 feet tall at maturity) or tall (60 to 100 feet at maturity) trees under power lines. If a tree must be planted near power lines, choose one that grows no higher than 15 to 25 feet.

Smaller transplanted trees establish and resume growing more quickly than larger (and often more expensive) trees. A larger caliper (trunk diameter) tree (such as 3- to 4-inch caliper) takes several years to recover from transplant shock. A 1½ - to 2-inch caliper tree establishes and grows more quickly and often catches up to the 4-inch caliper tree before the larger tree recovers from shock.

DESIGN

Before selecting a tree, consider the function you wish the tree to provide. Will it be viewed as a single specimen, or is it part of a cluster of trees and plants that create a grove or mass? How is the site used? Do people want shade, a screen from traffic or the enclosure provided by a canopy of trees? Should the tree be green all year (evergreen), or should it allow sun to warm the area in the winter (deciduous)? What special features, such as bright fall color, winter bark interest, colorful fruit or showy flowers, are desired?

If the effect of an individual species is desired, allow the following distances between trees so each tree has room to develop as it matures:

Large trees (60-100 feet tall)	40-75 feet
Medium trees (30-50 feet tall)	30-50 feet
Small trees (less than 30 feet tall)	20-40 feet

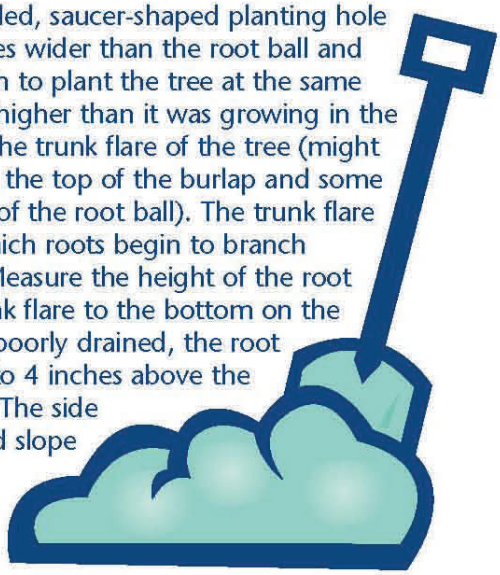
Try planting some trees together in a cluster. The shared root space will improve tree survival and the effect will be more natural. Select trees whose mature size and shape is in the proper scale to fit the site and surrounding buildings.

- Select trees that perform the desired function
- Look for special ornamental attribute (i.e., flower, fruit, bark and fall color)
- Space trees properly as individuals or in natural-looking clusters
- Select trees with the proper scale for the site

SITE PREPARATION

The single most common cause of tree failure in urban environments is compacted soil. Before planting, do whatever you can to loosen the soil, except in the bottom of the planting hole. If you are planting a large bed with several trees, shrubs and groundcovers, work up the soil and mix in organic matter, such as compost. The time and money you spend in proper preparation will result in much greater tree survival and be well worth the effort. If you are planting a single tree, work up the soil in as large an area as possible. Work up a space 2 to 3 times the diameter of the root ball. It is very difficult to modify the soil once the tree is planted. Check the soil pH. If it is too low, add lime to the planting area. If it is too high, add granular sulfur. High pH is often a problem in urban soils. Building materials buried in the soil elevate pH and make essential nutrients such as iron unavailable.

Dig a rough-sided, saucer-shaped planting hole that is 2 to 3 times wider than the root ball and only deep enough to plant the tree at the same depth or slightly higher than it was growing in the nursery. Look at the trunk flare of the tree (might require removing the top of the burlap and some loose soil on top of the root ball). The trunk flare is the point at which roots begin to branch from the trunk. Measure the height of the root ball from the trunk flare to the bottom on the ball. If the site is poorly drained, the root ball should be 2 to 4 inches above the surrounding soil. The side of the hole should slope gradually up to the surrounding grade.



Do not dig a deep hole and backfill because the soil underneath the ball will settle and your tree will be planted too deeply.

- Loosen compacted soil as much as possible
- Test and modify pH if indicated (lime to raise pH and sulfur to lower pH)
- Locate trunk flare to measure depth of root ball
- Dig a hole that is 2 to 3 times wider than the root ball and as deep or shallower than the root ball
- Dig a saucer-shaped hole with rough sides
- Leave the soil undisturbed at the level the root ball will rest

PLANTING PROCESS

The best times to plant trees are the spring and early fall. If you plant early in the fall, the tree becomes settled and will begin root growth immediately. If you wait until spring, plant early enough so tree roots grow into the surrounding soil before the hot, dry summer arrives. However, certain species that produce little root growth in the fall should be planted in the spring. These species include magnolia, tulip poplar, most evergreens, oaks and dogwood.

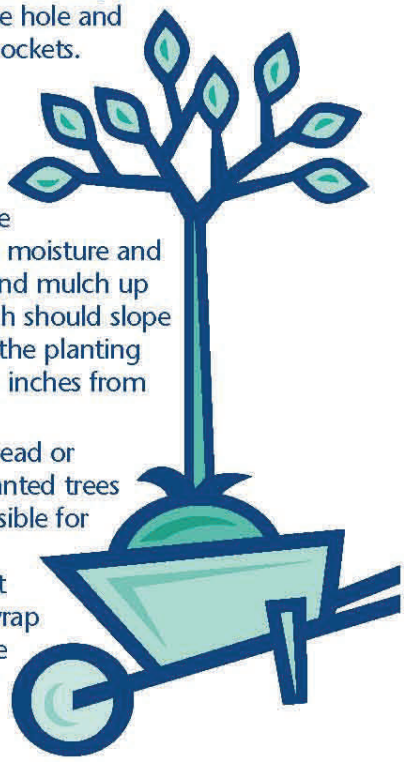
You can plant in late spring or summer, but you will need to provide extra water for the entire growing season as the tree attempts to support its leaves with a limited root system. Trees take about one year per inch of trunk caliper (trunk diameter at 6 inches above the ground) to become established in a site. A large, 3-inch caliper tree will require three years of extra care before it is established in its new location. Many people care for their trees for the first month after planting, but trees require much longer care to become well established.

Gently place a balled-and-burlapped tree into the planting hole to avoid breaking the root ball, because if the root ball falls apart, many minute root hairs are ripped away and the root cannot adequately absorb water and nutrients. Always handle balled-and-burlapped trees by the root ball—not the tree trunk. A balled-and-burlapped tree has less than 10 percent of its original root system, so you must be careful with what is left!

Container trees are usually planted in lightweight artificial media and are often pot-bound. Since container trees have 100 percent of their original root system, you can damage a few roots without harming the tree. Break up circling roots to promote root growth into the surrounding soil and remove as much of the artificial media as possible, either by teasing the roots apart or by washing the media away with a hose.

Cut and remove all twine from the tree trunk. Once the ball is in the hole, gently slide the burlap out or cut away as much as possible. Treated or synthetic burlap and tree bags must be removed completely. For trees in wire baskets, cut and remove wire (at least top two circles).

Backfill with the soil you removed from the hole. If the soil is too poor or full of debris, use soil that is as similar as possible to the surrounding soil. Backfill two-thirds of the hole and add water to eliminate air pockets. Continue backfilling and watering until the hole is filled.



Spread a 2- to 3-inch mulch layer around the base of the tree to help conserve moisture and reduce weeds. Do not mound mulch up against the tree trunk. Mulch should slope gradually from the edge of the planting space to the soil line several inches from the trunk.

At planting, prune only dead or injured branches. Newly planted trees need as many leaves as possible for photosynthesis required to provide energy for new root growth. Remove any tree wrap that was used to protect the tree trunk during transit. Once planted, tree wrap only harbors insects and undesirable moisture that may rot tree bark. Don't fertilize trees at planting. Wait until the second year to avoid burning young roots.

Most trees do not need staking. Trees are often planted and forgotten. When no one removes the stakes, staking straps can girdle the tree. If trees are large, top heavy, planted in a very windy area or require protection in a tough urban environment, staking may be necessary. Stake trees properly by hammering two tall stakes or three short stakes into the ground beyond the root ball area. Secure the tree with flexible strapping and allow 1 inch of play in the straps to help the tree develop a strong trunk and root system. Remove the stakes and strapping after 4 to 6 months. (Do not use wire and hose!)

- Plant in the early spring or fall
- Handle balled-and-burlapped trees gently
- Remove artificial media and loosen circling roots on container trees
- Cut and remove all twine
- Remove as much burlap as possible and all synthetic burlap

- Cut the top two rings of wire baskets
- Backfill with soil from the planting hole and settle the soil by watering
- Spread a 2- to 3-inch deep layer of mulch around the tree
- Keep all mulch 2 to 3 inches away from contact with the trunk
- Prune only dead or injured branches
- Remove tree wrap
- Don't fertilize at planting
- Stake only trees that require staking; use flexible straps and allow about 1 inch of movement. (Do not use wire and hose!)

MAINTAINING YOUR TREES

Planting a tree is satisfying, yet too many people forget the next step—long-term care.

WATERING

To ensure the establishment and growth of a new tree, water it correctly during the first year. Water new trees at least once a week to a depth of 1 foot. Water more frequently during dry weather.

- When using a hose, allow the water to trickle out for at least an hour, and move the hose several times during that time. Watering bags are effective tools for applying water slowly.
- If you are watering from a container, apply at least 5 gallons, pouring it slowly over a board or shovel blade to spread the water.
- Keep trees well watered throughout entire establishment period (one year or more) with deep, slow watering

FERTILIZING

Do not apply fertilizer during the first year after planting. Fertilizer may burn tender roots and promote top growth before the root system becomes well established. Fertilize the next year after planting, but first take a soil test to determine how much phosphorous, and potassium are present in the soil. Nitrogen (N), phosphorous (P), and potassium (K) are primary tree growth elements. A bag of fertilizer lists three numbers; for example, 10-8-6. The first number is the percentage of nitrogen; second is the percentage of phosphorous; and the third is the percentage of potassium.

A mature tree growing in a lawn that is fertilized regularly does not need extra fertilizer. Trees confined to small planting areas usually have a greater need for fertilizer.

To speed young tree growth the second year;

- Take a soil test to determine fertilizer needs during the second year after planting and fertilize young trees to promote growth. Recommendations are attached to soil test results from the University of Delaware Soils Testing Laboratory provide information on proper tree fertilization.
- Spread 2 cups of 10-8-6 around the base.

MULCHING

Mulching helps reduce weeds, moderates soil temperatures, and is a visual reminder to keep mowers and string trimmers away from tree trunks. Many materials make good mulches, including shredded bark and bark chunks, composted sewage sludge, one-year-old wood chips, pine needles, and composted, shredded leaves.

- Don't use plastic sheets under the mulch because they interfere with the passage of air and water as well as inhibit root growth.
- Apply 2 to 3 inches of mulch around, but not touching, the tree trunk.
- Never pile up a cone of mulch around the trunk! Rodents and insects will over-winter in mulch and feed on the trunk. Cone-shaped mulch piles and thick layers of mulch also can keep water from reaching tree roots.
- Do not build up layers of mulch by adding a new layer each year. Each spring, rake to remove any hard crust and add only enough new mulch to maintain a 2- to 3-inch layer.
- Maintain a 2- to 3-inch mulch layer around, but not touching the base of the tree.

PRUNING TREES

Prune sparingly immediately after planting, removing only branches damaged during the transplanting process. Wait to begin necessary corrective pruning

until after a full season of growth in the new location.

Pruning is the most common tree maintenance procedure, and a few simple principles will help anyone understand how to prune a tree. Proper technique is essential; poor pruning can cause damage that lasts for the life of the tree. Learn where and how to make the cut before picking up the pruning shears. Each cut has the potential to change tree shape, so always have a purpose in mind before making a cut.

Trees do not "heal" the way people do. When a tree is wounded, it must grow over and "compartmentalize" the wound. In effect, the wound is contained within the tree forever. As a rule, small cuts do less damage to the tree than large cuts. This is why proper pruning (training) of young trees is critical. Waiting to prune a tree until it is mature can create the need for large cuts that the tree cannot grow over easily.

Although forest trees grow quite well with only nature's pruning, landscape trees require a higher level of care to maintain their safety and aesthetics.

- Remove dead or diseased wood anytime
- Correct crossing branches, branches that grow back into the center of the tree or branches that form narrow-angled crotches when a tree is young
- Remove suckers and water sprouts that disrupt the natural shape of the tree
- Prune with sharp tools that are appropriate for the branch size (pruning saw for branches thicker than ¾ inch; tree loppers for branches up to ¾ inch; pruning shears for branches no thicker than a pencil)
- Use the 3-cut method for any branch you cannot support with your free hand (usually 1 inch and larger diameter). This method prevents bark stripping.
  1) Saw a notch on the underside of large limbs several inches away from the trunk
  2) Then on the top of the branch, make your next cut just beyond the undercut to remove the bulk of the branch
  3) Make the final pruning cut outside the bark-branch intersection or collar
- Do not apply wound dressing or tree paint to the cut surface; it can trap water and start decay.
- Avoid pruning during the spring when trees are leafing out

An arborist is a specialist in the care of individual trees. Many professional arborists belong to and are certified by the International Society of Arboriculture (ISA), which advocates and documents the correct procedures for pruning trees. You can learn more about proper tree pruning procedures by contacting the ISA through a local arborist or at their Website: www2.champaign.isa-arbor.com.

Pruning or removing trees, especially large trees, can be dangerous work. Leave this to the professionals who have the proper equipment and safety measures. To ensure that the proper practices are employed, follow only ISA approved procedures and hire only ISA-certified professionals to perform tree work.

Common Problems to Avoid

Insects and disease-causing pathogens are not usually the primary reasons for trees failing even though they may be the first things that come to mind when you recognize unhealthy trees. Typically, insects and diseases are the secondary agents that attack already weakened, wounded, improperly treated, neglected or generally unhealthy trees. Healthy, vigorous trees have defense mechanisms to combat insect and disease problems. In order to maintain healthy trees in an urban environment, it is necessary to identify and avoid some basic cultural mistakes.

Compaction

When soil is excessively compacted, there is no room for the oxygen necessary for the health of tree roots. Eliminate traffic over the root system of trees.

Excess mulch

A 2- to 3-inch layer of mulch is sufficient. When mulch is piled upon mulch each year, roots grow into the mulch layer. Those roots are susceptible to drought stress and winter injury. Mulch can also become crusted, causing water to run off. Add mulch to maintain a 2- to 3-inch layer only as the old mulch decomposes. Rake the mulch periodically to break up the crust that forms and incorporate it into the soil.

Trunk, Bark, Branch and Root Damage

Any damage to the physical integrity of the tree provides an entry point for insects and disease organisms. Keep lawn mowers and string trimmers away from the base of trees. Do not fasten bicycle lock chains around tree trunks. Never put nails into the tree trunk.

Supports, Wire, Twine and Tree Wrap

Supports, wire and twine left on newly planted trees are common causes of girdling damage. The girdling will gradually cut off the flow of water and nutrients and by the time damage becomes noticeable the tree can be near death. Tree wrap left on too long provides

a haven for insects and can cause girdling. Remove all twine and tree wrap at planting and remove supports after one growing season.

Lawn Amendments and Chemicals

Some fertilizers, amendments and weed killers that are beneficial to lawns may be taken up by tree roots and can harm or kill a tree. Do not use chemicals such as Dicamba near desirable trees known to be sensitive to that chemical. Trees that require acidic soil such as pin oaks may not be compatible with a lawn area. Consider a compatible ground cover treatment such as mulch for the root zone of an acid-loving tree.

Dog urine

Urine is highly acidic. It causes root injury and reduces nutrient uptake. Discourage pet owners from allowing their dogs to repeatedly target trees.

Salt Damage

Salt used on roads and sidewalks for de-icing will cause tree root damage. De-ice sidewalks with sand, ash or calcium chloride instead of sodium chloride or rock salt.

Soil Grade Changes

Adding or removing even a small amount of soil at the surface of the tree's root zone will damage the tree. Excess soil on top of the roots reduces the oxygen available. Since most of a tree's roots are in the top 6 inches, removal of soil also means removal of roots. Avoid grade changes greater than 2 inches. Be aware that the root system may spread far beyond the furthest branches (drip line) of the tree, typically two to three times or more.

Wounds

When a tree is wounded or pruned, do not treat with a wound dressing. The tree is best able to recover from a wound when left to its own protective mechanisms. Carefully remove only damaged and loose bark that might be torn later and may inhibit callus growth.

DIAGNOSING PROBLEMS

Several signs can help pinpoint tree problems while they are still treatable.

Root Flare

Does the tree enter the ground with a natural flare or swelling? No flare may mean soil has been filled around the tree and roots are suffocating. No flare may also mean there is a girdling root restricting food, nutrients, and water.

Crown Dieback

Search for dead twigs or branches dying back from the tips to the trunk in the tree crown. Dead twigs and branches may mean old age, insect or disease infestation, or root injury. Crown dieback may indicate too much or too little moisture, or too much competition.

Abnormal Leaf Size

A tree that has leaves smaller than the normal size may have a root injury. Leaves that are larger than normal, especially on root suckers, can also indicate root damage.

Trunk Scars

Partially "healed" wounds on trunks may be signs of hidden decay. Look for ragged scars on the trunk that are not callused over. To speed callusing, remove damaged, ragged tissue carefully with a sharp knife. Coating wounds with preparations has not been proven to promote healing, and coatings can trap water and provide habitat for insects and diseases that cause damage and decay.

Disruption of Root System

Root systems grow primarily in the top 3 feet of soil; the small absorbing roots are mostly in the top 6 inches. The roots are easy to damage. Sidewalks and streets paved over roots can severely compact the soils around fine roots. Trenches cut to install underground utility lines can remove all roots alongside of a tree. The impact of such root damage may not show up in the tree crown for two to five years.

Yellow Foliage

The general yellowing of a leaf, often called chlorosis, can be caused by a variety of factors, including insects, disease, too much moisture, cold weather, air and soil pollution, excess minerals in the soil, nutrient deficiencies, or a pH imbalance.

Sticky Substance Dripping From the Tree

Insect honeydew is usually the waste product of insects such as aphids, lace bugs, or scale. While this aggravating problem can be controlled with insecticides, insects causing the honeydew seldom harm the health of the tree.

Insects

Large populations of insects may or may not damage a tree. Inspect your trees on a regular basis. Look for signs of reduced tree health. Some adult insect populations last only a few days and some can last for eight weeks. An impulsive control measure will destroy the natural predators that could control the pest without any intervention. If you suspect an insect pest, collect the pest and the symptoms and take them to your local Cooperative Extension office for identification and control recommendations.