United States
Department of Agriculture

Forest Service

Northeastern Area
State and Private Forestry

NA–FR–01–10
July 2010

Tree Owner's Manual

www.treeownersmanual.info

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Table of Contents

Important Precautions

WARNING: To reduce the risk of personal injury or permanent damage to your tree, read and follow these important precautions:

- ❑ Do not dig until you are sure there are no buried utilities. Call the free utility marking service at 1-888-258-0808 (p. 5).
- ❑ Never prune trees or branches that are within 10 feet of utility lines; contact your local utility company.
- ❑ Keep lawn mowers and weed whips away from the base of your tree.
- ❑ Do not tie string, ribbon, wire, or pet leashes around the trunk or branches.
- ❑ Do not allow construction activities (digging, repaving, grading, building) within the Protected Root Zone (p. 24).
- ❑ Do not top your tree (p. 23).
- ❑ When hiring an arborist, select someone who has general liability insurance of at least $1 million per occurrence and $2 million aggregate (p. 28).
- ❑ Check with your city or town to see if there are laws regarding planting and pruning.
- ❑ If you cannot prune your tree with both feet on the ground, hire an arborist (p. 28).
- ❑ Do not let children climb trees that have branches within 25 feet of a power line.
- ❑ Do not nail or screw anything into your tree.

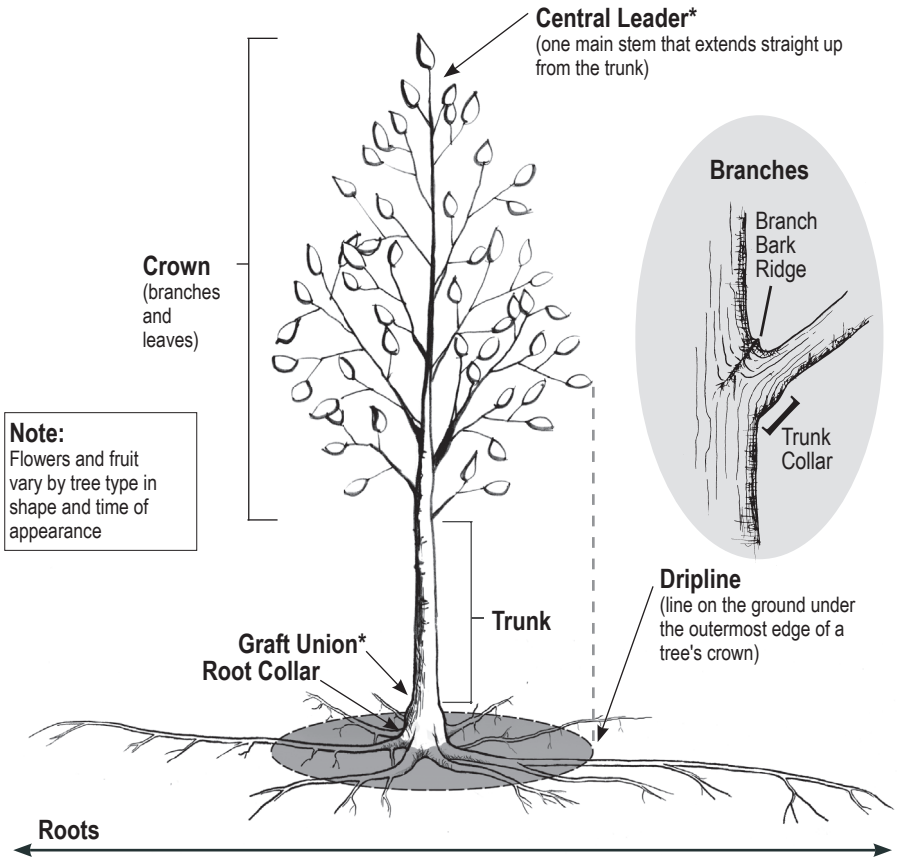
These symbols are used throughout this manual:

⚠ = Potential for personal injury or legal issues

= Potential for permanent damage to tree

> > > > > > > Save this manual for future reference. < < < < < < <

Broad-leaved Model
(has flat leaves, but is not a palm)

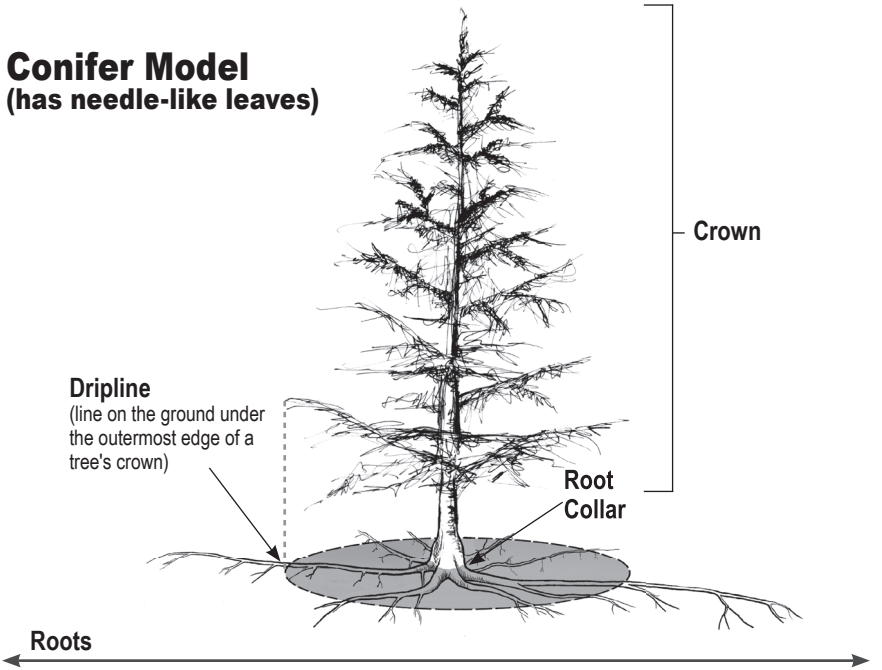


Palm Model
(has fronds for leaves)

Palms only grow leaves from one spot—the top of the trunk.

*Not present on all trees

Conifer Model
(has needle-like leaves)



PACKAGING

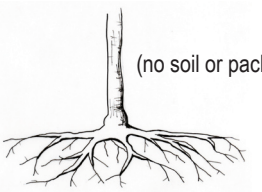
Roots

Your tree has been packaged in one of the following ways:

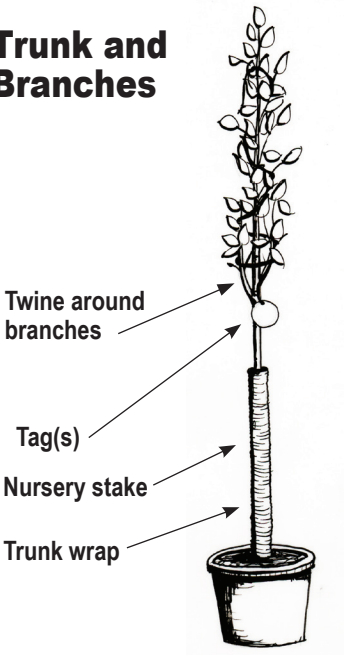
Balled and burlapped/ boxed

Containerized

Bare root



Trunk and Branches



Pre-Installation (Preparing to Plant)

Materials

- ❑ Tape measure
- ❑ Phone

Instructions

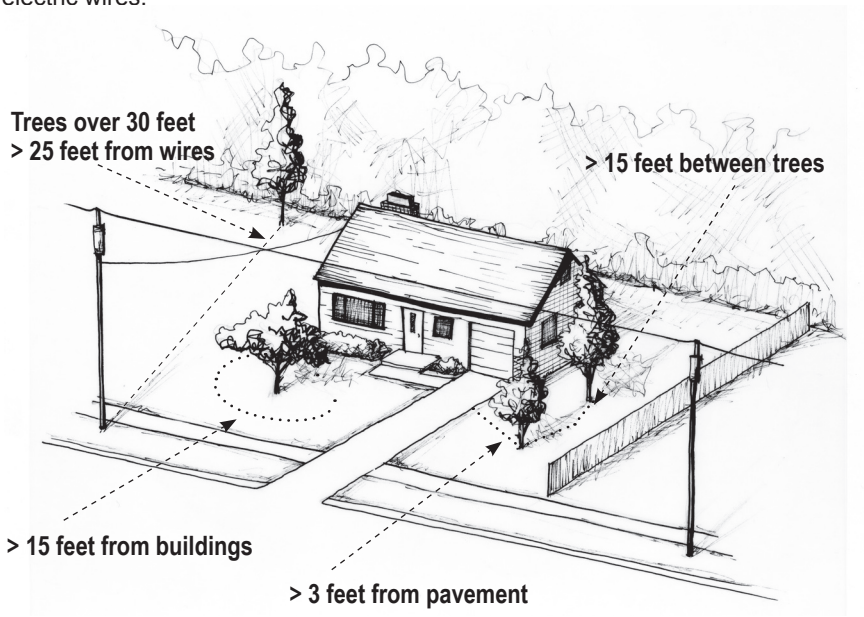
Step 1: Check above ground.

Your tree will grow.
Do not plant your tree where it will interfere with buildings, overhead utility lines, pavement, or intersection sightlines as it gets bigger.

Make sure your planting spot is at least. . .

- ❑ 3 feet from pavement or fencing on all sides
- ❑ 15 feet from buildings or other trees
- ❑ 25 feet from overhead electric wires, if your tree will grow taller than 30 feet.

If your tree will grow taller than 30 feet, do not plant it within 25 feet of overhead electric wires.



Step 2: Check below ground.

⚠ **It's the law to call (in most states).**

⚠ **Shocks can be deadly.**

At least 72 hours in advance of planting, call the underground utility locating service in your area to be sure that there are no buried utilities where you want to plant. Most services will mark utilities (e.g., electric, cable, gas) for free.

Call before you dig!
1-888-258-0808

Step 3: Check laws.

Some government agencies have laws governing tree planting, care, and removal. Check with your town or municipality to be sure that you are complying with these regulations and landscape ordinances.

Will Your Tree Become a "Public Tree," Under the Control of Your City or Town?

Public trees are those located on municipal property or within the road right-of-way (ROW)– regardless of who planted the tree.

The ROW is an extension of your city's or town's control beyond the street edge, oftentimes reaching 10 feet or more beyond the pavement.

Trees located within the ROW are under the jurisdiction of the municipality.

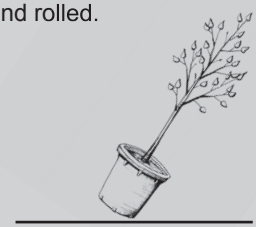
In these cases, state or local laws may dictate the type and location of trees that can be planted in the ROW. Check with your city or town regarding ordinances or policies pertaining to public trees.

Installation (Planting)*

How to Move Your Tree

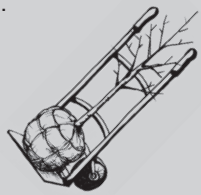
Carry your tree by its root package (ball or container)—not the trunk! Steady it by holding the lowest part of the trunk.

Large containerized trees may be tipped onto the bottom edge and rolled.



For balled-and-burlapped trees, you may find it easiest to place tarps or ropes under the ball as a sling.

A dolly or other cart may also be used.



Protect the trunk. Even a small wound on a young tree can cause permanent damage.

Materials

- ❑ Tape measure or yard stick
- ❑ Metal skewer, coat hanger, stout wire, or pointed screwdriver
- ❑ Shovel
- ❑ Sharp knife or scissors
- ❑ Hand pruner—*bypass* type (p. 19)
- ❑ 5 gallons of water
- ❑ 4-5 cubic feet of organic mulch (one wheelbarrow load or two large bags)
- ❑ Large-gauge wire cutter if balled and burlapped or boxed
- ❑ Hand saw if containerized and the main root system is more than 1 inch below the soil surface (Step 4). An inexpensive folding pruning saw works well, but any saw would work.

Instructions

If you have NOT yet read the section on Pre-Installation (Preparing to Plant), do so now.

Do not dig until Step 6.

*Hargrave, R.; Johnson, G.; Zins, M. 2002. Planting trees and shrubs for long-term health. St. Paul, MN: University of Minnesota Extension Service. 12 p.

Step 1. Move the tree.

Young trees are not 2 by 4's.
Do not lift or carry your tree by its trunk (unless bare root). See the sidebar on How to Move Your Tree.

Step 2. Remove trunk and branch packaging.

Remove trunk wrap, twine around the branches, labels, and nursery stake. Leave any root packaging in place for now.

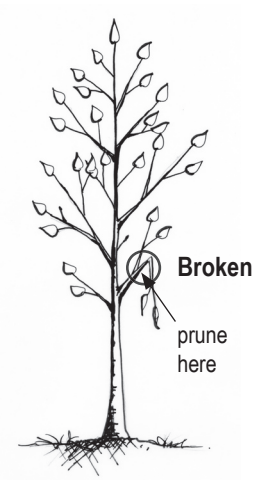
Step 3. Prune critical branches and no others!

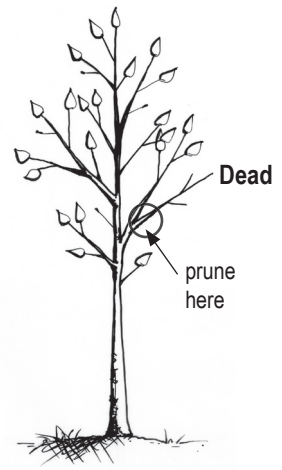
Prune only branches that are broken, dead, or competing as a leader. Most trees should have one central leader (p. 2-3). If there are two or more leaders, choose which one you want to remain and remove the other(s).

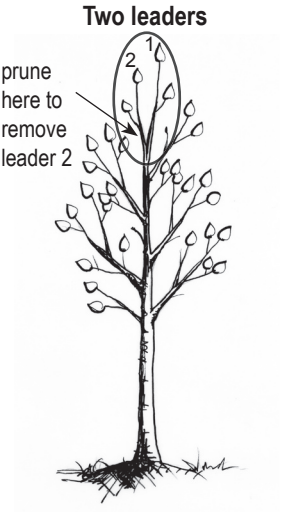
Minimize pruning at the time of planting!
Trees need as many leaves as possible to recover from transplant shock (leaves produce the tree's food).

Do not prune oaks in the spring or early summer if you live in an area with oak wilt (see map, p. 21)!

See "Pruning" p. 18.







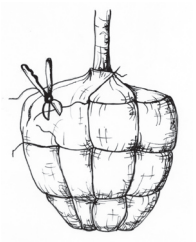
Step 4. Find the main root system, and remove excess soil.

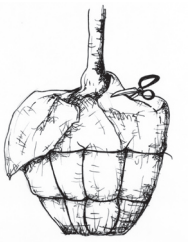
Remove soil from the top of the root ball until the top of the main root system is exposed. There should be several roots at least as big around as a pencil extending in opposite directions from the trunk. You may have to remove 2-4 inches of soil before finding the main roots.

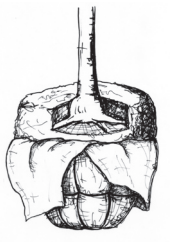
TIP: Probe the soil ball with a wire, kabob skewer, or screwdriver to find the main root system and estimate how much soil to remove. If the roots are located more than 4 inches deep, return the tree to the place of purchase.

Bare root trees: There is no soil or root packaging to remove.

Balled-and-burlapped trees: Remove the top of the root ball packaging. Cut any twine from around the trunk taking care not to nick the bark. Then bend the wire basket back off the top of the ball. Remove soil from the top of the root ball until the main root system is found. You may have to cut some of the wire. Leave the rest of the wire basket in place until the tree is put in the ground.

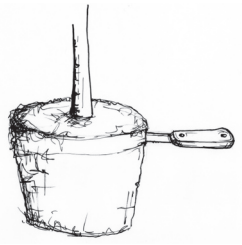


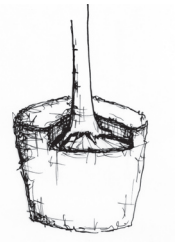




Containerized trees: Remove the entire container. Pull or cut the soil off the top of the root ball until the main root system is found.

TIP: A saw works well to remove the top layer of soil. Be careful not to cut into the trunk.

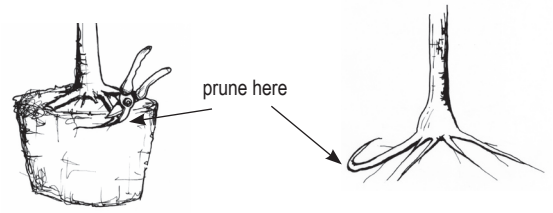




Step 5. Remove problem roots.

A. Remove all small roots above the main root system with a hand pruner.

B. Examine the main root system for roots that extend out but then turn to the side or back towards the trunk. Prune these roots at the point where they turn.

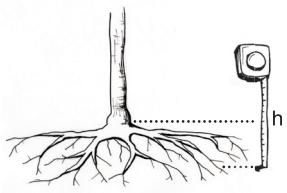


Step 6. Determine how deep and wide to dig.

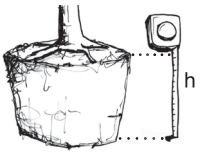
A. Measure the height of the remaining root ball. This is exactly how deep you should dig the hole.

B. Measure the approximate width of the root ball or root system. Multiply this by 2, or if your soil is hard (clay or compacted), by at least 3. This is how wide you should dig the hole.

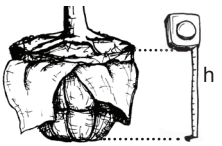
Bare root
(roots spread out flat on the ground)



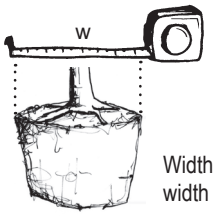
Containerized
(excess soil removed)



Balled and burlapped
(excess soil removed)



h = depth of planting hole

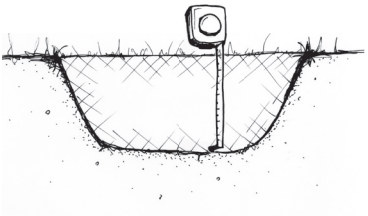


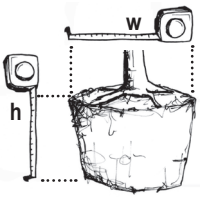
Width of hole should be 2-3 times the width of the root ball

Step 7. Dig a hole.

Do not put a $100 tree in a $10 hole. The dimensions of the hole are very important in determining the survival of your tree. Dig the hole ONLY as deep as the root system (NO deeper!).

HOLE DEPTH = height of root ball (h)
HOLE WIDTH = width of root ball (w) x 2 or 3



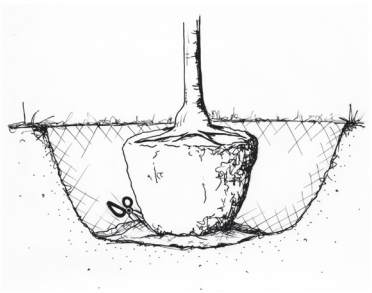


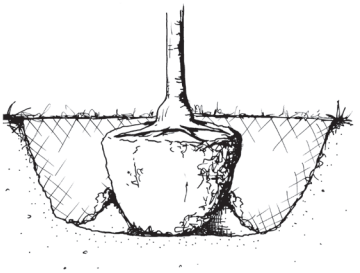
Step 8. Put the tree in the hole.

If the tree has a heavy root ball, slide it into the hole, and straighten the trunk.

Step 9. For balled-and-burlapped trees, remove root ball packaging.

Balled-and-burlapped trees: Without loosening the root ball, cut, peel back, and remove as much of the wire basket and burlap as possible (at least the top third).





A root ball should remain a root ball. If it starts to fall apart as you take off the wire and burlap, backfill the hole with enough soil to stabilize it. Then carefully remove the wire and burlap, and backfill as you go to keep the root ball intact.

Step 10. Backfill with the same soil.

Make sure the trunk is straight. Put the original soil back in the hole, breaking up large clods, and working it in with your hands or a shovel.

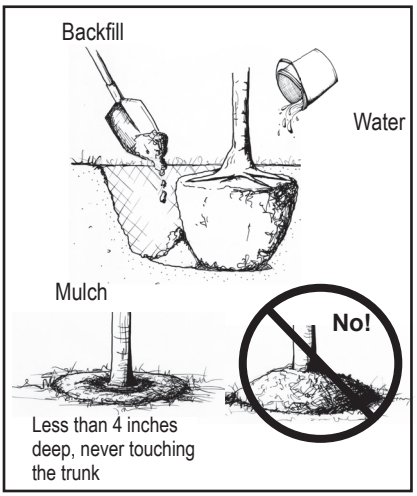
Step 11. Water.

Water the root ball and entire backfilled area.

Step 12. Mulch.

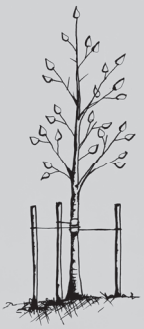
Put a 2-4 inch layer of mulch over the backfilled area. Pull mulch away from the trunk so that none touches the bark.

Mulch becomes soil.
There should never be more than 4 inches of mulch over the roots. Too much can prevent the roots from getting necessary oxygen.



To Stake or Not to Stake

Some trees need to be staked to remain standing straight in their new planting site. Stake only if the root ball is unstable or the trunk is bending. Use wide nylon, canvas straps, or nylon stockings wrapped around one side of the trunk. The tree should not be tied tightly.



If the root ball is unstable, use 1-3 stakes attached LOW on the trunk.

If the trunk is bending, use 1 stake attached HIGHER (at least 6 inches below the first set of branches).

Remove stakes after 1-2 years.

Maintenance Schedule

Follow this maintenance schedule for the life of your tree. Detailed instructions are on the pages indicated in parentheses. Use regionally adapted or native plants to reduce water and other maintenance needs for the life of the tree.

Type of Care	Timeline			
	At planting	Years 1 to 3	Years 4 to 10	After 10 years
Water (p. 13)	5 gallons	Correct amount is *critical* from spring through autumn and during dry winters →	As needed →	
Mulch (p. 16)	2-4 inches deep, not against trunk	Check and adjust level in spring →	→	→
Protect Trunk (p. 14)	As needed →	Check in spring and autumn →	→	N/A
Stake (p. 11)	*Only* if needed →	Check in spring and autumn. Remove after 1-2 years.	N/A	N/A
Clean Root Collar (p. 15)	Uncover at planting	Clean root collar every year →	→	→
Check for Encircling Roots (p. 9, 15)	Check before planting (p. 9)	N/A	Check every 4-5 years (p. 15) →	→
Check Health (p. 17, 35)	Select a healthy tree (p. 35)	Inspect leaves, branches, crown and trunk every year (p. 17) →	→	→
Check Safety (p. 17)	N/A	Inspect in summer, winter, and after storms (p. 17) →	→	→
Prune* (p. 7, 18-23)	Prune only critical branches or to eliminate extra leaders (p. 7)	Prune lightly in Year 2 or 3 (p. 18-23)	Every 3 years	Fruit trees every 1-3 years, other broad-leaved trees every 5 years, conifers only as needed

*For some tree types, pruning or removal during certain times of the year can increase the likelihood of disease transmission. See p. 20 for details.

N/A—not applicable

Watering*

An important factor in tree survival is providing water at the correct frequency. The first 3 years are most critical, but pay attention to watering needs throughout the tree's life. In arid environments most trees will have to be watered throughout the growing season and during dry winters for life unless they are native to that area.

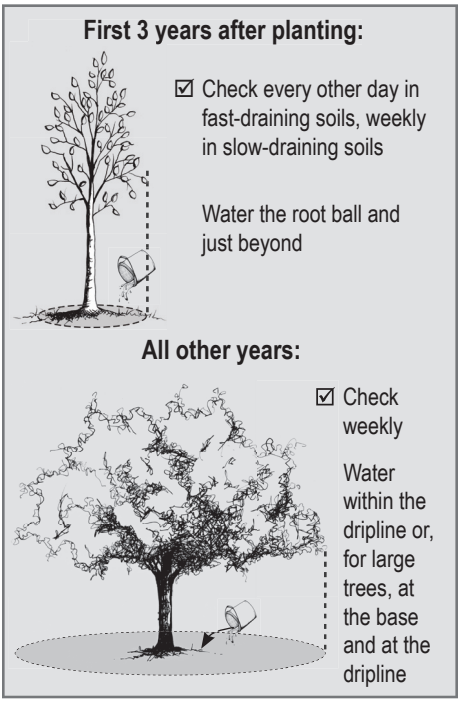
How often and how much?

Frequency depends on water uptake by plants, surface evaporation, and soil drainage. Soils that drain quickly will require more frequent watering than those that drain slowly. To determine your soil's drainage rate, see p. 34. The best way to know how often and how much to water is to check the soil moisture at 6 inches below the surface. Water when dry.

First 3 years after planting: If the soil is dry, provide about 2 gallons of water per diameter inch of the trunk.

All other years: Because soil type and weather conditions influence the demand for water, irrigation schedules and amounts vary.

Tree roots need oxygen. Soil saturated with water for more than 24 hours can prevent roots from getting oxygen. Therefore, watering too much is as dangerous as watering too little (and is harder to correct).



Where? Water the root ball and just beyond. For large trees, focus watering on the area within 6 feet of the trunk and at the dripline.

When? Start checking soil moisture and watering when necessary in early spring, and continue until the soil freezes. For mild climates, water as needed during dry winters. For winter watering, choose warm days above freezing to ensure water soaks into the ground.

*Gilman, E. 1997. Trees for urban and suburban landscapes. Albany, NY: Delmar Publishers. 662 p.

Installing a Trunk Guard

Trunk Protection

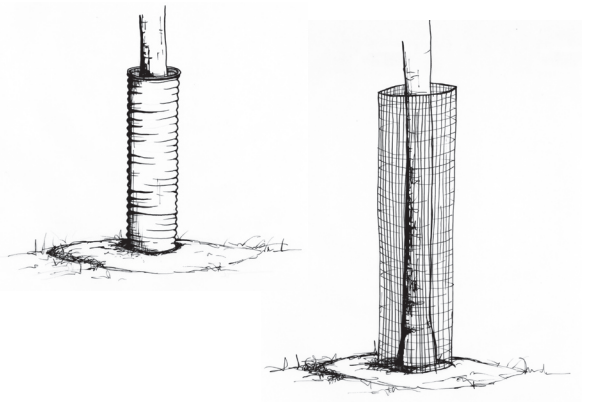
Young broad-leaved trees have thin bark that can easily be damaged by animals and equipment (most commonly string trimmers and lawn mowers). Mulch does a great job of keeping grass (and therefore grass-cutting equipment) away from trunks, but rodents such as rabbits and mice like to chew on young bark (usually low on the trunk). Deer also scrape tree trunks with their antlers.

To prevent long-term damage associated with trunk wounding, install plastic tubing or hardware cloth (stiff wire fencing with 1/4-1/2 inch mesh squares) around the trunk. The tube should be big enough around to allow 1-4 inches of space between it and the trunk. It should be 1-3 feet tall (extending above the anticipated snow depth) for small rodents and as tall as possible for deer.

How? Wrap the tube around the trunk, taking care not to scratch the bark. Use a few pieces of wire to keep the tube closed. Push the tube into the ground or mulch less than an inch. Attach it to one or two stakes if necessary.

When? At a minimum, the trunk should be protected during the winter months (apply early in the autumn to prevent deer scraping). Protection can be applied anytime and left on all year round, as long as it does not touch the bark.

Your tree will grow.
As the tree grows, the tube will need to be enlarged and eventually removed.



Preventing and Correcting Encircling Roots*

Problem

Roots that encircle the trunk will likely cause health or safety problems later. Make sure that soil or mulch is never piled against the root collar.

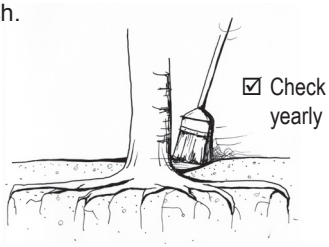
Root likely to become a problem (when trunk and root meet)

Problem root already touching the trunk

Covering the root collar with soil or mulch encourages encircling roots

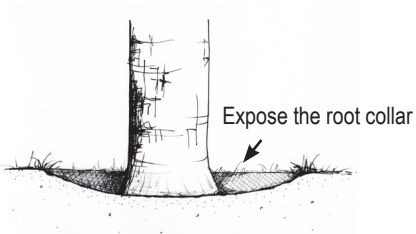
How to Prevent

Plant at correct depth (see Planting Steps 4-7, p. 8-10). Annually clean the root collar by removing soil and mulch.



How to Monitor and Correct

Every 3-4 years, check for roots that encircle the trunk. Use a hand trowel to loosen and remove the soil around the base of the tree until the first set of roots is found.



TIP: Removing soil with a wet-dry vacuum speeds the work without harming the roots.

If a tree has an encircling root, leave the top of the root exposed, and consult an arborist regarding treatment. When caught early, this can be an inexpensive and effective way to save your tree.

*Johnson, G.; Fallon, D. 2007. Stem girdling roots: the underground epidemic killing our trees. St. Paul, MN: University of Minnesota.

Mulching

Maintain a ring of organic mulch around the tree (the wider the better). Organic materials like wood chips and leaves are best. Wood chips will take longer to break down and, therefore, will not require replacement as often. In arid regions, do not use rock or gravel as mulch unless the trees are adapted to dry, rocky environments.

TIP: Newspaper kills grass.
If there is grass in the area that needs to be mulched, put a 5-page layer of newspaper over the grass, and then add mulch on top (this will help keep the grass from growing up through the mulch).

Mulch becomes soil.
There should never be more than 4 inches of mulch over the roots. Too much mulch or soil can prevent oxygen from reaching the roots.

Fertilizing

Apply nitrogen fertilizer ONLY if diagnosis by an arborist indicates that it is necessary.

Apply other fertilizers ONLY if a soil test shows that nutrients are lacking.

Do not overdose.
Fertilizer that is not absorbed by the tree has the potential to alter the soil or leach out and pollute groundwater, rivers, ponds, and lakes. Overdosing with fertilizer can harm your tree.

Applying "weed and feed" to your lawn might injure or kill your tree.
Most combination weed killers and lawn fertilizers will injure trees. Do not use anything that states it will kill broad-leaved weeds (it can harm broad-leaved trees as well). Preemergent herbicides are safe to use near most trees, but always check the label.

In some cases, a long-term plan to change the soil pH may be necessary.

Checking Tree Health

Tree health can be difficult to determine, but checking your tree yearly may help you notice problems as they appear.

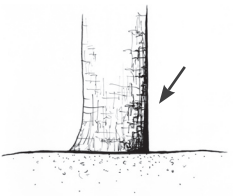
Is the current year's growth much less than past years' growth? Fast growth does not mean good health, but a dramatic reduction in growth rate may be an indication of poor health.

TIP: Look at the branch tips or tree top. Current year's branches will typically be smaller in diameter and a different color.

Also inspect the size, color, and distribution of the leaves. Look at individual leaves as well as the whole crown for differences between branches or sections of the crown.

Inspect the base of the trunk for damage (e.g., from rodents or string trimmers).

Also inspect the base of the tree to see if there is a flat side to the trunk.



If anything is found, follow the guidance in the Troubleshooting section, p. 30-31.

Checking Tree Safety

Healthy trees can fall down.
A tree may be green and lush, but that does not guarantee that it is structurally safe.

Inspect trees anytime, but especially after storms. Examine the crown, branches, trunk, and area around the roots for these common dangers:

- Broken, dead, or hanging branches
- Cracks, fungi, and cavities
- Weak trunk or branch unions
- Encircling root compressing the trunk (a flat-sided trunk at the ground level is a good indicator). See illustration above.
- Recent lean (especially if the soil or grass has lifted on one side).

Branch Unions

If anything is found, or if in doubt, contact an arborist, p. 28.

Pruning*

Pruning can be dangerous work. Follow these safety precautions to be sure you are around to enjoy your tree.

⚠ **Electricity flows through branches.**
Never prune trees or branches that are within 10 feet of utility lines; instead contact your local utility company.

⚠ **Ladders and trees do not mix.**
If pruning cannot be done with both feet on the ground, hire an arborist (p. 28).

⚠ **Chainsaws cut limbs.**
If power equipment is required, hire an arborist (p. 28).

The main reasons for pruning trees are safety, health, and esthetics. Pruning can encourage trees to develop a strong structure and reduce the likelihood of damage during severe weather.

Pruning for safety involves removing branches that could fall and cause injury or property damage, trimming branches that interfere with lines of sight on streets or driveways, and removing branches that grow into utility lines.

Pruning for health involves removing diseased or insect-infested wood, thinning the crown to increase airflow and reduce some pest problems, and removing crossing and rubbing branches.

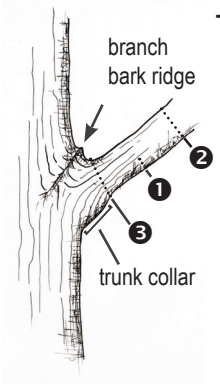
Pruning for esthetics involves enhancing the natural form and character of trees or stimulating flower production.

*Except where noted, this section has been adapted in part, from: Bedker, P.; O'Brien, J.; Mielke, M. 1995. How to prune trees. [Newtown Square], PA: USDA Forest Service Northeastern Area. 30 p.

Where to Cut

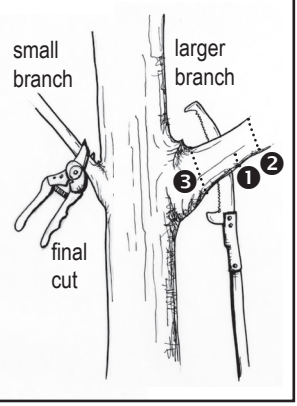
Support the branch with one hand while you make the cut to prevent the bark from ripping. If the branch is too large to support, use the three-step method (see details below).

For the final cut, look for the branch bark ridge and trunk collar. Begin the cut just outside of the branch bark ridge, and angle down away from the trunk. Stay close to the trunk collar without cutting into it (see images below).



Three-step method

1. Cut one-third of the way through the branch on the under side.
2. Go 2-4 inches beyond the undercut to remove the branch.
3. Make the final cut just outside the branch bark ridge and trunk collar.

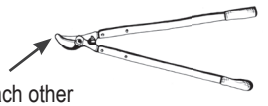


Pruning Tools

BEST

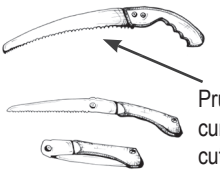
Hand pruner—bypass type

Lopper—bypass type

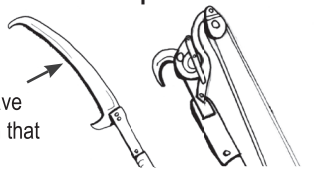


Bypass blades cross each other like those in a scissors.

Hand saw



Pole saw or pruner



Pruning saws usually have curved blades with teeth that cut when you pull.

OK

Bow saws can be used, but it is often difficult to fit the saw between branches to make the correct pruning cut.

How Often

Beginning 2 years after planting, prune broad-leaved trees lightly every year or every other year. After 10 years, frequency of pruning depends on the type of tree and amount of shade the canopy receives.

Do not remove more than 25 percent of the tree's live branches (and therefore leaves) at any one time.

Tree Type	First 10 years	10+ Years After Planting
Fruit trees	Once every 1-2 years	Once every 1-3 years
Broad-leaved trees	Once every 1-2 years	Once every 4-7 years*
Conifer trees	Only as needed**	Only as needed**
Palms	Once every 3-6 months in tropical climates, annually otherwise***	

* Pruning lightly and more frequently is better than pruning heavily and less often.

** Conifer trees usually need pruning only if they are diseased or their branches need to be raised up from the ground. In either case, prune off the entire branch (p. 19).

*** Prune only dead or dying fronds. If fruit is a problem, remove flower stalks or fruit clusters as needed.

Removal of the following can be done every year:

- Broken, dead, or rubbing branches
- Competing leaders
- Branches sprouting from the base of the trunk.

Time of Year

Winter is the best time of year to prune because branches are easy to see, diseases cannot be spread, and there is minimal stress to the tree. But for most trees, pruning can be done at any time. Exceptions are trees that are prone to fire blight or oak wilt.

Trees susceptible to fire blight include mountain ash, apple, crabapple, hawthorn, pear, flowering quince, and pyracantha. Trees susceptible to oak wilt include most oaks. To minimize disease infection of these types of trees, follow the pruning guidelines on the next page.

FIRE BLIGHT

Range: All counties in the United States

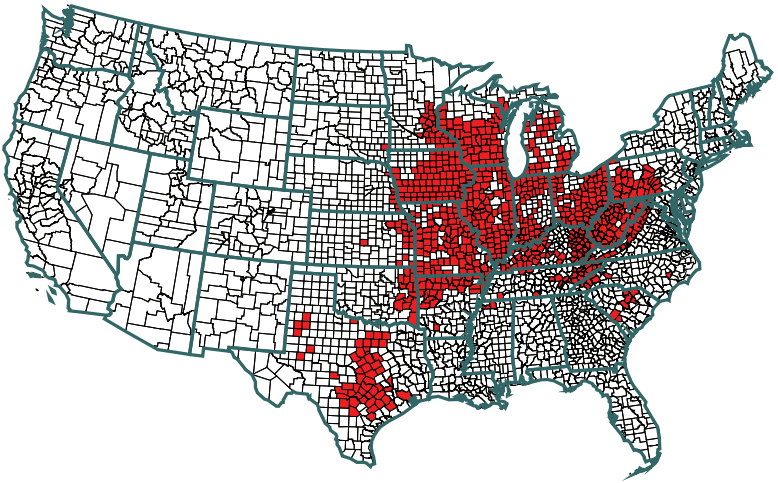
Types of trees: mountain-ash, apple, crabapple, hawthorn, pear, flowering quince, pyracantha

Pruning guidelines: Avoid pruning from the time that spring flowers emerge until leaves drop. If pruning must be done on these tree types during disease-transmission times, sanitize pruning tools before each branch is pruned. Use rubbing alcohol, or household bleach diluted 1 to 9 with water. Tools should be immersed in the solution, preferably for 1-2 minutes. Bleach is corrosive to metal, so tools should be thoroughly cleaned with soap and water after each use.

OAK WILT

Range: See map below

Types of trees: oaks



Pruning guidelines: Avoid pruning from early spring through early summer (April, May, and June in the Lakes States). Check with your plant diagnostic clinic (see page 31 for phone numbers) to get exact dates for your area. If pruning must be done on oaks during disease-transmission times, immediately apply wound paint after the cut is made.

Wound dressings are not necessary in any other case. In fact, they may be harmful.

Pruning Young Trees*

Pruning a young tree saves money. Removing small branches is fairly easy compared with waiting until limbs are large, when pruning can be costly and a bigger risk to the tree. Correctly pruning a tree when it's young will help it develop a strong, well-balanced crown. Prune to have the following:

A. Branches that are well-attached to the trunk
Branches with a branch bark ridge (bark pushed out at the point where the branch attaches to the trunk) are less likely to break off in wind or heavy ice or snow. Branches that are less than half the diameter of the trunk are also less likely to break off in storms.

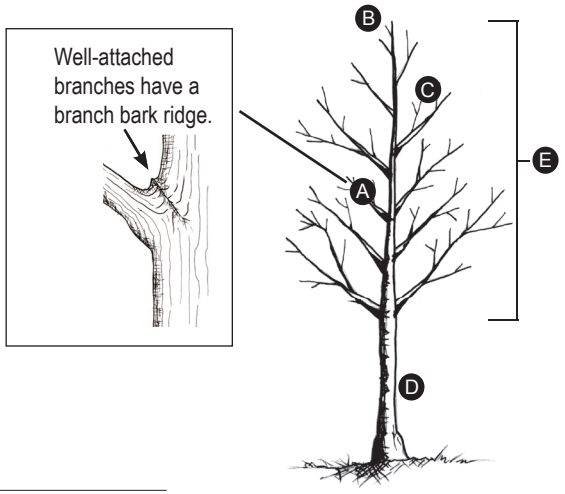
B. One central leader
Most trees will be strongest if they have one central leader (instead of multiple). Unless your tree is an arborvitae or fruit tree, choose one leader to keep, and prune off the competitors.

C. Good spacing between branches
Vertical space between branches should eventually be 12 inches for fruit or small-statured trees and 18 inches for medium- and large-stature broad-leaved trees. Try to space branches equally around the tree.

D. Enough clearance between the ground and first branch
As a tree grows taller, branches remain at the same height. Branches located low on the trunk may get in the way of sidewalk paths or lawn mowing as the tree gets bigger. Over time, gradually remove low branches.

E. Good crown height
The crown of a broad-leaved tree should be at least 60 percent of the total tree height.

Do not remove more than 25 percent of the tree's live branches (and therefore leaves) during one growing season.



*Gilman, E. 2002. An illustrated guide to pruning, 2d ed. Albany, NY: Delmar Publishers. 330 p.

Topping*: (Also called stubbing, heading, tipping, hat-racking, dehorning, or roundover)

Topping is not pruning.
Topping is the indiscriminate removal of branch ends. Topping injures and ultimately results in early failure or death of a tree.

TIP: If the end of the branch must be removed, cut it back to a side branch that is at least one-third (preferably one-half) the diameter of the branch being cut.

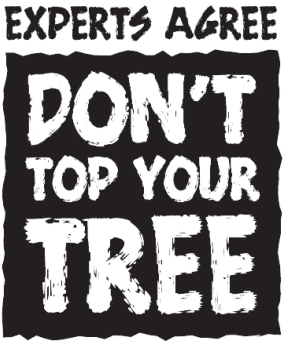
Topped tree

Myth: Topping will make the tree easier to maintain.
Truth: Topped trees can regain their original height quickly, often in 2 years. A topped tree will require more attention than a properly pruned tree because of the fast growing, loosely attached shoots that form.

Topped tree with regrowth

Myth: Topping invigorates a tree.
Truth: Topping immediately injures a tree and starts it on a downward spiral. Topping wounds expose the tree to decay and invasion from insects and disease. While a tree may survive topping, its life span will be significantly reduced.

Myth: Topped trees will add value to your property.
Truth: Topped trees lack natural beauty and may actually reduce your property values. Also, a topped tree can become hazardous and cause property damage, making it a liability.



*Adapted, with permission, from the "Experts Agree: Don't Top Your Tree" campaign which was developed by the Missouri Community Forestry Council and Forest ReLeaf of Missouri, with financial assistance currently provided by the Missouri Department of Conservation.

Protecting Trees from Construction Damage*

Are you planning to build or remodel a home? Are you going to expand or pave your driveway? Are your city's streets, curbs, sidewalks, and buried utilities about to be widened, modernized, or replaced? Before construction begins, consider the impact on trees.

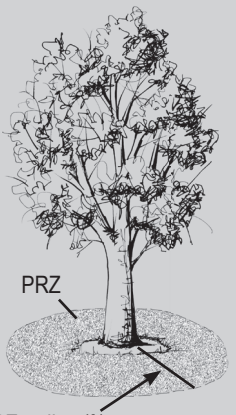
Careful tree protection will help you avoid the expense and heartache of later repairing or removing trees that were located too close to construction activities (see "How Close is Too Close?" below). Depending on the type of construction and proximity to trees, you may be able to protect the trees yourself, or it may be best to consult with an arborist to design, implement, and enforce a tree protection plan.

Start planning early. To minimize costs and increase the likelihood of successful tree preservation, start tree protection planning as soon as possible.

How Close Is Too Close? Defining The Protected Root Zone (PRZ)

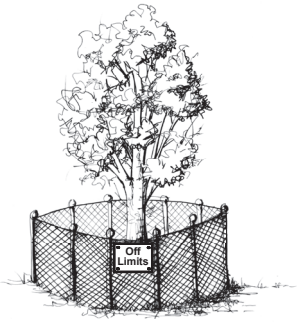
The tree's Protected Root Zone (PRZ) can be identified as follows:

1. Measure the diameter (width) of the trunk at chest height, to the nearest inch. To do this, either wrap a tape measure around the trunk and divide that number by 3 or hold a yard stick up to the trunk and approximate the distance.
2. Multiply that number by 1.5 for mature or stressed trees or by 1.0 for young, healthy trees. Express the result in feet.
3. Measure that distance from the trunk of the tree. The area within this radius is the Protected Root Zone (PRZ).



*Adapted, with permission, from: Johnson, G. 1999. Protecting trees from construction damage: a homeowner's guide. St. Paul, MN: University of Minnesota Extension. 21 p.

The activities listed below all negatively impact tree roots. To protect your trees, define the Protected Root Zone (PRZ), and keep these activities away from this area, at a minimum.

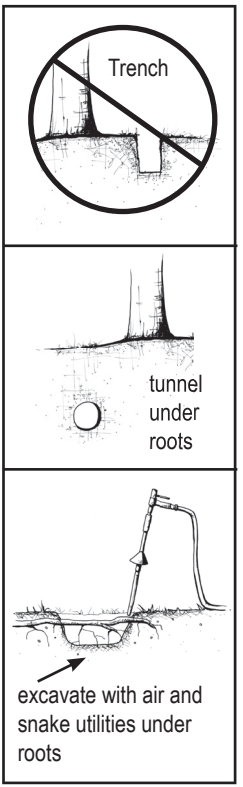


Storing Materials and Moving Equipment

Soil compaction is one of the main killers of urban trees. Stockpiling building materials, using heavy machinery, and excessive foot traffic all compact the soil. To minimize damage, install orange polypropylene or chain link fencing and post "Off Limits" signs around the PRZ of the trees you plan to save. Check the fence often to be sure that it is still intact and serving as a barrier.

Changing the Grade

Adding or removing as little as 2 inches of soil in the PRZ can kill a tree. To minimize damage, consult an arborist about methods to protect the roots if fill needs to be added or soil needs to be removed within the PRZ.



Excavating

If utility or irrigation lines cannot be relocated outside the tree's PRZ, reduce root damage by requiring tunneling under the tree's root system (instead of trenching through it). Specialized equipment that blows soil away from the roots using compressed air allows utilities to be placed with very little root damage. Otherwise soil tunneling equipment can be used, reducing root damage by up to 25 percent compared with trenching.

For all digging operations, insist that exposed roots be cut cleanly to promote quick wound closure and regeneration. Vibratory plows, chain trenchers, stump grinders, and hand tools do a better job at this than bulldozers and backhoes.

Avoid excavating during hot, dry weather; keep the plants well watered before and after digging; and cover exposed roots with soil, mulch, or damp burlap as soon as possible.

Paving

To minimize damage, keep walkways at least 3 feet from the anticipated mature trunk.

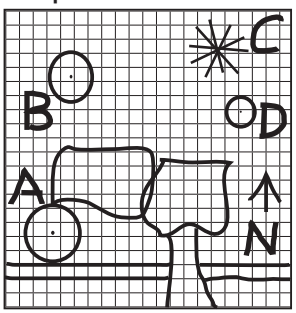
Record of Tree Types and Locations

Use this space to keep a record of trees planted on your property. Map tree locations on p. 27.

ID	Tree Type/ Species	Where Purchased	Date Purchased	Date Planted	Warranty Period	Mature Height	Max Width
A	HERITAGE RIVER BIRCH	GREENS NURSERY	4/29/07	5/01/07	1 YEAR	40-50'	50'

Sketch the location of your house and all trees on your property. Label each tree with a letter (A, B, C, etc.) to match the record on the opposite page (use a pencil to draw). Each square can represent 2, 5, or 10 feet, depending on the size of your yard.

Sample:



Key:

Broad-leaved

Conifer

How to Hire an Arborist*

You can find arborists listed in the phone directory, usually under “Tree Service.” When selecting an arborist, look for the following qualifications:

- ❑ **Education** (degree in arboriculture, urban forestry, forestry, horticulture)
- ❑ **Membership in Professional Organization(s)**
  Organizations include the International Society of Arboriculture (ISA), Tree Care Industry Association (TCIA), American Society of Consulting Arborists (ASCA), and your state’s arborist association. Such membership demonstrates a willingness to stay current on techniques and information.
- ❑ **ISA Certification or State Certification/License**
  Certified or State-licensed arborists are experienced professionals who have passed an examination and meet requirements for on-going education.
- ❑ **Proof of Insurance**
  A reputable arborist carries personal and property damage insurance ($1 million per occurrence, $2 million aggregate) and worker’s compensation insurance ($1 million). If an arborist is uninsured, homeowners could be held responsible for damages and injuries that occur as a result of the tree work. Request certificates, and phone the insurance agency to verify. Ask if the entire job will be performed by employees of the tree care company bidding the job. If not, ask for insurance certificates from all independent contractors as well.
- ❑ **Necessary Permits and Licenses**
  Some governmental agencies require contractors to apply for permits, a license, or both, before they are able to work. Be sure contractors comply with any local, state, provincial, or national laws.

Other Advice

- **Ask for references and speak to former clients.**
- **Get more than one estimate.**
- **Do not automatically accept the lowest bid.**
- **Never pay in advance.**
- **Be wary of door-to-door sales.** These are especially common after storms. Know that good arborists perform only accepted practices and wear safety equipment. For example, topping a tree and using climbing spikes for pruning are unacceptable. Safety equipment includes hard hats and ear protection.
- **Get it in writing.** When will the work be started and completed? Who will be responsible for clean-up? What is the hourly rate for additional work?

*Adapted, with permission, from: International Society of Arboriculture. 2004. Why hire an arborist? Champaign, IL. 4p.

Record of Service

Record work completed on your trees. Use the tree letter from the record on page 27.

Tree ID	Date:	Type of Maintenance Completed:	Work Performed By:	Date of Next Service:

TROUBLESHOOTING

If you see:	Potential cause:	You should:
TRUNK		
A flat-sided trunk at the base of the tree	Encircling root restriciting the flow of water and nutrients between the roots and rest of the tree	Excavate to check for encircling root (see p. 15)
Bark damage near the bottom of the tree	Rodent or string trimmer	Apply mulch/trunk guard to protect from future damage (see p. 14, 16)
An elm tree with liquid oozing from the trunk	Slime flux or wetwood	Not worry about health
BRANCHES		
An elm tree with bright yellow leaves on one or two branches	Dutch elm disease	Immediately call the University* or an arborist
Webs in the branches or webs covering the tips of branches	Fall webworm or Eastern tent caterpillar	Not worry about health
Many branch tips snipped off and laying on the ground	Squirrel damage	Not worry about health
Black clumps on branches of a cherry tree	Black knot	Call for advice*
Very little growth	Many	Call for advice*
Hole in trunk or branches	Many	Call for advice*
LEAVES		
Leaves sticky and covered with a black velvety coating (like soot)	Piercing, sucking insect and sooty mold	Not worry. Hose down the leaves to get rid of sap.
Leaves wilted	Many	Call for advice*
Spots on leaves	Many	Call for advice*
Small leaves	Many	Call for advice*
Sparse leaves	Many	Call for advice*
Yellow or brown leaves	Many	Call for advice*
Holes in leaves	Insect feeding	Not worry about health
Bumps on leaves	Many	Not worry about health

*Call an arborist or your University plant diagnostic service (next page).

Other Sources of Help

Arborists can provide good information about the health of your tree, and many communities have city foresters that may be of assistance. In addition, most land grant universities have an Extension service for answering tree health questions (see phone numbers listed below).

Alabama (Auburn University)
(334) 844-5507

Alaska (University of)
(907) 474-2423

Arkansas (University of)
(501) 676-3124

Colorado (State University)
(970) 491-6950

Connecticut (University of)
(877) 486-6271

Delaware (University of)
(302) 831-1390

Florida (University of)
(352) 392-1795

Georgia (University of)
(229) 386-7495

Illinois (University of)
(217) 333-0519

Indiana (University of)
(765) 494-7071

Iowa (State University)
(515) 294-0581

Kansas (State University)
(785) 532-1385

Kentucky (University of)
(859) 257-8949

Louisiana (State University)
(225) 578-4562

Maine (University of)
(800) 287-0279

Maryland (University of)
(800) 342-2507

Massachusetts
(University of)
(413) 545-3208

Michigan (State University)
(517) 355-4536

Minnesota (University of)
(612) 624-3020 or
(612) 625-1275

Mississippi (State University)
(662) 325-2146

Missouri (University of)
(573) 882-3019

Montana (State University)
(406) 994-5150

Nebraska (University of)
(402) 472-8725

New Hampshire
(University of)
(603) 862-3200

New Jersey
(Rutgers University)
(732) 932-9140

New Mexico (State)
(575) 646-1965

New York (Cornell University)
(607) 255-7850

North Carolina
(State University)
(919) 515-3619

North Dakota
(State University)
(701) 231-7854

Ohio (State University)
(614) 292-5006

Oklahoma (State University)
(405) 744-9417

Oregon (State University)
(541) 737-3472

Pennsylvania
(Penn State University)
(814) 865-2204

Puerto Rico (University of)
(787) 837-3905

Rhode Island (University of)
(401) 874-2900

South Carolina
(Clemson University)
(864) 656-2677

South Dakota
(State University)
(605) 688-5543

Tennessee (University of)
(615) 835-4572

Texas (A&M University)
(979) 845-8032

U.S. Virgin Islands
(University of)
(340) 693-1083

Utah (State University)
(435) 797-2435

Vermont (University of)
(802) 656-0493

Virginia (Tech)
(540) 231-6758

Washington
(State University)
*Contact County Extension Office

West Virginia (University of)
(304) 293-6023

Wisconsin (University of)
(608) 262-2863

Wyoming (University of)
(307) 766-2397

In the Event of an Emergency

Large branch or tree on the ground
If it is near a downed utility line, do not go near the tree! Call the utility company. If it is in the street, contact the city. If it is in your yard, call an arborist to have it removed.

Tree or branches on utility line
Stay away from the tree! Call your utility company.

Branches broken, still hanging in the crown
Call an arborist (p. 28) to have the "hangers" removed, and make clean cuts at a lateral branch or bud (p. 2, 19).

Ice coating and weighting the branches
Stay in a protected area, out from underneath the branches. Some limbs may break. Once the ice is gone, check for safety (p. 17), and call an arborist if necessary. Many branches return to their original state after severe bending.

Tree hit by vehicle
If possible, get the license plate number, name, and insurance information of the driver. Document the tree's injuries with photographs. Contact an arborist to evaluate the damage (p. 28).

Wounded trunk
Use a scissors or hand pruner (p. 19) to cut off any loose bark. Monitor health (p. 17). Do not apply "wound paint."

Chemical spill around tree
Call an arborist (p. 28), asking for someone with experience in soil contamination.

Root severed
Photograph and call an arborist to assess safety and make treatments as necessary.

Flooding
Monitor the trunk to see if it begins to lean in one direction. Check the ground area around the roots to see if the soil or grass has lifted. If so, contact an arborist right away for a safety assessment. Monitor the tree's health over time (p. 17). It may take a year or more for symptoms to appear.

Lightning or storm damage
Call an arborist to assess safety and make necessary treatments.

Trunk nicked by lawn care equipment (weed trimmer or lawn mower)
Stop doing that! Create a mulch ring around the tree to eliminate grass (p. 16), or use a trunk protector (p. 14).

Removal and Disposal

Whole Tree

Electricity flows through branches.
If the tree or branches are within 10 feet of utility lines, contact your local utility company for information on assistance in removal.

To remove a large tree, hire an arborist. If you are interested in having the tree milled into lumber, visit www.harvestingurbantimber.com to find someone with a portable mill in your area. You may also try contacting local woodworkers and technical schools to see if they would like the wood.

Disposing of debris:
Option 1: The arborist can remove the wood for you.
Option 2: If you or someone you know could use the tree for firewood, ask the arborist to cut and leave the wood for you in moveable chunks. If you do not know anyone who needs firewood, consider advertising it on community bulletin boards (e.g., at local grocery stores).

Insects and diseases are hitch hikers.
Many insects and diseases can be spread by moving firewood. To be safe, do not transport firewood to another town.

Trimmings

Check with your city or town for compost sites that accept tree branches and leaves.

Leaves

If you live in the city, keep leaves out of the street to avoid clogging storm sewers and polluting water (nutrients from leaves get leached into the storm drains, which typically lead directly to lakes and rivers). Leaves can be used as mulch around your trees and in your garden beds or taken to your city's compost site. Check with your city to find out if they will collect leaves left on the curb in the autumn.

Decide on the type of tree

TIP: Visit http://orb.at.ufl.edu/TREES/ to find trees that will fit your site.

Check for aboveground and belowground conflicts (p. 4-5). Then examine these important factors:

Location
If within 25 feet of overhead utility wires, choose a tree that will not get taller than 30 feet.

Cold Hardiness
Find your cold hardiness zone by contacting the University Extension Service, garden center, or at: www.usna.usda.gov/Hardzone. Select a tree with a number the same or less than your zone.

Soil Drainage
Check how quickly water soaks into the ground by digging a hole 18 inches deep and filling it with water. Let it drain completely. Refill it with water, and time how long it takes for the water to drain.

Less than 2 hours = Very Fast
18 hours or more = Very Slow

Soil pH
Use a pH meter (for sale at garden centers) or get a soil test (contact University Extension Services).

Sun Exposure
Is the area mostly sunny, mostly shady, or partly sunny?

Fill out the following worksheet to help choose a tree for your site.

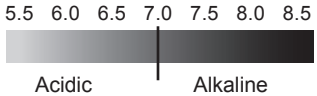
Cold Hardiness Zone (write in)

_____

Soil Drainage (circle one):

Very fast Medium Very slow

Soil pH (circle one):



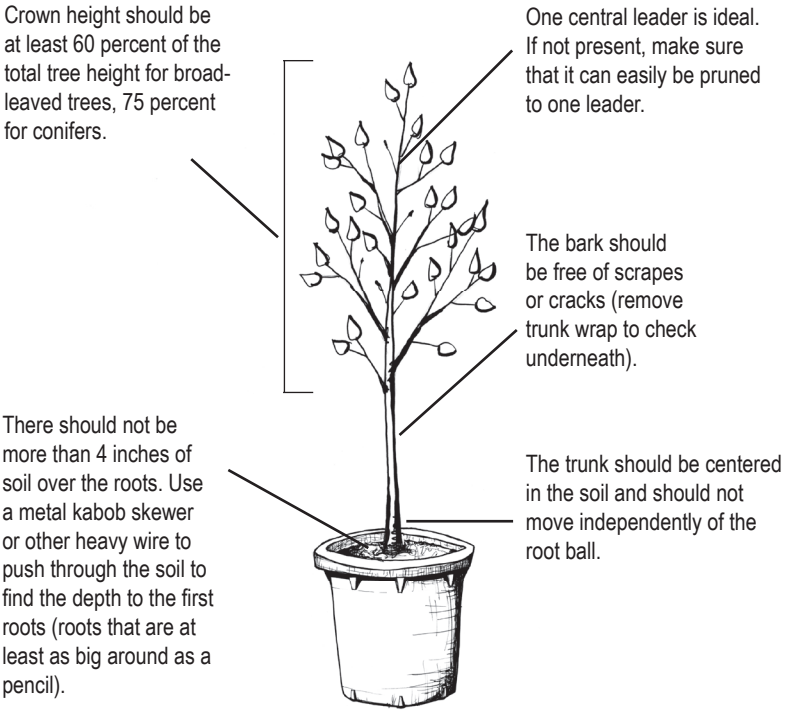
Sun Exposure (circle one):

Mostly sunny Morning or afternoon sun Mostly shady

Desired tree features (check all):

- ❑ Spring flowers
- ❑ Summer flowers
- ❑ Autumn leaf color
- ❑ Attract birds
- ❑ No messy fruit
- ❑ Provide shade
- ❑ Short
- ❑ Medium
- ❑ Tall

Select a high-quality tree at the nursery



Additional Sources of Information

Tree Owner's Manual Web site	www.treeownersmanual.info
Your State Forestry Agency	www.stateforesters.org/SFlist.html
International Society of Arboriculture	www.treesaregood.org
University Extension Service	www.eXtension.org
TreeLink	www.treelink.org
American Forests	www.americanforests.org
Arbor Day Foundation	www.arborday.org
Tree Care Industry Association	www.treecareindustry.org
Forest Service	www.na.fs.fed.us/urban

Transporting Your Tree

Moving your tree is easiest if the branches are tied.

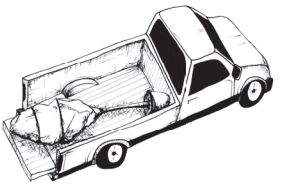
Do not lift by the trunk if the roots are packaged with soil in a container or burlap. Instead, lift the root ball (see the sidebar on How to Move Your Tree, p. 6).

If your tree has leaves and will be sticking out the back of a vehicle, the crown should be wrapped with a sheet, tarp, or burlap.

Wrap branches with a sheet or tarp!

Tree fits in bed

Tree hangs out back of vehicle



Storing Your Tree Until Planting

Keep the soil around the roots moist to the touch. Store in a shady spot.

For bare root trees, pack wet newspapers, sawdust, or mulch around the roots, and wrap them in a big plastic bag. Plant the tree as soon as possible (within 2 days). The biggest risk to bare root trees is the roots drying out.

For balled-and-burlapped or containerized trees, if you cannot plant the tree within 24 hours, water the roots well and either cover the entire root ball with mulch or wrap the root ball in plastic or a tarp. Keep the soil moist to the touch.

Before you leave the Nursery or Garden Center, write down:

- **Where tree was purchased**
- **Date of purchase**
- **Warranty period (years)**
- **Type of tree (species)**
- **Mature height and width**