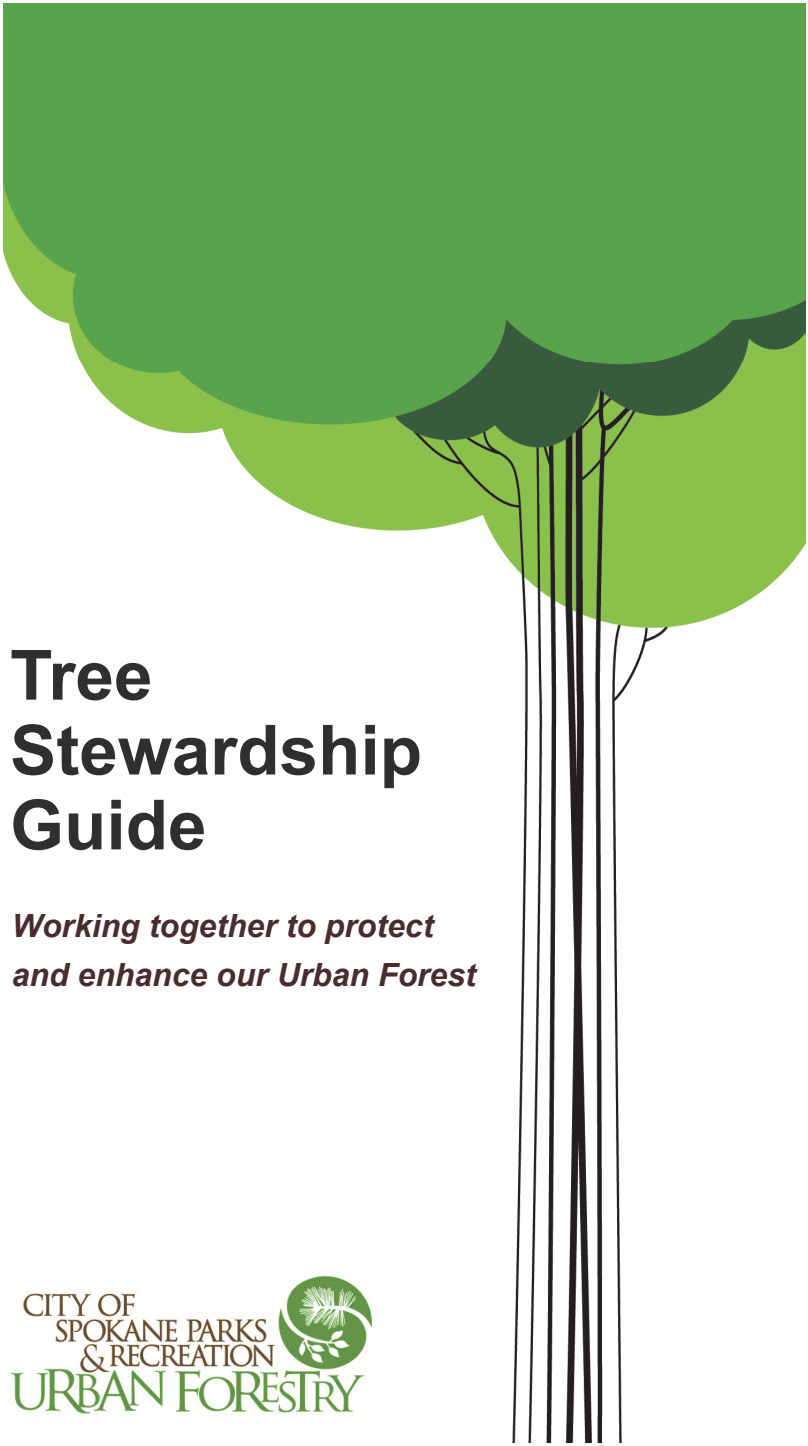

Tree Stewardship Guide

Working together to protect and enhance our Urban Forest

CITY OF SPOKANE PARKS & RECREATION
URBAN FORESTRY

Produced by
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Contributing Sources

City of Seattle Tree Steward Resource Field Guide
Up By The Roots, by James Urban
Gardening in the Inland Northwest, by Tonie Fitzgerald
A Guide to Field Identification, Brockman/Merrilees
International Society for Aboriculture
Dirr's Manual of Woody Landscape Plants
How to Prune Trees, by Bedker, O'Brien & Mielke
with
Illustrations by Julie Martinez
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INTRODUCTION

Spokane's Urban Forest Belongs to Everyone

The *urban forest* refers to all the trees and vegetation within an urban area - public and private. The urban forest is comprised not just of trees in parks but also the trees that line the roadways and the trees that are on private property.

Our urban forest is a large network that doesn't stop at boundary lines. The part of the urban forest that exists within the City of Spokane is a component of the larger canopy network that includes Spokane County and our neighboring counties and cities. The City of Spokane Urban Forestry program is specifically focused on protecting and maintaining the trees of the urban forest that are within city rights-of-way, parks, and other public spaces within the boundaries of the City of Spokane.

There are many benefits of trees and collectively our urban forest provides a unique green infrastructure which, if maintained and cared for, continues to give back to the community. Our goal is to continue to protect, properly maintain, diversify, and enhance the health of our urban forest to ensure these benefits are provided for generations to come.

Trees play a vital role in the community of Spokane, Washington and provide numerous benefits both tangible and intangible to residents, visitors, and neighboring communities. Spokane has demonstrated that public trees along streets and in parks are a valued community resource, an important component of the urban infrastructure, and a key part of the city's identity.

Trees make our city more livable. Individual trees and a healthy urban forest play important roles in the quality of life and the sustainability of Spokane's environment. Research has demonstrated that healthy urban trees can improve the local environment and lessen the impacts resulting from urbanization and industry. Trees improve air quality by manufacturing oxygen and absorbing carbon dioxide (CO_2), as well as filtering and reducing airborne particulate matter such as smoke and dust. Urban trees reduce energy consumption by shading structures

from solar energy and reducing the overall rise in temperature created through urban heat island effects. Trees slow and reduce storm water runoff, helping to protect critical waterways from excess pollutants and particulates. In addition, urban trees provide critical habitat for wildlife and promote a connection to the natural world for residents.

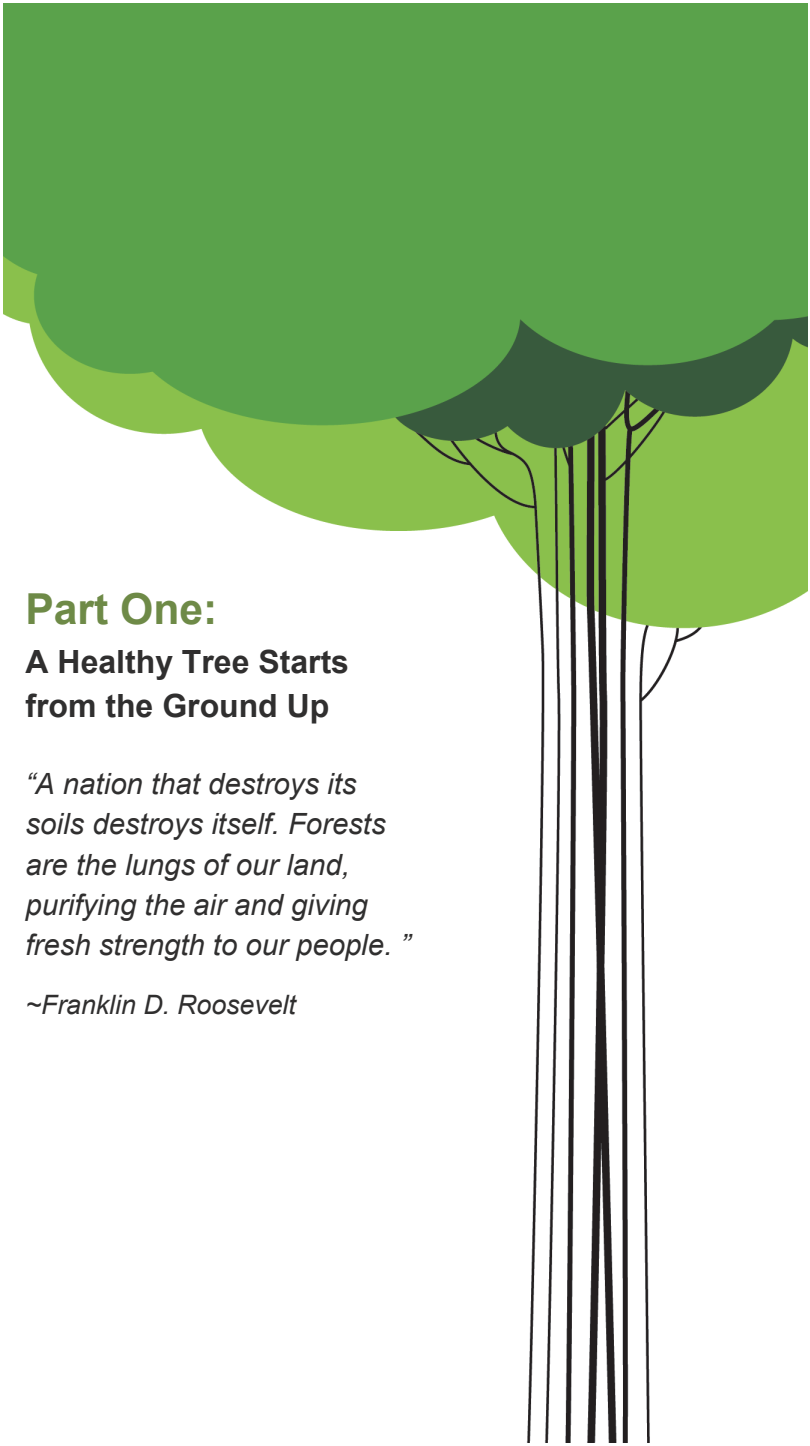
Beyond their functional value, trees are beautiful. Bare branches silhouetted against a winter sunset, blossoms in the spring, brilliant red, orange, and gold leaves in autumn – who has not stopped to admire these? Trees trace the changing of the seasons, reawakening our faith in growth and renewal. They so perfectly embody attributes we revere that we've incorporated them into our metaphors: sturdy as an oak, bending like a willow.

Studies show trees foster community pride, promote neighborliness, and can even speed up healing of hospital patients. Healthy urban trees increase the overall attractiveness of a community and have been proven to increase the value of local real estate, as well as promoting shopping, retail sales, and tourism. Trees support a more livable community, fostering psychological health and providing residents with a greater sense of place.

Community trees, both public and private, soften the urban environment by providing a green sanctuary and making Spokane a more enjoyable place to live, work, and play.

The City of Spokane has over 100,000 public trees on developed land playing a prominent role in the urban forest benefits afforded to the community. Spokane residents rely on the City's Parks and Recreation Urban Forestry staff to enhance and protect this vital resource.

As citizens of Spokane, you share ownership of those trees. This resource guide was created to educate and guide our community in protecting and enhancing our urban forest.



Part One:

A Healthy Tree Starts from the Ground Up

"A nation that destroys its soils destroys itself. Forests are the lungs of our land, purifying the air and giving fresh strength to our people. "

~Franklin D. Roosevelt

SOILS

For trees, what happens below ground determines what can happen above. Soil is a place for roots to absorb nutrients and water, as well as anchor the tree. The type of soil around a tree determines how much water is available, how easily the tree can absorb nutrients and whether the tree will thrive, just survive, or fail.

Soil is made up of inorganic and organic components.

Organic particles are made up of dead plants and animals that are broken down over time to provide a slow release of nutrients. This process is called decomposition, and it is done by earthworms, ground beetles and microorganisms that live in the soil.

Organic matter is beneficial to trees because it provides nutrients and also helps hold water in the soil. It adds pore space for air and water to reach the roots and in healthy soils, it is continually replenished as old plant material, insects and fungi, die and break down.

Inorganic matter, often referred to as minerals, is made up of the solid soil particles that were never alive such as rock, gravel, sand, silt and clay. Just as organic material breaks down, so does the inorganic. It just takes much, much longer. As minerals are broken down they can become water soluble and then absorbed by roots. There are 17 required **nutrients** for plants, but not all of them come from the soil, and some are used in very small quantities.

Macronutrients are the six elements the plant needs in larger quantities to survive. These include, Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg) and Sulfur (S). The first three are found in most fertilizers, because they are the most likely to be deficient in the soil. Nitrogen is an essential ingredient in all plant growth and helps build chlorophyll in the leaves. Phosphorus is essential for root growth and respiration, which converts carbohydrates into energy for growth. Potassium helps the plant absorb water, and make carbohydrates for energy. Calcium, Magnesium and Sulfur are important to plant health, but are more likely to be found in the soil.

Micronutrients are needed by the tree, in very small quantities. While essential to certain specialized functions of the plant, they are rarely added to fertilizers. These elements are: Boron (B), Chlorine (Cl), Cobalt (Co), Copper (Cu), Iron (Fe), Manganese (Mn), Molybdenum (Mo), and Zinc (Zn). Ongoing research also suggests that Nickel (Ni), and Silicone (Si) are also required for healthy plant growth.

Soil fertility is a measure of whether these nutrients are in the soil and if they are available to the plant. It can be measured with a soil test, to help you determine whether you need to fertilize. Too much fertilizer can actually harm a tree, so test before adding anything. Excess fertilizer often ends up in ground water, lakes and streams where it can kill fish and fertilize weedy plants.

The fertilizer package always has an analysis on the front, to tell you what percentage of each nutrient is inside. They will always be in this order: N-P-K. For example 12-10-7 is 12% Nitrogen, 10% Phosphorus and 7% Potassium. If there is a fourth number, it will be identified with its chemical symbol; S stands for Sulfur, Fe for Iron and so on.

Soil pH is a measure of how acidic or alkaline the soil is. It is measured on a scale of 1 to 14 with one being the most acidic, 14 the most alkaline and a range of about 6.5 to 7.3 being neutral. Soils in the Spokane area range from slightly alkaline to slightly acid, which means most hardy plants will do well here. In very acidic or very alkaline soils, some nutrients become unavailable to plants, so it's good to check your pH.

Soil texture describes the type of soil you have, and the degree to which it is made up of clay, silt or sand. These three types of soil particles are graded by their size, but each has different properties.

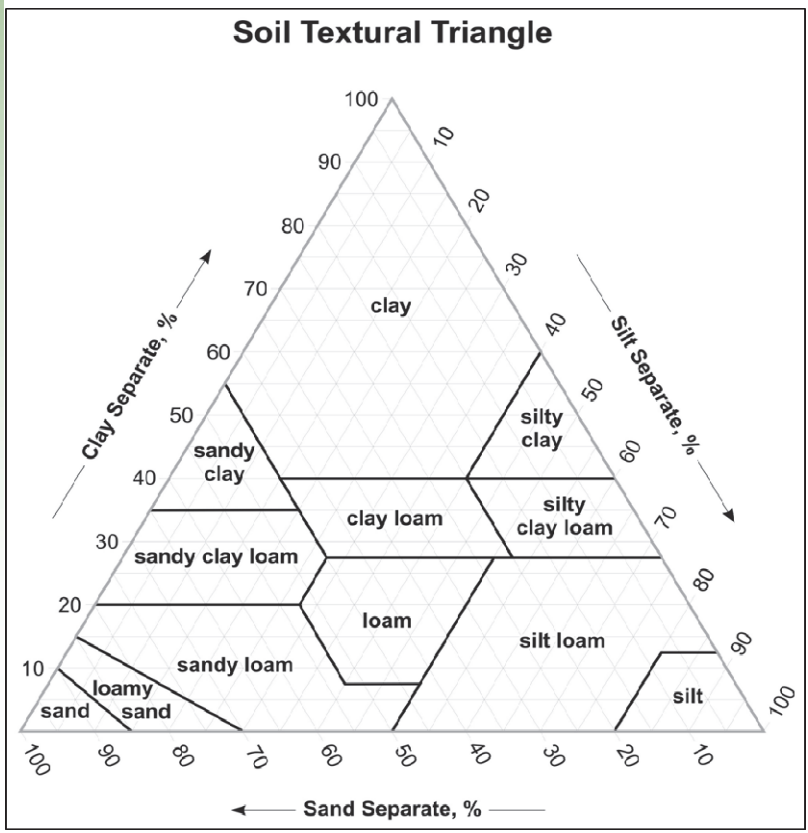
Sand is the largest size of particle and feels gritty in your hand. Sandy soils have lots of pore space for air and water, but can't retain water or nutrients very well.

Silt particles are the medium size, and might feel like flour in your hand. Silt is better at holding water and nutrients that sand, and still has good pore space for air and water to enter the soil.

Clay soil particles are so small they are literally microscopic. They stick to water, nutrients, each other, and your hand extremely well. They hold nutrients and water longer than silt or sand. Clay soils are the most prone to compaction, as well as becoming water logged. For this reason, trees may not grow as well in soils high in clay.

Loam doesn't refer to a size of soil particle, but a soil that is a good mix of sand, silt and clay. Loamy soils combine the advantages of all three and minimize the disadvantages. They are ideal for plant growth.

Soil Testing



You can test your soil in a variety of ways. One of the easiest is to put some soil in a jar with a lid and fill it up with water. Shake the jar until it is well mixed, then let the soil settle out. Measure how much has settled to the bottom after a minute and this will be your percentage of sand. Mark the level of sand so you can measure from there later. After 1-2 hours, measure the second layer, which is silt. Don't forget to mark it as well. You can measure the level of clay after letting the jar settle overnight. If the water is till very cloudy, you might have to wait longer. Measure the entire sample, from the bottom of the sand to the top of the clay and divide each of the other measurements by this number. This will give you your percentage of each particle. Use the soil texture triangle chart to find out what kind of soil you have.

Amended Soil vs Non-amended Soil

It is extremely difficult to change your soil texture or pH by adding amendments. You will have much more success if you adapt your planting choices to your conditions, rather than trying to change the soil. Healthy trees have root systems that grow two to five times the diameter of their canopy, and several feet deep. Most of us don't have the means to replace or amend that much soil before planting a tree.

In the past it was recommended to add peat, manure, compost or other organic material to the planting holes of trees and shrubs, but recent research has shown that problems result from this practice. Adding rich organic material to a planting hole creates a soil and root environment very different from the native, non-amended soil in a yard and the interface between the two soil types creates a barrier that water and new growing roots won't cross. The result may be a planting hole that stays too wet and roots that stay within the original planting hole, becoming gnarled and stunted. The tree itself grows slowly, if at all, and may eventually die. It is better to plant the right kind of tree into the soil you already have. In the long term, you and your tree will be much happier.

Final tips:

Avoid working with wet soil, especially if it has high clay content. This will compact the soil and create long term problems for tree roots.

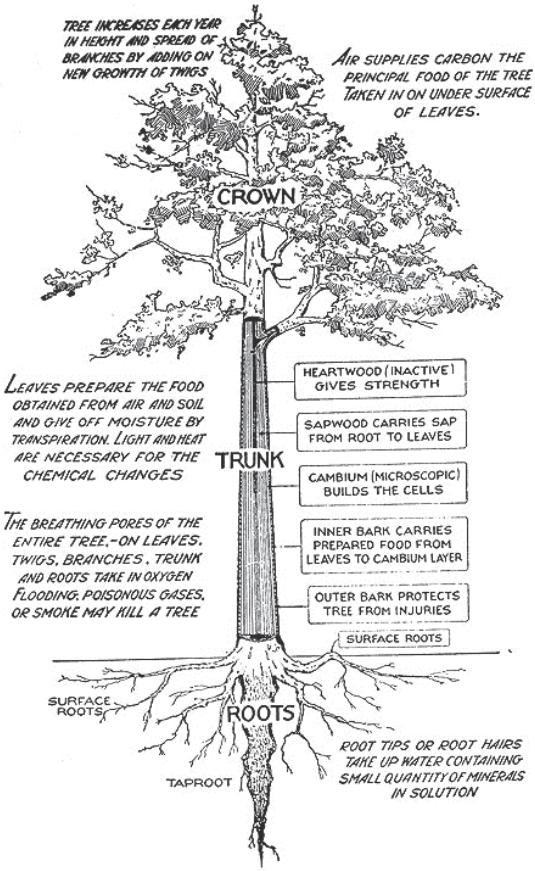
Creating a large mulch ring around your tree protects it from string trimmers and soil compaction from foot traffic.

If fertilizers are needed for your tree, use slow release products to avoid a big flush of growth that may attract insects like aphids.

Source material:
City of Seattle Tree Steward Resource Field Guide by The Tree Steward Program
Up By The Roots by James Urban
Gardening in the INW by Tonie Fitzgerald

TREE ANATOMY AND GROWTH

It's easier to help a tree stay healthy if you understand a little bit about how it works. In this section, we will look at the major parts of a tree, and how they grow.



Roots

The root system anchors the tree in the ground and absorbs the water and nutrients that help it grow. As discussed in the soil section, roots need minerals, water and air to remain healthy. In return, roots add organic matter to the soil, and because they bind to soil particles, they reduce erosion and runoff during storms.

The majority of the roots are in the top two feet of soil, where most of the water and oxygen is. It's important to plant trees at the right soil level so the roots don't suffocate by being buried.

There are several types of roots performing different functions for the tree:

Absorbing roots are the smallest, often no bigger around that a human hair. They make up much of the tree's root mass. They take in water and nutrients. Unfortunately, they also absorb other chemicals, like the herbicide from weed and feed products. They are among the shallowest roots and often do not survive when the soil is too wet, too dry or too cold. Those that do live may mature into lateral roots.

Lateral roots are the woody framework from which the absorbing roots grow and serve an important role in anchoring the tree. They transport water and nutrients to the trunk as well as store carbohydrates. These roots sometimes appear in your lawn and disrupt the turf nearby. Misdirected lateral roots may also circle the trunk, choking off the flow of water and sap.

Stabilizing roots grow primarily to anchor the tree, and keep it from falling over. Taproots grow straight down from the trunk of young trees, but in most species they are overgrown and disappear as the plant matures. Heart roots grow down, usually at an angle from the trunk to keep the tree from tipping. Sinker or striker roots are shoots that grow straight down from lateral roots, adding more points of anchorage to the tree.

Roots grow outward from the trunk until they reach a barrier. This causes them to turn and try to grow around, below or above the obstruction. If the barrier is something like a nursery pot, roots may grow around in a circle, and unless this is addressed, they may end up choking the tree. These roots should be spread out or cut to prevent long term damage to the trunk.

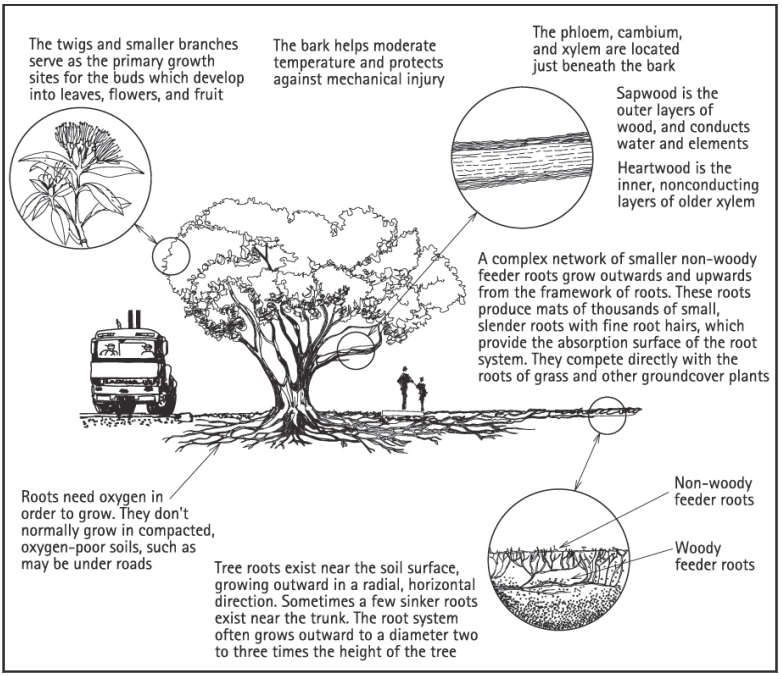
Some root barriers are obvious, like concrete foundations, but others are less noticeable, like a change in the soil texture. Roots may struggle to cross the boundary between soil that has been amended with compost or new soil. This may interfere with healthy root system development, so soil amendments are generally not recommended.

How wide do tree root systems grow? Counting the hair-like absorbing roots, they regularly grow two times as wide as the canopy. As they mature, they increase in diameter and can cause problems with sidewalks, foundations, sewer lines and other utilities. When picking a planting spot, choose one with lots of room for roots as well as branches overhead.

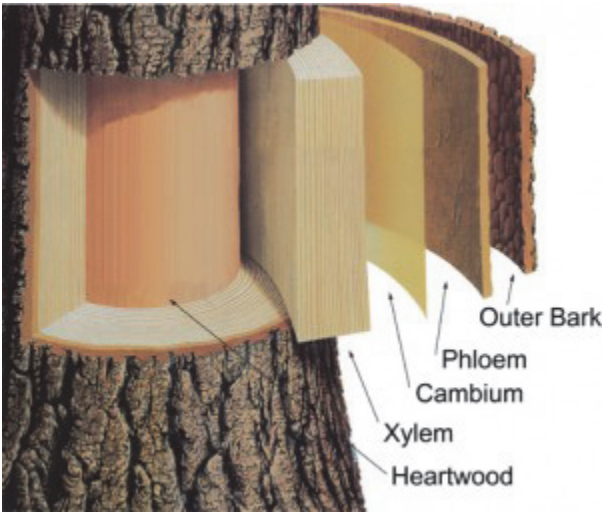
As roots come together at the base of the tree, they form the root plate, a zone about five times the diameter of the tree trunk. Any severe disruption (digging, construction, etc.) to this area, especially on a mature tree, will severely compromise its stability and may kill it outright.

Trunk & Branches

The trunk of the tree supports the weight of the canopy above, but also transports water from the roots and carbohydrates from the leaves.



The Inside Story of Bark



The **outer bark** is the tree's protection from the outside world. Continually renewed from within, it helps keep out moisture in the rain, and prevents the tree from losing moisture when the air is dry. It insulates against cold and heat and wards off insect enemies.

Inner bark or **phloem**, is the pipeline through which food is passed to the rest of the tree. It lives for only a short time, dies, turns to cork and becomes part of the protective outer bark.

The **cambium cell layer** is the growing part of the trunk, producing new bark annually and new wood in response to hormones that pass down through the phloem with food from the leaves. These hormones, called "auxins", stimulate growth in cells. Auxins are produced by leaf buds at the ends of branches as soon as they start growing in spring.

Sapwood or xylem is the tree's pipeline for water moving up to the leaves. Sapwood is new wood. As newer rings of sapwood are laid down, inner cells lose their vitality and turn to heartwood.

Heartwood is the central, supporting pillar of the tree. Although dead, it will not decay or lose strength while the outer layers are intact. A composite of hollow, needlelike cellulose fibers bound together by a chemical glue called lignin, it is in many ways as strong as steel. A piece 12" long and 1" by 2" in cross section set vertically can support a weight of twenty tons!

As you can see in the illustration on the previous page, there are different kinds of tissue in the tree trunk. A cross-section of any branch on the tree would look very similar to one of the trunk. The **bark** protects the tree from disease, injury and drying out, similar to the way our skin protects us. While the outer bark is dead tissue, inside it there is a layer of living cells called the **cork cambium** that produces new bark. Injuries to the bark create entry points for disease and may attract harmful insects, as well as killing the cork cambium which would keep new bark from growing in the area of injury.

Below the bark is a very thin layer of **phloem** tissue, which transports carbohydrates (sap) throughout the tree. Below the phloem is the thinnest, but most important layer of cells in the trunk, the vascular **cambium**. These cells divide and become xylem or phloem tissue and are responsible for the growth in the girth of the trunk. If you've ever counted the annual rings to determine the age of a tree, it is the cambium that started all these rings. Inside the ring of cambium cells is the **xylem** which transports water up the tree from the roots.

If these layers of live tissue are killed, by injury from a string trimmer, disease or herbicide, then the trunk stops growing and stops moving sap and water. A tree can survive if only part of the tissue is lost or damaged, but if it dies all the way around the trunk, the whole plant will die.

Another important part of the tree trunk is the root flare. All trees grown from seed, have a naturally forming flare at the base of the trunk, marking the transition into the root system. If a tree is planted too low in the soil, or buried under mulch, this part of the trunk may begin to rot.

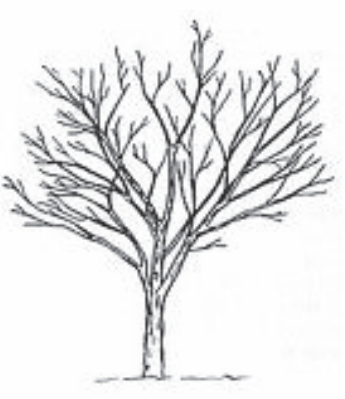
Sometimes new branches grow from the base of the tree, out of the root system. These shoots are called **suckers**. Many shrubs grow by sending up suckers to create new stems. This is not a concern in shrubs such as lilacs, the plant that gives our city its nickname. Lilacs send out these shoots and if allowed to grow, create a dense grove. In trees however, these suckers divert water and nutrients from the main trunk into the new growth, which reduces the vigor of the main plant. In some cases, trees are grafted to a different type of root stock. By allowing suckers to grow and divert resources, the original tree may disappear and be replaced by a less desirable one.

Canopy

There are dozens of great reasons to plant a tree, but most of them involve the above ground portion of the tree made up of leaves and branches. This is the section we call the canopy.

The canopy is shaped by genetics and environment, as well as the helping (or harmful) care by those who manage them. Each tree has a natural shape or **growth habit**. Some grow with a strong central leader, meaning they are more upright and much taller than they are wide. Think of our native Ponderosa pine, and you will have an example of **excurrent** growth habit. Other trees tend to spread out wide, without a strong central trunk or leader. Think of a crabapple or Japanese maple, and you will see a **decurrent** growth habit. When planting a tree, knowing the canopy shape and mature size will help you select the right species. For example, you wouldn't want to plant a pine, or other excurrent tree underneath a power line.

Excurrent



Decurrent

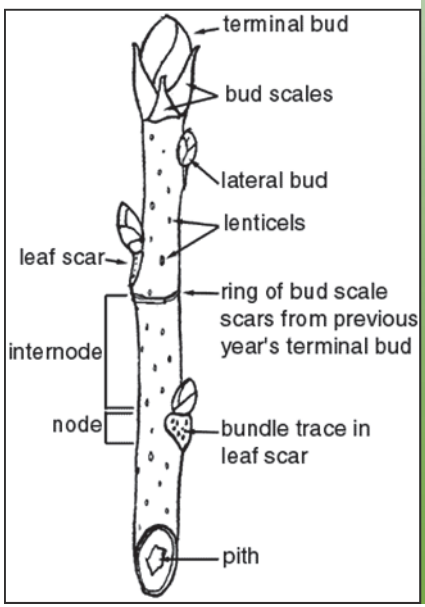
Leaves are the fuel factory of every plant. Everything that happens in the tree, from growing taller, to producing flowers, to sealing off wounds, is possible because of the energy they create. It is in the leaves that the plant takes water from the roots, carbon dioxide from the air, and energy from the sun to produce sugars. This process is called **photosynthesis.** When the leaves are deprived of any raw materials (sun, air, minerals or water), the tree begins to lose vigor and will eventually die. If the tree loses too

many leaves during the growing season, either through pruning, weather damage or because of a pest, this can also cause the plant to slow down.

Annual growth: Every year, a healthy tree canopy grows in size, both in height and width. This growth takes place at the ends of twigs and branches. Every spring, the **terminal bud** opens and expands, creating new tissue. In addition to the vascular tissue we've already discussed, this new growth includes buds for leaves, flowers and future stems to grow. These buds or areas for new growth are called **nodes**, and the space between them is the **internode**. Finding these on a branch is important when you are pruning a tree. (See Pruning) By examining a branch closely, you will be able to locate the **bud scale scar**, which marks the location of previous years terminal buds. The distance between the bud scale scar and the terminal bud marks the amount of annual growth.

This growth occurs so the tree can maximize its exposure to the sun, and is shaped by its genetically determined growth habit. It is also influenced by the overall health of the tree, and its access to sufficient water and mineral nutrients. An unhealthy tree will grow less than a healthy one, and unhealthy branches will grow less than healthy ones, on the same plant.

By measuring and comparing the annual growth on branches, you can determine if the tree is healthy and growing normally, or if it may be under stress. You can also learn whether a specific branch is healthy, by checking to see if the annual growth is fairly consistent from one year to the next.



Annual growth is also influenced by hormones within the tree. The terminal or apical buds grow faster than side or lateral buds by secreting a hormone called **auxin**. This hormone suppresses growth of the laterals, to prevent them from growing too fast or too large and creating a crowded, unhealthy canopy. When the terminal bud is lost, either by pruning or wounding, auxin disappears and the lateral shoots begin growing to replace the lost tissue. We can use this reaction in pruning, to direct tree growth to a side branch growing in a desired direction, or when removing diseased or broken branches.

Tree Defense

Trees must deal with wounds all the time. Whether branches are lost in a windstorm or through pruning, they have to guard against the possibility of disease and decay anytime they lose their protective layer of bark.

When a wound is severe, or pruning is done incorrectly, the tree may respond with a flush of very vigorous shoots, usually growing straight up. These are called **water sprouts** and grow from dormant buds along the branch. These shoots are not as well attached to the tree as normal growth, and under stress from wind or snow, are much more likely to tear off, creating open wounds. Water sprouts should generally be removed as soon as they are noticed, and before they can grow too large.

Where branches diverge from the trunk there is an area called a **branch collar**. This is a swelling at the base of each branch, made of overlapping tissue grown by the trunk and branch. When a branch is broken or pruned, this tissue grows across the open wound, sealing it against decay. It is important to make pruning cuts just outside this branch collar. Cutting the collar itself removes the tissue that will seal the wound leaving the tree open to rot. Branch collars are also found where branches diverge from each other. You do not want to remove branch collar tissue or leave a stub that collar has to grow over in order to seal. More details about this in the pruning section.

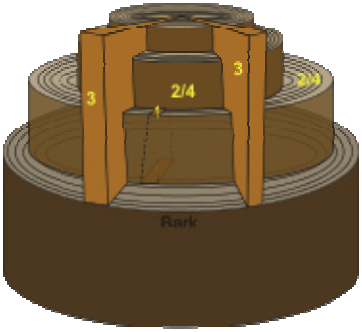
Above the branch, where this overlapping tissue is being pushed together, a healthy branch attachment will form a **branch bark ridge** (Figure A below). If the branch angle is too narrow, or the branch is close to the same diameter as the trunk, the ridge may look more like a valley. This is called **included bark**; the branch and trunk are separated by this layer of bark, and never knit together as they should (Figure B below). Over time, decay may set in and eventually, the branch union may tear out or fail. The resulting wound may be so large that the tree has to be removed.

A. U-shaped strong union

B. V-shaped weak union

The branch collar is not the only defense that a tree has against injury. It also seals off wounds internally. If a decay causing fungus gets into the tree, the wood begins to weaken, and the tree begins losing structural strength. The flow of water and nutrients is interrupted. If the tree can't limit the decay, it may die.

When a plant is wounded, it reacts immediately to seal off the area and prevent the spread of decay. It does this through a process called **compartmentalization of decay in trees** or **CODIT** for short. The CODIT model was developed by Dr. Alex Shigo, and is illustrated below.



There are four barrier walls:

Wall 1 resists *vertical* spread of decay by plugging xylem tissues. This is the weakest barrier.

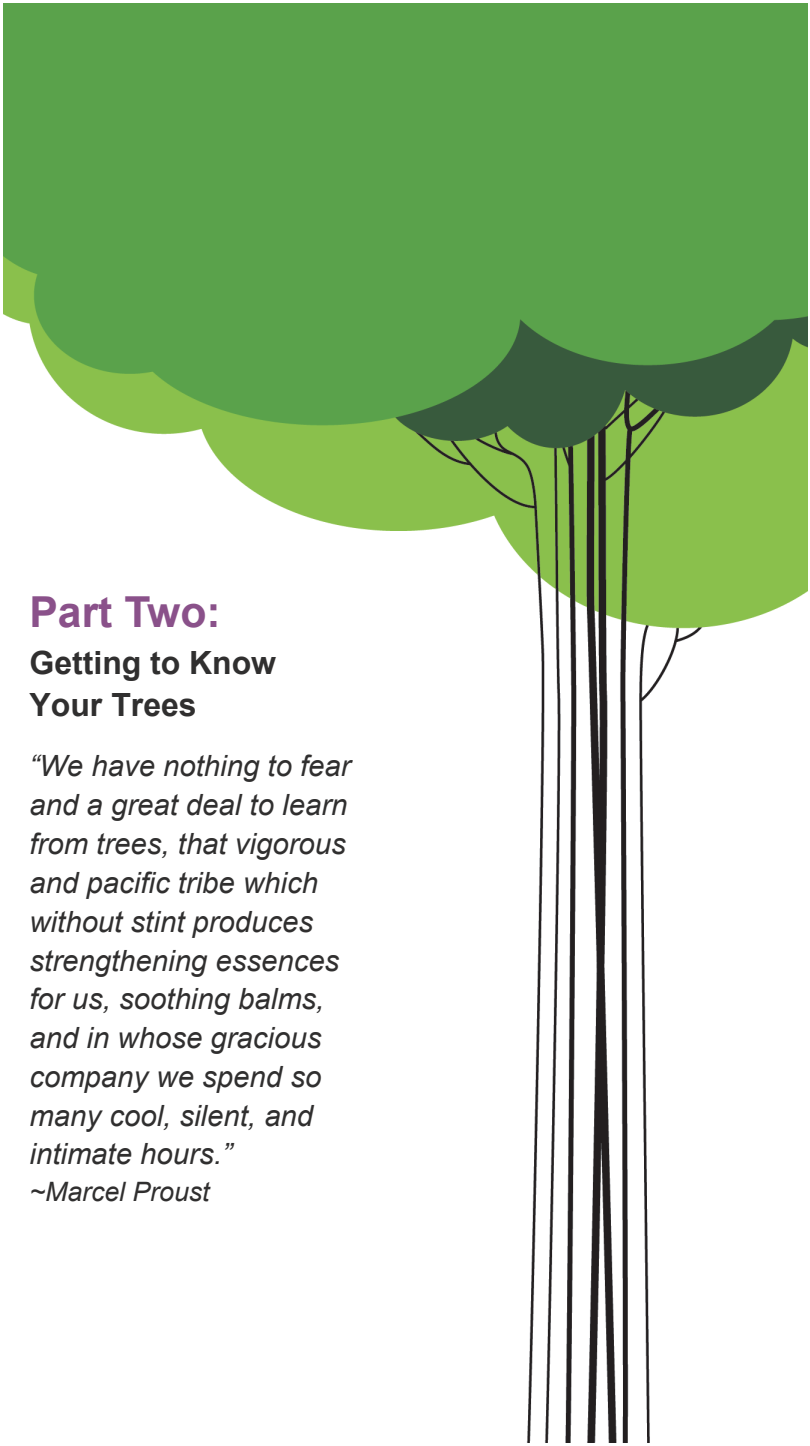
Wall 2 resists *inward* spread of disease by plugging the growth ring on the interior side of the wound.

Wall 3 resists *lateral* spread of decay through chemical changes to certain cells called “rays”.

Wall 4 resists *outward* spread of decay by new growth on the exterior of the wound. This is the strongest wall, and allows trees to continue standing even when largely hollow on the inside.

A tree can survive with pockets of decay in the trunk, but depending on the type of fungus causing the rot, as well as the size of affected area, and the location, it may be wise to have a certified tree risk assessor inspect the plant to determine the level of safety risk.

For a current list of certified arborists in your area, consult the websites of Spokane Urban Forestry, or WSU Extension Master Gardeners of Spokane County, or International Society for Arboriculture’s “Trees Are Good”.



Part Two:

Getting to Know Your Trees

"We have nothing to fear and a great deal to learn from trees, that vigorous and pacific tribe which without stint produces strengthening essences for us, soothing balms, and in whose gracious company we spend so many cool, silent, and intimate hours."
~Marcel Proust

IDENTIFICATION OF TREES

Trees are broadly classified into two groups, confers and broadleaves, which are described in this chapter. Clues for identifying specific trees can be found by looking at leaves, branching patterns, buds, size, growth habit and color.

A word about tree names. The scientific name describes both the genus and species and is used by botanists throughout the world. The common name is like a nickname, and can vary by region. For example, the western larch tree is called a tamarack in some places, but its scientific name remains *Larix occidentalis*.

Conifers are cone-bearing trees, so named because their seeds are most often borne within woody, scaly structures called cones. Botanically speaking, cones are considered primitive structures because the seeds lack a protective covering, much like nuts without a shell. For this reason, conifers are also called gymnosperms, from two Greek words meaning “naked seeds”. Most conifers are evergreen, retaining their leaves all year long. In reality, many conifers do lose the prior year’s leaves, but this is masked by the current year’s growth. Exceptions to these generalizations include juniper, with berry-like fruit, and tamarack, which drops all its leaves in fall. Conifer leaves are often quite aromatic due to the presence of resins.

Identifying Trees by Leaf Structure

Coniferous leaves are quite different from those of broadleaved trees. Coniferous leaf and branch arrangements are often whorled, radiating from the branch or trunk like spokes from a hub. The arrangement may not be apparent in a seedling because branch development is incomplete.

Awl-like leaves are pointed. They are usually very sharp to the touch. This leaf type is characteristic of cypress.

Scale-like leaves have foliage that overlaps like shingles on a roof, or scales on a fish. This type of foliage is relatively soft to the touch, and is found on cedars and junipers.

Needle-like leaves are the most common among conifers. Needles may be relatively flat, round or triangular in cross-section, and either rounded or pointed at the tip. Pine needles are usually bundled in twos, threes, fives, or mixed groups of twos and threes. Other species have needles borne singly or in clusters along the stem, either attached to the stem by peg-like structures, as with spruce, or attached directly to the stem, as with fir.

Broadleaved trees are known scientifically as angiosperms, or "covered seeds", referring to their protective coverings. Deciduous broadleaved trees shed all their leaves each fall. Evergreen broadleaves, such as holly and some magnolias, drop the prior year's leaves in the summer.

Broadleaved leaf types may be classified into two groups:

Simple leaves have a single leaf attached to the tree by a ***petiole***, or stem. The shape of the leaf may vary considerable and the leaf edge may be toothed or smooth.
Examples of simple leaves are maple, oak, cherry and sweetgum.

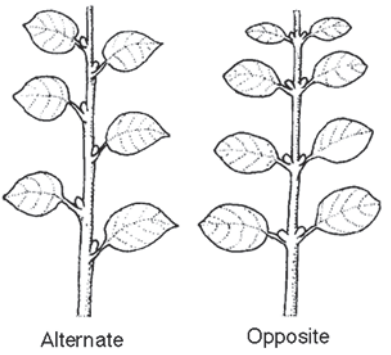
Compound leaves have three or more leaflets each attached by a ***petiolule*** to the petiole. Common arrangements of leaflets are ***palmate*** (leaflets arranged like fingers on a hand, as in horse-chestnut), pinnate (leaflets arranged in pairs, usually with a single leaflet at the tip, as in ash), and bipinnate (a pinnate leaf with each leaflet itself composed of pinnate leaflets, seen in mimosa and honey locusts).

A leaf has a bud at the base of its petiole; a leaflet does not.

Broadleaf leaf and branch arrangements are usually either opposite or alternate. Branches, leaves and buds generally share the same type of arrangement.

Alternate leaves and branches arise in a staggered pattern along the stem. Most commonly planted ornamental trees have this branching habit. Examples are oak and sweetgum.

Opposite leaves and branches arise directly across from one another on the stem or trunk, in a matched set. Examples are maple, ash and dogwood.



Identifying Trees by Bark

Bark is especially helpful for identification in the winter months when the leaves are not present.

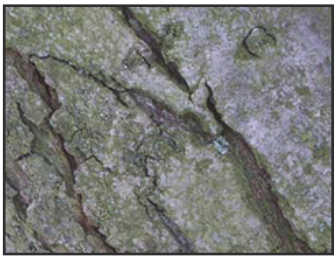
The bark of English oak is blackish brown with deep grooves

The bark of European alder is blackish brown with lenticels and later with flat scales

The bark of most common maple trees is grey-brown

The bark of ginkgo is greyish brown and furrowed

The bark of katsura tree is brown-green with elongated grooves



The bark of hawthorn is greyish green and scaly

The bark of honey locust is grey to greyish brown, furrowed, and may be thorned

The bark of hornbeam is smooth and grey to grey-brown

The bark of horse chestnut is brown to greyish green

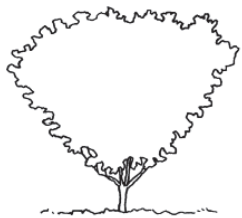
The bark of Italian alder smooth, greyish green with lenticels, later scaly

Identifying Trees by Shape, Form or Habit

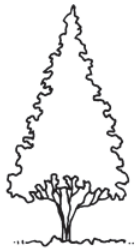
The character of tree crowns and the form or shape of trees varies among species as much as leaf shapes or bark patterns. Shape is another clue to how well a tree will fit the space available, what problems might occur, and how well it will help meet the goals for the property.

Rounded

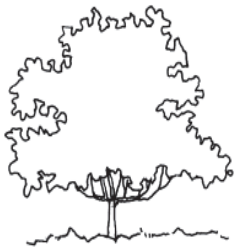
Oval



Vase



Pyramidal



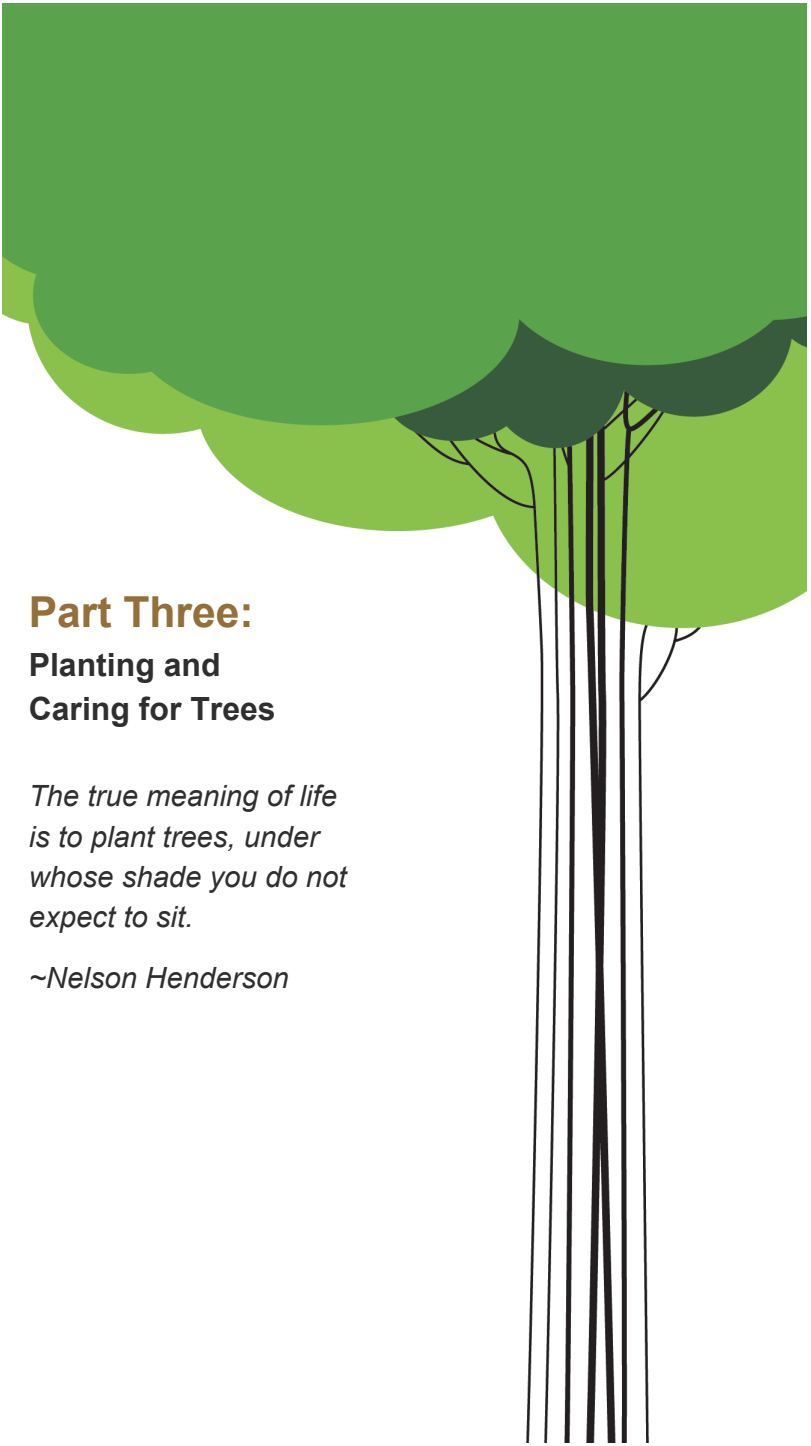
Irregular

Recommended References:

A Guide To Field Identification Trees of North America, Brockman/Merrilees

ISA Arborists' Certification Study Guide

Dirr's Manual of Woody Landscape Plants



Part Three:

Planting and Caring for Trees

The true meaning of life is to plant trees, under whose shade you do not expect to sit.

~Nelson Henderson

TREE PLANTING

Think of the tree you just purchased as a lifetime investment. How well your tree, and investment, grows depends on the type of tree and location you select for planting, the care you provide when the tree is planted, and follow-up care the tree receives after planting.

Site Considerations

Choosing a good site means complying with City of Spokane policies found at the Spokane Urban Forestry website http://www.SpokaneUrbanForestry.org and matching the tree to a site with the optimum conditions for healthy growth.

When selecting a site, check for:

Utilities: If there are overhead wires select a small- or medium-sized tree. For low wires, select a small tree, no taller than 25 feet at maturity. Situate the tree so it will not obstruct access to fire hydrants or obscure stop signs, and its roots will not interfere with underground utilities.

Room for root and crown growth: Plan for the mature size of the tree. Narrow planting strips will necessitate a small-scale or columnar tree. Consider planting a tree in the adjoining yard instead of in the planting strip.

Soil drainage: Compacted and clay soils are common in planting strips and new building developments. To test drainage, dig a hole 10 inches deep, fill with water, and check back on hour later. Water should drain freely at about one inch per hour.

Other site considerations are:

Side of the house: Properly sited, trees can improve a home's energy efficiency. In general, large deciduous trees are best on the south side of a house where they can provide shade in summer yet allow the sun to warm the house in winter. Conifers make good windbreaks.

Future maintenance: Trees next to businesses or in industrial areas may be less likely to receive good care than those planted near homes. Stresses such as insufficient water, soil compaction and reflected heat from pavement should all be considered when selecting a site.

Before You Dig!

Homeowners often make risky assumptions about whether or not they should get their utility lines marked, but every digging job requires a call – even small projects like planting trees and shrubs.

The depth of utility lines varies and there may be multiple utility lines in a common area. Digging without calling can disrupt service to an entire neighborhood, harm you and those around you and potentially result in fines and repair costs.

Calling 811 before every digging job gets your underground utility lines marked for free and helps prevent undesired consequences.

811®

Know what's **below.**
Call before you dig.

Bare Root, Balled and Burlapped (B&B) or Container Grown

Provided by: WSU Master Gardeners of Spokane County

When you purchase a new tree to plant it will be Bare Root, (B&B) Balled and Burlapped or Container Grown.

Bare Root

Bare root plants are mostly deciduous plants that have been dug without any attached soil while dormant in the winter.

When considering a bare root tree, its roots must be kept moist until planting. Dig the hole twice the width of the root system and deep enough that the junction of roots and trunk is at ground level. Spread the roots out so that none are bent or circling. Backfill the planting hole with soil that was dug from the hole. Don't add fertilizer or organic matter. Water it immediately to settle the soil and force out air pockets. Keep the ground moist, not wet, to encourage good root development. Bare root trees are purchased early in the spring and planted before their buds open.

Balled & Burlapped (B&B)

Balled and burlapped plants are dug from nurseries with soil around their roots and wrapped with either biodegradable natural burlap or non-biodegradable synthetic material.

Keep this wrapped rootball moist. Dig the planting hole twice the diameter of the rootball and deep enough so that the tip of the rootball is even with or an inch or two higher than ground level. After the plant is in the hole, remove all strings or twine around the wrap. Cut away the burlap as far down into the planting hole as possible before backfilling with the native soil.

Always remove non-biodegradable synthetic material. If the soil around the root ball is different from the soil into which it is being planted, gently fork some of the soil away from the root system to expose surface roots before backfilling with native soil. Roots in contact with native soil will grow into that soil.

Container Stock

Container grown plants pose special problems. They are usually grown in a highly organic "soil-less" medium. By the time of purchase, plant roots often have grown out to the edge of the container and may even be circling around the pot.

If roots are circling, make several vertical slices into the root clump to cut the circling roots. Then spread apart the root clump as much as possible. As with balled and burlapped plants, set the plant into the planting hole so that the top of the root mass is at or slightly above the ground level. Backfill with native soil, making sure roots remain spread out in the hole while filling it in.

Planting the Tree

Developed by the International Society of Arboriculture (ISA)
http://www.treesaregood.org/treecare/tree_planting.aspx

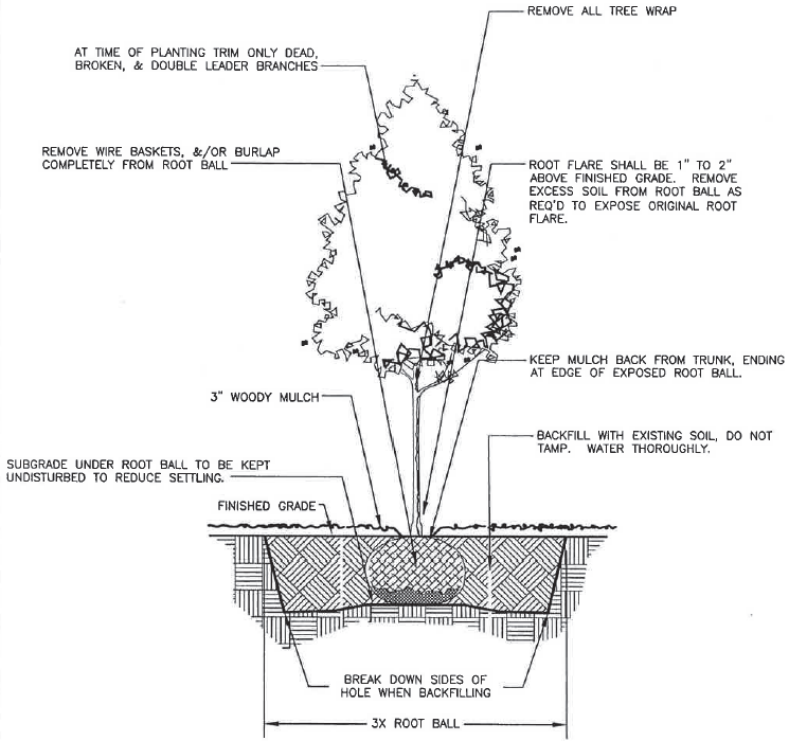
The ideal time to plant trees and shrubs is during the dormant season in the fall after leaf drop or early spring before bud break. Weather conditions are cool and allow plants to establish roots in the new location before spring rains and summer heat stimulate new top growth. However, trees properly cared for in the nursery or garden center, and given the appropriate care during transport to prevent damage, can be planted throughout the growing season. In either situation, proper handling during planting is essential to ensure a healthy future for new trees and shrubs.

If the tree you are planting is balled or bare root, it is important to understand that its root system has been reduced by 90 to 95 percent of its original size during transplanting. As a result of the trauma caused by the digging process, trees commonly exhibit what is known as transplant shock. Containerized trees may also experience transplant shock, particularly if they have circling roots that must be cut. Transplant shock is indicated by slow growth and reduced vigor following transplanting. Proper site preparation before and during planting coupled with good follow-up care reduces the amount of time the plant experiences transplant shock and allows the tree to quickly establish in its new location. Carefully follow nine simple steps, and you can significantly reduce the stress placed on the plant at the time of planting.

1. **Dig a shallow, broad planting hole.** Make the hole wide, as much as three times the diameter of the root ball but only as deep as the root ball. It is important to make the hole wide because the roots on the newly planted tree must push through surrounding soil in order to grow well and get established quickly. On most planting sites in new developments, the existing soils have been compacted and are unsuitable for healthy root growth. Breaking up the soil in a large area around the tree provides the newly emerging roots room to expand into loose soil and hasten establishment.
2. **Identify the trunk flare.** The trunk flare is where the roots spread at the base of the tree. Find it so you can determine how deep the hole needs to be for proper planting. This point should be partially visible after the tree has been planted. If the trunk flare is not partially visible, you may have to remove some soil from the top of the root ball.
3. **Remove tree container for containerized trees.** Carefully cutting down the sides of the container may make this easier. Inspect the root ball for circling roots and cut or remove them. Look for the trunk flare and expose it if necessary.
4. **Place the tree at the proper height.** Before placing the tree in the hole, check to see that the hole has been dug to the proper depth and no more. The majority of the roots on the newly planted tree will develop in the top 12 inches of soil. If the tree is planted too deeply, new roots will have difficulty developing because of a lack of oxygen. It is better to plant the tree a little high, 2 to 3 inches above the base of the trunk flare, than to plant it at or below the original growing level. This planting level will allow for some settling. To avoid damage when setting the tree in the hole, always lift the tree by the root ball and never by the trunk.
5. **Straighten the tree in the hole.** Before you begin backfilling, view the tree from several directions to confirm that it is straight. Once you begin backfilling, it is difficult to reposition the tree.
6. **Fill the hole gently but firmly.** Fill the hole about one-third full and gently but firmly pack the soil around the base of the root ball. If the root ball is wrapped, cut and remove any fabric, plastic, string, and wire from around the trunk and root ball to facilitate growth. Be careful not to damage the trunk or roots in the process. Fill the remainder of the hole, taking care to firmly pack soil to eliminate air pockets that may cause roots to dry out. To avoid this problem, add the soil a few inches at a time and settle with water. Continue this process until the hole is filled and the tree is firmly planted. It is not recommended to apply fertilizer at the time of planting.

7. **Stake the tree, if necessary.** If the tree is grown and dug properly at the nursery, staking for support will not be necessary in most home landscape situations. Studies have shown that trees establish more quickly and develop stronger trunk and root systems if they are not staked at the time of planting. However, protective staking may be required on sites where lawn mower damage, vandalism, or windy conditions are concerns. If staking is necessary for support, two stakes used in conjunction with a wide, flexible tie material on the lower half of the tree will hold the tree upright, provide flexibility, and minimize injury to the trunk. Remove support staking and ties within the first year of growth.
8. **Mulch the base of the tree.** Mulch is simply organic matter applied to the area at the base of the tree. It acts as a blanket to hold moisture, it moderates soil temperature extremes, and it reduces competition from grass and weeds. Some good choices are leaf litter, pine straw, shredded bark, peat moss, or composted wood chips. A 2- to 4-inch layer is ideal. More than 4 inches may cause a problem with oxygen and moisture levels. When placing mulch, be sure that the trunk of the tree is not covered. Doing so may cause decay of the bark at the base of the tree. A mulch-free area, 1 to 2 inches wide at the base of the tree, is sufficient to avoid moist bark conditions and prevent decay.
9. **Provide follow-up care.** Keep the soil moist but not soaked; overwatering causes leaves to turn yellow or fall off. Water trees at least once a week, barring rain, and more frequently during hot weather. When the soil is dry below the surface of the mulch, it is time to water. Continue until mid-fall, tapering off for lower temperatures that require less-frequent watering. Other follow-up care may include minor pruning of branches damaged during the planting process. Prune sparingly immediately after planting and wait to begin necessary corrective pruning until after a full season of growth in the new location.

After you have completed these nine simple steps, further routine care and favorable weather conditions will ensure that your new tree or shrub will grow and thrive. A valuable asset to any landscape, trees provide a long-lasting source of beauty and enjoyment for people of all ages.



BASIC TREE CARE

When planting trees remember that follow up care is essential, especially for the first three years until these young trees become established.

Watering

The single most important factor in the survival and establishment of young trees is proper watering. A lack of water will cause drought stress which weakens the trees making them susceptible to pest problems such as borers. Lack of water can also cause young roots to die, which in turn will cause additional stress related health problems. When roots die the plant won't recover very quickly even when water eventually becomes available. Prolonged drought will cause the death of additional plant tissues and can easily result in the death of the young tree.

Too much water can be almost as damaging as too little, especially in heavier soils such as clay. When the root zone of the tree is saturated with water there is little oxygen available to tree roots. Water uptake is slowed when oxygen is lacking and roots are more prone to rot and die. When roots die they cannot take up the water the tree needs so the tree may appear drought stressed, causing people to believe the tree needs more water which continues the cycle.

Adequate, not excessive, water is critical especially during the first year of tree establishment. Young trees in the Spokane area should be watered deeply once or twice a week. Five gallons of water per inch of trunk diameter should be applied to the root zone per week. The frequency and duration of applications will vary depending on the soil type and weather conditions, but long, slow, infrequent applications are recommended over frequent shallow applications.

If the planting site does not have irrigation then a slow draining watering bag or bucket can be used to gradually water the root system of the tree. These bags can be filled with water and allowed to drain into the trees root system for several days after the bags are filled. These bags should be refilled as needed for the first one to three years until the young tree becomes established.

Once trees become established they will be able to survive for longer periods without water, although additional water is often needed during our dry summer months. Frequency and duration varies as to tree species, soil type, and weather conditions.

Fertilizing

Newly planted trees generally should not be fertilized for the first couple of years unless a soil test shows nutrient deficiencies. Fertilizers are salts which can harm tree roots by reducing water uptake. If a soil test shows that essential nutrients are missing, then fertilize with a low salt, slow release product designed to replace elements missing from the soil.

Pruning

Only minimum pruning is recommended for the first couple of years and it is usually limited to only what is needed to train the young tree. More details on pruning are ahead in this publication.

Removal of suckers

Suckers are the vigorous upright shoots at the base of the young tree. These shoots often come from below the graft union and they may show undesirable characteristics of the species used for the root stock. Suckers should be removed when they are young and the diameter is small. Suckers can be plucked out of the trunk by hand or pruned back as close to the tree as possible.

Weed control

Weed growth around the base of young trees can cause several problems for the tree, such as robbing the soil of water and nutrients that could have been used by the tree. The weeds may release chemicals into the soil that will inhibit tree root growth and slow tree establishment. Weeds look bad and when string trimmers or herbicides are used to kill them the tree may be harmed in the process. Use of mulches to smother and inhibit weed growth is highly recommended, reducing the need for the use of mowers and string trimmers that could easily mar the trunk of the new trees. If weeds around the base of the tree are quite large then hand-pulling them may be the safest bet.

Herbicides may be necessary to control creeping and deep rooted weeds. Pre-emergent herbicides will kill weed seedlings before they emerge from the soil and they are generally safe to use around trees which were planted a few weeks prior to the treatment. Roundup or other Glyphosate products can be used to spot treat weeds around young trees. It is especially helpful in controlling weeds with a creeping habit. Some broadleaf herbicides can be used to kill broadleaf weeds as well. Use caution when using these materials around desirable trees. Be sure to read and follow label instructions to avoid causing harm to the trees.

Insects and diseases

Sometimes pest problems become a concern on young trees. Try to keep trees healthy so the trees can better defend themselves from pests. If you see pests such as aphids then check for beneficial predators such as ladybeetles. If the beneficial insects are keeping the pest numbers at low levels, then additional control treatments are generally not needed. If you have a concern about insect or disease problems on your trees then please contact the local WSU Master Gardener Plant Clinic and Resource Center, 509-477-2181.

Ground covers

Ground cover plantings under young trees are discouraged, as these plants can compete with the trees for water and nutrients. Ground covers can reduce weed growth around tress and they can beautify the landscape, but if used, be sure to keep them a few inches away from the trunk.

Tree grates and pavers

Tree grates and pavers are often used in urban areas to cover the soil around trees planted in sidewalks. These grates and pavers can damage trees as the trunks increase in diameter with growth. Grates and pavers should have openings adequately sized to allow for trunk growth. These need to be replaced every few years as tree trunks expand to avoid causing damage if they become imbedded in the trunk.

PRUNING

(Courtesy of "How to Prune Trees" by Bedker, O'Brien & Mielke, with illustrations by Julie Martinez)

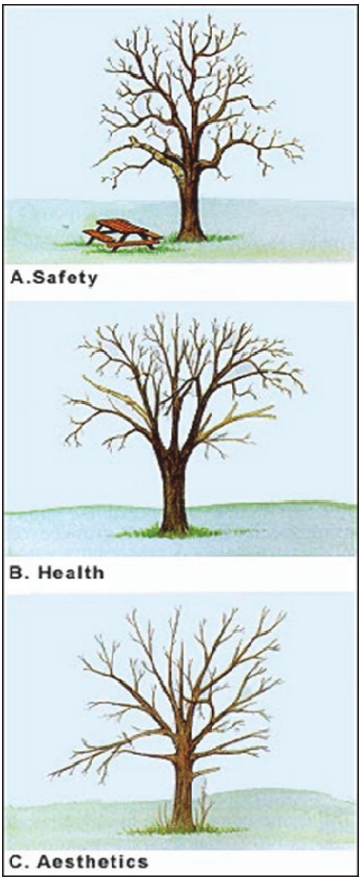
Introduction

The objective of pruning is to produce strong, healthy, attractive plants. By understanding how, when and why to prune, and by following a few simple principles, this objective can be achieved.

Reasons For Pruning

The main reasons for pruning ornamental and shade trees include safety, health, and aesthetics. In addition, pruning can be used to stimulate fruit production and increase the value of timber.

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. Safety pruning can be largely avoided by carefully choosing species that will not grow beyond the space available to them, and have strength and form characteristics that are suited to the site.



Pruning for *health* involves removing diseased or insect-infested wood and removing crossing and rubbing branches. Pruning can best be used to encourage trees to develop a strong structure and reduce the likelihood of damage during severe weather. Removing broken or damaged limbs encourages wound closure.

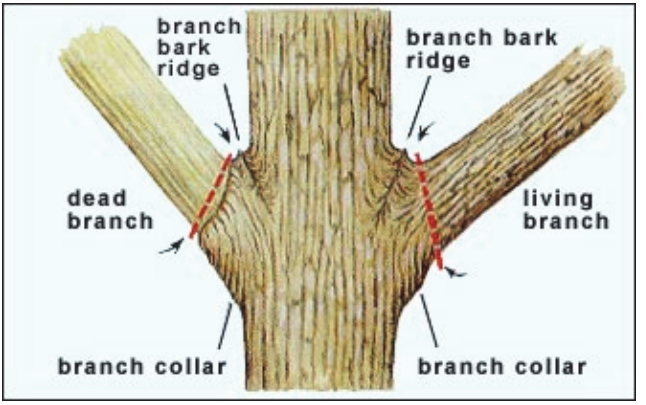
Pruning for *aesthetics* involves enhancing the natural form and character of trees or stimulating flower production. Pruning for form can be especially important on open-grown trees that do very little self-pruning.

Pruning Cuts

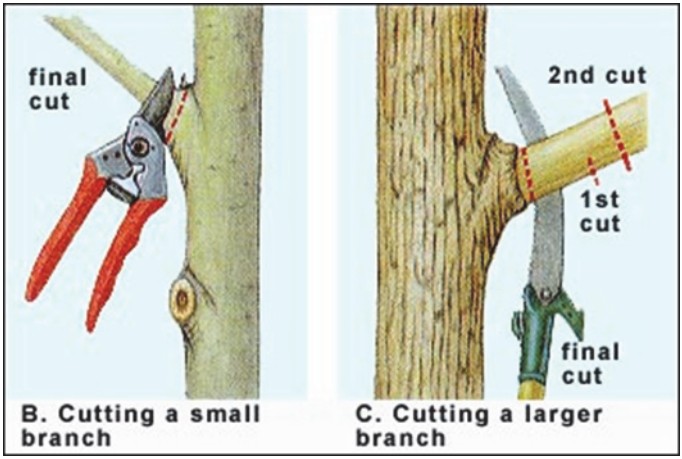
Pruning cuts should be made so that only branch tissue is removed and stem tissue is not damaged. At the point where the branch attaches to the stem, branch and stem tissues remain separate, but are contiguous. If only branch tissues are cut when pruning, the stem tissues of the tree will probably not become decayed and the wound will seal more effectively.

Pruning living branches

Targeting the cut



To find the proper place to cut a branch, look for the branch collar that grows from the stem tissue at the underside of the base of the branch. On the upper surface, there is usually a branch bark ridge that runs (more or less) parallel to the branch angle, along the stem of the tree. A proper pruning cut does not damage either the branch bark ridge or the branch collar.



A proper cut begins just outside the branch bark ridge and angles down away from the stem of the tree, avoiding injury to the branch collar. Make the cut as close as possible to the stem in the branch axil, but outside the branch bark ridge, so that stem tissue is not injured and the wound can seal in the shortest time possible. If the cut is too far from the stem, leaving a branch stub, the branch tissue usually dies and woundwood forms from the stem tissue. Wound closure is delayed because the woundwood must seal over the stub that was left.

The quality of pruning cuts can be evaluated by examining pruning wounds after one growing season. A concentric ring of woundwood will form from proper pruning cuts. **Flush cuts** made inside the branch bark ridge or branch collar result in pronounced development of woundwood on the sides of the pruning wounds with very little woundwood forming on the top or bottom. As described above, stub cuts result in the death of the remaining branch and woundwood forms around the base from stem tissues.

When pruning small branches with hand pruners, make sure the tools are sharp enough to cut the branches cleanly without tearing. Branches large enough to require saws should be supported with one hand while the cuts are made. If the branch is too large to support, make a three-step pruning cut to prevent bark ripping.

1. The first cut is a shallow notch made on the underside of the branch, outside the branch collar. This cut will prevent a falling branch from tearing the stem tissue as it pulls away from the tree.

2. The second cut should be outside the first cut, all the way through the branch, leaving a short stub.

3. The stub is then cut just outside the branch bark ridge/branch collar, completing the operation.

Pruning dead branches

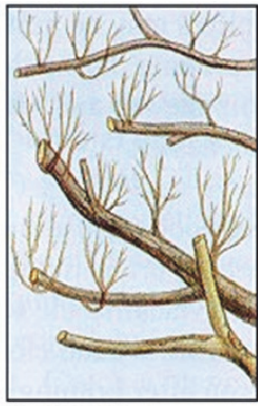
Prune dead branches in much the same way as live branches. Making the correct cut is usually easy because the branch collar and the branch bark ridge can be distinguished from the dead branch because they continue to grow (Fig. 6A). Make the pruning cut just outside of the ring of woundwood tissue that has formed, being careful not to cause unnecessary injury (Fig. 6C). Large dead branches should be supported with one hand or cut with the three-step method, just as live branches. Cutting large living branches with the three step method is more critical because of the greater likelihood of bark ripping.

Pruning Practices That Harm Trees

Topping and tipping are pruning practices that harm trees and should not be used. Crown reduction pruning is the preferred method to reduce the size or height of the crown of a tree, but is rarely needed and should be used infrequently.

Topping, the pruning of large upright branches between nodes, is sometimes done to reduce the height of a tree. Tipping is the practice of cutting lateral branches between nodes to reduce crown width.

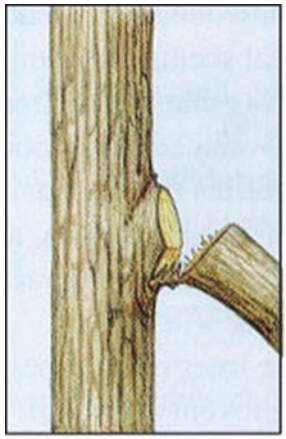
A. Topping



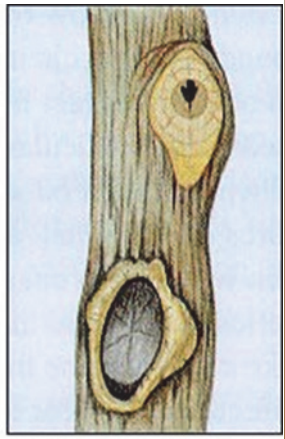
B. Tipping

These practices invariably result in the development of epicormic sprouts, or in the death of the cut branch back to the next lateral branch below. Epicormic sprouts are weakly attached to the stem and eventually will be supported by a decaying branch.

Improper pruning cuts cause unnecessary injury and bark ripping. Flush cuts injure

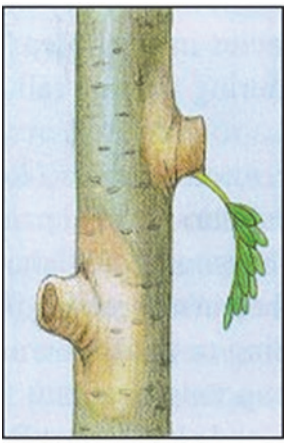


C. Bark ripping



D. Flush cutting

stem tissues and can result in decay. Stub cuts delay wound closure and can provide entry to canker fungi that kill the cambium, delaying or preventing woundwood formation.


E. Stub cutting

In addition, a tree's foliage protects the tree's branches and trunk from the sun. When so much of the crown is removed at once, scalding and damage to bark may occur. If neighboring trees and shrubs depend on shade, they also will suffer without it.

The large branch stubs left by topping have difficulty healing. The size and terminal location of these cuts leaves them especially vulnerable to disease and insect invasion. If decay is already present, its spread will be accelerated.

A topped tree is a disfigured tree. It will never regain the appearance that is characteristic of its species, and its aesthetic value will be forever changed.

NO Tree Topping.

When to Prune

Conifers may be pruned any time of year, but pruning during the dormant season may minimize sap and resin flow from cut branches. Recent wounds and the chemical scents they emit can actually attract insects that spread tree disease. For instance, pruning pines during the annual flight of Pine Bark Beetles may attract the insect to your tree, so avoid severe pruning during the growing season.

Hardwood trees and shrubs *without showy flowers*: prune in the dormant season to easily visualize the structure of the tree, to maximize wound closure in the growing season after pruning, to reduce the chance of transmitting disease, and to discourage excessive sap flow from wounds. Check with your county extension office or a horticulturist for additional information to find out when to prune vulnerable tree species in your area. Usually, the best time is during the late fall and winter.

Flowering trees and shrubs: these should also be pruned during the dormant season for the same reasons stated above; however, to preserve the current year's flower crop, prune according to the following schedule:

- Trees that flower in early spring (cherries, lilac, dogwood, etc.) should be pruned immediately after flowering (flower buds arise the year before they bloom).
- Many flowering trees are susceptible to fire blight, a bacterial disease that can be spread by pruning. These trees in the rose family, crabapple, hawthorn, pear, and mountain ash, should be pruned during the dormant season.
- Trees that flower in the summer or fall always should be pruned during the dormant season (flower buds will form on new twigs during the growing season, and the flowers will bloom normally).

Dead branches can be removed any time of the year.

Pruning Guidelines

To encourage the development of a strong, healthy tree, consider the following guidelines when pruning.

General

- Prune first for safety, next for health, and finally for aesthetics.
- Never prune trees that are touching or near utility lines; instead consult your local utility company.
- Avoid pruning trees when you might increase susceptibility to important pests (e.g. prune trees susceptible to fire blight only during the dormant season).

Use the following decision guide for size of branches to be removed (on a mature tree):

1. Under 1.5 inches diameter? Go ahead, prune.
2. Between 1.5 and 3 inches diameter? Think twice.
3. Greater than 3 inches diameter? Call a certified arborist.

Thinning

- Assess how a tree will be pruned from the top down.
- Favor branches with strong, U-shaped angles of attachment. Remove branches with weak, V-shaped angles of attachment and/or included bark.
- Ideally, lateral branches should be evenly spaced on the main stem of young trees.
- Remove any branches that rub or cross another branch.
- Make sure that lateral branches are no more than one-half to three-quarters of the diameter of the stem to discourage the development of co-dominant stems.
- Do not remove more than one-quarter of the living crown of a tree at one time. If it is necessary to remove more, do it over successive years.

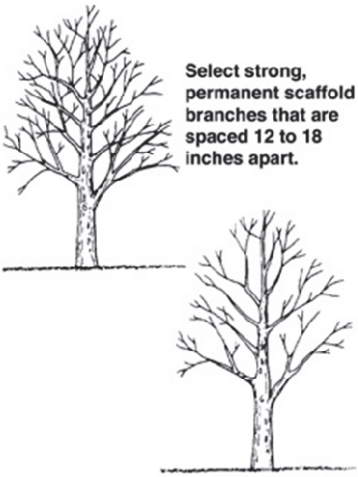
Crown Raising (pruning the lowest branches)

- Always maintain live branches on at least two-thirds of a tree's total height. Removing too many lower branches will hinder the development of a strong stem.
- Remove basal sprouts and vigorous epicormic sprouts.

Crown Reduction (reducing tree height)

- Use crown reduction pruning only when absolutely necessary. Make the pruning cut at a lateral branch that is at least one-third the diameter of the stem to be removed.
- If it is necessary to remove more than half of the foliage from a branch, remove the entire branch.

Establishing a Strong Scaffold Structure



A good structure of primary scaffold branches should be established while the tree is young. The scaffold branches provide the framework of the mature tree. Properly trained young trees will develop a strong structure that requires less corrective pruning as they mature.

The goal in training young trees is to establish a strong trunk with sturdy, well-spaced branches. The strength of the branch structure depends on the relative sizes of the branches, the branch angles, and the spacing of the limbs. Naturally, those factors vary with the growth habit of the tree. Pin oaks and sweetgums, for example, have a conical shape with a central leader. Elms and oaks are often wide-spreading without a central leader. Other trees, such as lindens and pears, are densely branched. Good pruning techniques remove structurally weak branches while maintaining the natural form of the tree.

Trunk Development

For most young trees, maintain a single dominant leader growing upward. Do not prune back the tip of this leader. Do not allow secondary branches to outgrow the leader. Sometimes a tree will develop double leaders known as co-dominant stems.

Co-dominant stems can lead to structural weaknesses, so it is best to remove one of the stems while the tree is young.

When co-dominant stems develop, bark may become "included" in the crotch. It is best to prune one of the stems while the tree is young.

The lateral branches growing on the sides contribute to the development of a sturdy well-tapered trunk. It is important to leave some of these lateral branches in place, even though they may be pruned out later. These branches, known as temporary branches, also help protect the trunk from sun and mechanical injury. Temporary branches should be kept short enough not to be an obstruction or compete with selected permanent branches.

Permanent Branch Selection

Nursery trees often have low branches that may make the tree appear well-proportioned when young, but low branches are seldom appropriate for large-growing trees in an urban environment.

Branches should be well spaced radially and along the trunk as shown in the tree on the left.

How a young tree is trained depends on its primary function in the landscape. For example, street trees must be pruned so that they allow at least 16 feet of clearance for traffic. Most landscape trees require only about 8 feet of clearance.

The height of the lowest permanent branch is determined by the tree's intended function and location in the landscape. Trees that are used to screen an unsightly view or provide a wind break may be allowed to branch low to the ground. Most large-growing trees in the landscape must eventually be pruned to allow head clearance.

The spacing of branches, both vertically and radially, in the tree is very important. Branches selected as permanent scaffold branches must be well-spaced along the trunk. Maintain radial balance with branches growing outward in each direction.

A good rule of thumb for the vertical spacing of permanent branches is to maintain a distance equal to 3 percent of the tree's eventual height. Thus, a tree that will be 50 feet tall should have permanent scaffold branches spaced about 18 inches apart along the trunk. Avoid allowing two scaffold branches to arise one above the other on the same side of the tree.

Some trees have a tendency to develop branches with narrow angles of attachment and tight crotches. As the tree grows, bark can become enclosed deep within the crotch between the branch and the trunk. Such growth is called included bark. Included bark weakens the attachment of the branch to the trunk and can lead to branch failure when the tree matures. You should prune branches with weak attachments while they are young.

Avoid over thinning the interior of the tree. The leaves of each branch must manufacture enough food to keep that branch alive and growing. In addition, each branch must contribute food to grow and feed the trunk and roots. Removal of too many leaves can starve the tree, reduce growth, and make the tree unhealthy. A good general rule is to keep at least half the foliage on branches arising in the lower two-thirds of the tree.

STREET TREE PROBLEMS

Street trees in many cities suffer wide range of problematic issues. Issues are most often the result of poor planning, poor planning, and poor planning.

The wrong tree, planted in the wrong place is often doomed from the beginning.

- A tall tree species planted under overhead utility wires,
- A tree that matures with large, wide girth characteristics planted in narrow planting strips,
- A tree planted too close to buildings, sidewalks, or parking strips (where bumpers or doors could possibly come in contact with stems), and
- A tree with a robust root system planted in too closely to underground utilities and sewer lines.

All are ultimately compromised aesthetically, structurally, and/or biologically.

Give trees a chance to succeed by using a planning/planting/mature height guideline such as the one below from ISA's Best Management Practices *"Utility Pruning of Trees"* .

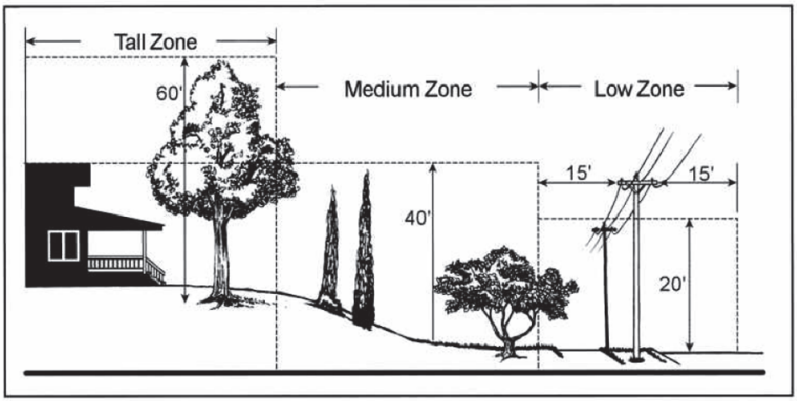


Figure 1. Proper selection and placement of trees minimizes the need for utility pruning.

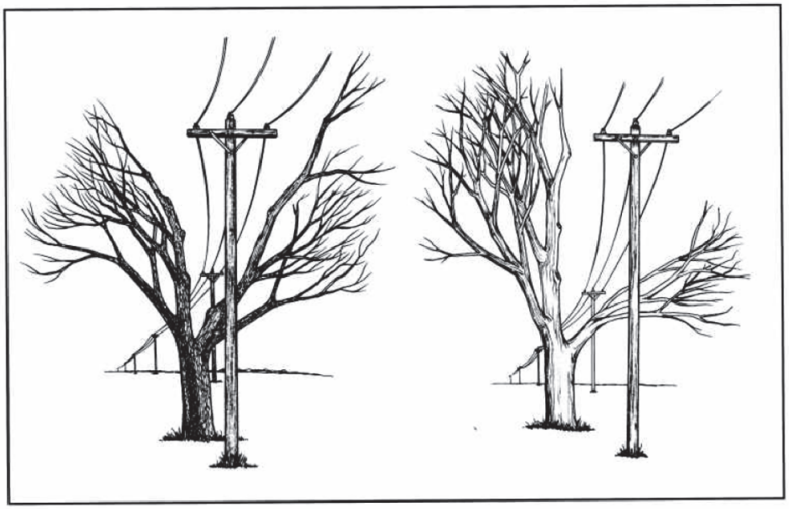


Figure 10. Directional pruning causes trees to assume different shapes depending on the location of utility facilities.

When vegetation management (pruning and/or removals) of street trees is necessary to maintain safe and reliable energy delivery, Avista Utilities adheres to the ISA Best Management Practices *"Utility Pruning of Trees"* and the ANSI A300 Part 1: *"Tree, Shrub, and other Woody Plant Maintenance"*, the industry's current standards for utility pruning.

Weather Damage

Street trees can be damaged by the extremes of weather in our area, but that damage isn't always immediately obvious. Understanding how this damage occurs can help tree managers respond, or better yet, prevent weather damage.

Winter weather can injure trees directly in several ways, including weight from snow load, very low temperatures, cycles of freezing and thawing, and winter wind damage. There is also indirect damage caused by our management of winter weather. Examples of this would be mechanical damage from snow removal equipment and thrown snow, and chemical damage from some de-icing compounds.

- Snow load injury is easy to recognize. The weight of snow (usually heavy or wet snow) causes limbs to break. If a limb is completely broken, the only treatment is to remove it and

make a proper pruning cut back to the nearest lateral branch or at the trunk. If temperatures are extremely cold, the final pruning cut may be delayed until warmer weather to prevent freezing of callus tissues.

- Cold temperatures can injure or kill trees. During cold temperatures, water in the cells of the tree freezes and expands, rupturing the cells. The damage may be limited to flower buds, or may kill branches, the trunk or the root system. Trees require a period of hardening in the fall to get ready for winter cold. An early freeze can damage normally hardy trees, if they are not prepared for cold. Trees with thin bark, newly planted trees, and borderline hardy species are the most likely to be damaged, even during a normal winter. The lower the temperature goes, or the longer cold weather persists, the more damage is done.

- Cycles of freezing and thawing, may also damage trees. This can cause “frost heaving” near the top of the soil, where tender roots are forced to the surface and die in the cold. This damage is rarely serious, except on newly planted trees with few roots. Mulching the root zone can help prevent this damage. Another type of damage is often called “southwest injury” because the freeze/thaw cycle will damage the south or southwest side of a tree trunk, where sunlight hits it. Warmth from the sun melts water inside the trunk, which refreezes when the sun goes down. This ruptures and kills trunk tissue, but it may not be obvious for months or years, when bark in that area turns color, and falls away. Large enough wounds of this type can stunt or kill a young or thin-barked tree.

- Winter drought or desiccation is easy to prevent, but harder to identify. Trees, especially evergreens, continue losing water through the winter. Without enough water in the soil, roots dry out and die, causing damage to the canopy above. If the drought is long or severe enough, the whole plant may die. Damage isn’t apparent until spring when the weather warms. On conifers, patches of brown appear. This usually happens quickly and may seem to happen overnight. In fact, the damage was done during the drought period which may have taken months. Watering trees late into the fall or during long

dry periods in the winter will help. It may take some hand watering, if irrigation systems are turned off, but adequate soil moisture is the only way to prevent this damage.

- Chemical damage from de-icing agents may mimic the winter drought symptoms above. That is because most of these chemicals are forms of salts. Salts desiccate or dry out plant tissues, whether above or below ground. Needles of evergreens may turn brown in uniform zones nearest to the application area. If enough deicer is washed into the soil, it may damage roots as well. There are “plant safe” deicers available, so check with your local distributor.

Summer weather damages trees in similar ways, but with heat. It can cause direct injury by scorching leaves and bark, or indirect injury by drying out plant and soil.

- Leaf scorch primarily occurs on leaves at the end of branches. Leaves turn yellow or reddish brown and dry out. They may or may not fall off the tree. It often occurs at the tops of trees, but can also be seen where heat or light reflects on to the leaves, for instance from a window, wall or large vehicle. Most of the time, this causes minor damage and just kills a handful of leaves. In some cases, however, the damage is more severe.

- Sunburn of tree bark is a more serious issue, especially when it occurs on the trunk. Very similar to the “southwest injury” described above, this damage kills trunk or branch tissue, disrupting nutrient and water transfer to the canopy, and slowing growth. It occurs on thin-barked trees and in parts of a plant newly exposed to the sun. It can occur after a heavy pruning, when a shading structure is removed or when a tree is moved from a low light to a high light area. This often occurs when trees are taken from nurseries and planted in the landscape during summer months. It is best to plant trees in spring and fall and give new trees adequate irrigation.

- Drought stress is one of the most common problems with all types of plants in our area. Spokane, Washington is an arid climate with hot summers, which means almost all trees will need

supplemental water. Symptoms of drought stress include wilting or flagging leaves, especially at the top of the tree. Leaves may turn yellow then brown and fall off the plant. By the time you see drought stress in the canopy, it has already begun killing roots below ground. Once again the best treatment is prevention. Drought stress increases the chance of disease or insect problems, including some that may kill the tree.

Watering Tips

Watering home landscape and garden plants properly is one of the most misunderstood yard chores. In many areas , particularly in Eastern Washington, there is not enough rainfall to support plant growth during times when water is critically needed. If landscape plants are water-stressed during the summer, they may experience other problems during the rest of the year, such as increased insect and disease susceptibility and decreased winter hardiness.

Water trees inside and outside the dripline, or outer edge of the leaf canopy. A hose, soaker hose, irrigation bubblers, drip heads or various types of sprinklers may be used. For areas outside of normal irrigation, you may consider a product like a TreeGator which is a bag that slowly releases water around the base of the trunk. For deep-rooted trees, a root needle or fertilizer feeding needle (minus the fertilizer) may be used for deep watering. This is a tedious process but it works. Penetration is important. A dished or shallow berm-enclosed area constructed around the base of a newly planted tree or shrub may be filled with water. Mulching newly established shrubs and trees helps prevent moisture loss. This allows for slow percolation into the root zone. However, on heavier soils, during the rainy season or in the winter, these basin rims are best removed to avoid concentrating too much water.

Shrubs and trees near house foundations, under eaves, and/or in southern, southwestern, or western exposures need to be watered more frequently. They get little water from precipitation, and reflected heat from walls leads to increased water and heat stress. Mounds or berms in which landscape plants have been installed have much more soil surface exposed to evaporation than the natural soil profile. They also drain more quickly. Therefore, these areas will have to be checked and watered more frequently.

Roots extend up to 2-5 times the width of the tree's canopy

The roots of a tree extend far from the trunk and are found mostly in the upper 6 to 12 inches of soil.

Illustration courtesy of International Society for Arboriculture

Recently transplanted woody plants need special attention. The soils in which balled-and-burlapped and containerized plants have grown are often radically different from the soils into which they are planted in the home landscape. When this occurs, interfaces are created between the original nursery soil and the soil at the new site. Water does not move readily between the different soil media. Container soils, in particular, have a tendency to dry out much faster than the surrounding or backfill soils. It is most important that new trees have water applied to both the nursery soil and the surrounding soil during the critical establishment period. Roots grow only where there is moisture and unless both media are moist, the roots may never grow out of the original nursery soil. Plants in such a situation may ultimately girdle themselves.

Woody plants native to dry areas may not need supplemental water during the summer months. Once established, they are more drought tolerant in the summer, but establishment can take up to three years of proper watering for larger trees.

Water Loss from the Soil

There are several ways in which water is lost from the soil. Rain, melted snow, or water applied by the homeowner may percolate through the soil beyond the root zone or run off the top of the ground. This water is useless to growing trees.

Water may also evaporate from the soil surface, leaving it dry. Water from lower layers in the soil is drawn to the dry surface by capillary action and also evaporates. This continual evaporation may deplete water from quite deep in the soil.

Transpiration is the process by which a plant loses water through its leaves. This is a necessary process for plant growth. A large tree may lose hundreds of gallons of water a day in the summer. Water lost from the soil by evaporation and transpiration must be replaced by precipitation or irrigation.

Important Factors to Remember:

- **Most** trees in **most** areas of Eastern Washington need irrigation in the summer.
- Frequent, shallow watering leads to shallow roots increasing plant stress under drought or hot conditions.
- Water at the coolest times of day, to reduce evaporation, preferably in the early morning.
- Too much water is as bad as, or worse than, too little. Rate of water application should be no more rapid than the rate at which the soil can absorb it.
- Conserve water whenever possible. It is a valuable resource that is becoming scarce.

Soil-Water-Air Relationships

Establishing the correct water-air relationships in the soil is essential for the best growth of all plant types. Oxygen in the soil is necessary for plants to grow. Watering too often or too much is likely to exclude oxygen from the soil pore spaces. Plant parts above ground exhibit symptoms of this stress: wilting, yellowing, and drying foliage, leaf drop and twig dieback may all occur. Constant overwatering will kill most plants.

Too little water, on the other hand, does not allow the roots to replace water lost by the plant through transpiration. The roots may dry up and die, and the top growth begins to show symptoms similar to overwatering. In both cases, the plant suffers from lack of moisture in its tissues.

Heavy clay soils are much more likely to be overwatered than sandy soils. Conversely, light sandy soils are dry and tend not to be watered enough. Although light soils allow deeper and quicker water penetration, they dry out more rapidly because they hold less water. Heavy soils, on the other hand, are slower to allow penetration but also dry out much more slowly.

A good rule of thumb to follow in watering plants is to fill the entire root zone with water and then allow the soil to dry out partially before the next irrigation. The amount of drying depends on the plant species and size. Large trees can be allowed to dry several inches down in the soil before watering again. A small or newly established plant will need watering before very much soil drying takes place. Use a shovel a few times after watering to determine how long your sprinkler takes to wet the root zone and how long your soil takes to dry out. After making this determination, it is not necessary to check the soil each time.

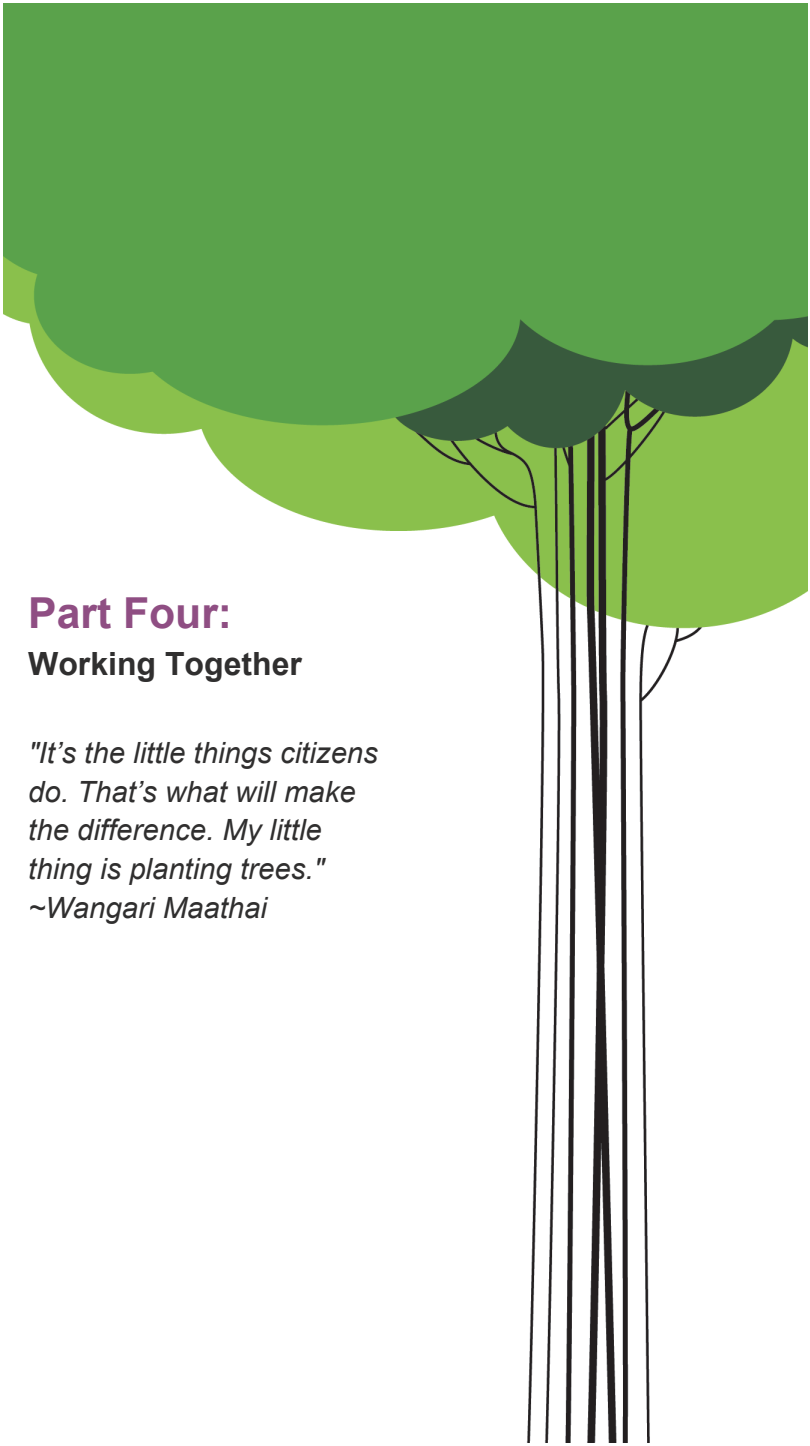
It is essential that gardeners become familiar with how long it takes the root zones of the various plants in their gardens to become completely moistened, and then, how deeply they can allow the soil to dry before the plants begin to show stress and need water. It is also necessary to understand that frequent, light sprinkling will not do the job of wetting the entire root zone.

Water Penetration

Soil type or texture is a major determining factor of how much water a soil will hold, or how quickly a soil can be irrigated. For example, one inch of water applied to a sandy soil will penetrate 12 inches. It will move anywhere from 6-10 inches into a good loam soil, and in a clay soil it will percolate down only 4-5 inches.

Soil Compaction

Water cannot soak into compacted soils, particularly if water is applied too quickly. For compacted soil or areas under the canopy of trees, the best treatment is to aerate the soil by removing plugs. Removal of turf and replacement with mulches around trees helps restructure the surface layer of compacted soils to allow more efficient penetration of water. Chemical wetting agents can also help water soak through dry organic layers like thatch, so that it moves into the soil.



Part Four:

Working Together

"It's the little things citizens do. That's what will make the difference. My little thing is planting trees."
~Wangari Maathai

GET INVOLVED

- Even by walking around your neighborhood, you can get to know the trees that are part of your community. Take notes about what you see, learn about the different species and which trees are best for our area. Use this guide and the information it provides to learn.
- You can learn about many of the trees by reviewing our **Approved Street Tree List**, found at *http://www.SpokaneUrbanForestry.org*
- Attend a **Urban Forest Tree Committee** (UFTC) & **Citzen Advisory Committee** (CAC) meeting to find out what is happening currently with the City of Spokane's Urban Forestry program. Contact Spokane Urban Forestry for meeting schedule information. *urbanforestry@spokanecity.org*
- Take the **Tree Board University** (http://www.treeboardu.org) online courses for free! This is a great resource for tree advocates and enthusiasts of any experience level.
- Attend the Arbor Day Celebration in April and Fall Leaf Festival in October, held at the John A. Finch Arboretum in Spokane, WA.

Other Great Resources:

Spokane Conservation District. The Forestry Department at the Spokane Conservation District applies an ecologically balanced approach to managing, utilizing, and protecting the forest and wildlife resources. They also provide information and assistance on urban forestry issues in Spokane County. *www.sccd.org*

The Lands Council in Spokane, is dedicated to planting and protecting native trees such as Ponderosa pine and Douglas fir through education and community action. They are frequently engaged in conservation advocacy and events throughout Spokane. *www.landscouncil.org*

Spokane Parks Foundation is committed to protecting, preserving and improving greater Spokane's parks. The Foundation helps preserve our valuable community green spaces and enhance them for future generations. *www.spokaneparksfoundation.org*

Tree Link Internet-based information and tools to improve urban and community forests. The site provides a variety of information, research and networking opportunities. *actrees.org/welcome-treelink-itreebank-visitors*

American Forests A non-profit organization that works to protect and restore urban trees and rural forests. American Forests' targeted audiences are individuals, community groups, government at all levels, educators, and businesses. *www.americanforests.org*

International Society of Arboriculture ISA was created to provide the general public with quality arboriculture, or tree care, related information. Resources include information on tree selection, proper tree care and pruning, and tree problems and treatments. *www.isa-arbor.com*

Pacific Northwest Chapter of the International Society of Arboriculture PNW-ISA is a Chapter of the International Society of Arboriculture, encompassing the states of Washington, Oregon, Idaho, Alaska, and the province of British Columbia. Available information includes tips on proper tree care and how to prevent your trees from becoming hazardous. *www.pnwisa.org*

National Arbor Day Foundation provides substantial tree information, including selecting the right tree for your location and tree care tips. *www.arborday.org*

Washington Community Forestry Council is a program of the Washington State Department of Natural Resources working to educate citizens and decision-makers about the economic, environmental, psychological and aesthetic benefits of trees and to assist local governments, citizen groups and volunteers in planting and sustaining healthy trees and vegetation. *www.dnr.wa.gov/AboutDNR/BoardsCouncils/WCFC/Pages/Home.aspx*

Urban and Community Forestry Program of the United States Department of Agriculture provides technical and financial assistance to help improve the livability of cities and communities through managing urban forest resources to promote a healthy ecosystem. *www.fs.fed.us/ucf/*

Community Canopy is a tree care education partnership of the cities of Spokane, WA, Coeur d'Alene, Hayden, and Post Falls, ID, along with the Spokane Conservation District, and with assistance from the University of Idaho Extension and Washington State University Extension. The goal of Community Canopy is to have healthy and sustainable community forests providing maximum environmental and visual benefits. *www.communitycanopy.org*

The Heritage Tree Program

The City of Spokane's Historic and Heritage Tree Preservation Program was established as a way for citizens to officially recognize special and significant trees in the community.

The City of Spokane believes that by providing this recognition we stay connected to the important historic events that have shaped our past. The purpose of the program is to:

~Increase public awareness of trees and specifically Spokane's urban forest.

~ Draw attention to and protect unique and significant heritage trees.

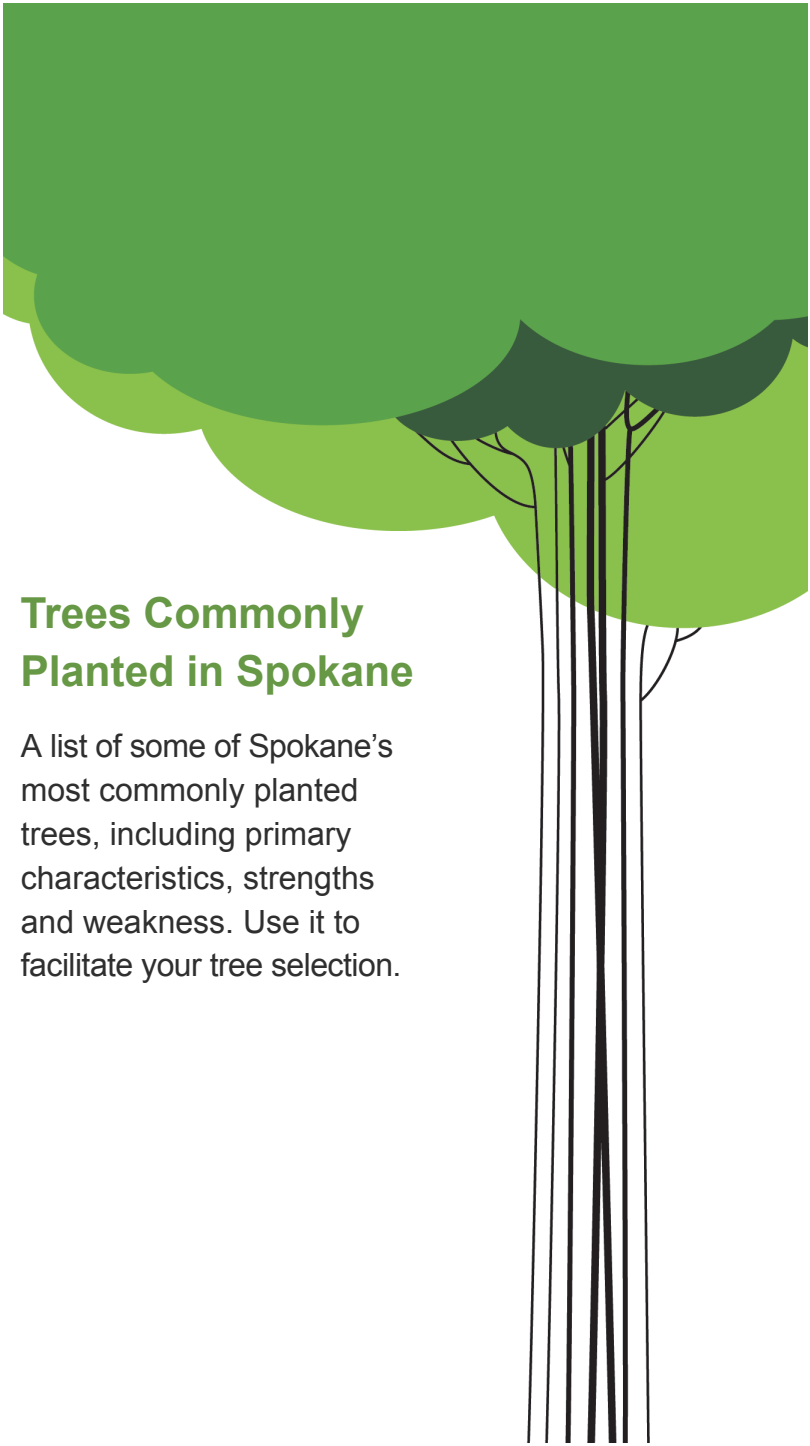
~Reinforce that trees are one of the key components of our City's unique character and sense of place.

~Encourage public participation in the identification and perpetuation of heritage trees throughout the City.

A "heritage tree" is a tree or collection of trees that is acknowledged and valued for the unique characteristics that set it apart from other similar trees. A heritage or historic tree is designated by the tree committee based on a detailed criteria - including the tree's historical significance, that it has attained significant size in height, caliber or canopy spread for its age and species and/or has special aesthetic qualities for its species. Ideally, a heritage tree would be prominently visible to the public, along major roads or in public places and possess rare horticultural value.

How to Nominate a Tree for historic or heritage recognition
If you have or know of a special tree or collection of trees to be considered for historic or heritage status, please review the ordinance: Section 12.02.916 and return the Heritage Tree Nomination Form and Property Owner Agreement Form (*www.SpokaneUrbanForestry.org*) to Spokane Urban Forestry at City Hall, 808 W Spokane Falls Blvd, Spokane, WA 99201; or by fax to 509.625.6205.

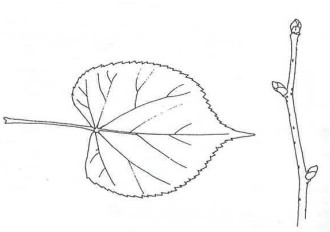
If you have additional questions please contact us at urbanforestry@spokanecity.org or at 509.363.5495.



Trees Commonly Planted in Spokane

A list of some of Spokane's most commonly planted trees, including primary characteristics, strengths and weakness. Use it to facilitate your tree selection.

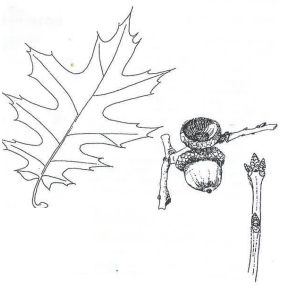
Littleleaf Linden *Tilia cordata*



Height: 40 ft.
Spread: 30 ft.
Growth Rate: Slow
Hardiness: -30 F
Zone: USDA 4a

General: One of best city and street trees. Pyramidal in youth; upright-oval to pyramidal rounded and densely branched in old age. **Fall Color:** Yellow or yellow-green. **Flower Color:** Small, individual flowers in loose drooping clusters, with a leaf-like bract. Light yellow or creamy flower color. Blooms in late June and early July, very fragrant; bees are attracted to the flowers. **Growing Conditions:** Full sun to part shade. Drought resistant, fragrant flowers, pH adaptable, urban tolerant. Readily transplanted, quite pollution tolerant. **Pests & Problems:** Same as *T. americana* also aphids and Japanese beetles often a problem.

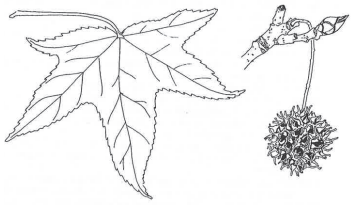
Red Oak *Quercus rubra*



Height: 50 ft.
Spread: 45 ft.
Growth Rate: Slow
Hardiness: -30 F
Zone: USDA 4a

General: Rounded in youth, in old age often round-topped and symmetrical. Long-lived. **Fall Color:** A mixture of russet-red, yellow and tan. Color develops late, can be quite good or disappointing. **Flowering:** Pale yellow-green catkins (male) add slight seasonal interest in May. Fruits are acorns borne singly or in pairs, and have large saucer-like caps. **Growing Conditions:** Full sun, prefers acid soil, salt and urban tolerant. Transplants readily because of negligible taproot; prefers sandy loam soils; withstands polluted air of cities. **Pests & Problems:** Basically free of problems, although problems listed for white oak can sometimes be problematic for this oak – including leaf eaters and gall forming cankers. Fruit can be numerous and create a litter problem for lawns and sidewalks.

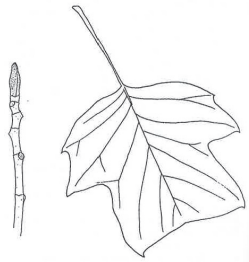
American Sweetgum *Liquidambar styraciflus*



Height: 60-80 ft.
Spread: 40-60 ft.
Growth Rate: Medium to Fast
Hardiness: -15 F
Zone: USDA 5b

General: Nice shade tree, pyramidal when young, oblong to rounded when mature. Alternate “maple-like” star shaped leaves. **Fall Color:** Typically quite showy, best trees are orange, red, burgundy, and purplish. **Flowering:** Monoecious, yellowish-green in May, not showy. Fruit are 1-1.5” spiny balls. **Growing Conditions:** Best in full sun, part shade okay. Prefers deep, moist, bottomland soils. Transplant B&B due to fleshy, coarse root system. Use larger plants when transplanting in colder areas to avoid cold injury to twigs. **Pests & Problems:** Chlorosis on high pH soils and lack of cold hardiness – especially in young trees, shallow root system. Fruit can be a litter problem.

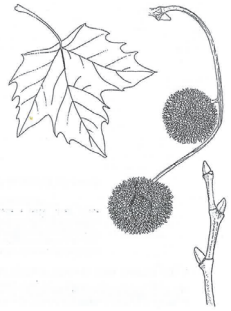
Tulip Tree *Liriodendron tulipifera*



Height: 60 ft.
Spread: 35 ft.
Growth Rate: Fast
Hardiness: -20 F
Zone: USDA 4a

General: Extremely large size. Somewhat pyramidal in youth maturing to oval-rounded or irregular, long-fruiting season. Trunks are massive. **Fall Color:** Can be very showy. Golden yellow to clear yellow. **Flowering:** Has 2-3” tulip shaped upright blossoms borne singly at branch ends. Blooms late May through mid-June. Petals are yellow-green. **Growing Conditions:** Full sun, prefers a deep, moist, fertile soil, slightly acidic is best, pH adaptable. Avoid very dry, hot sites. Has a fleshy, poorly branched root system. **Pests & Problems:** Aphids are a real problem - their "honeydew" covers leaves which then are overrun by sooty mold fungus. Susceptible to other pests as well.

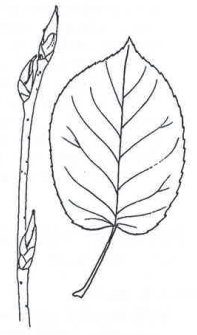
London Plane *Platanus x acerifolia*



Height: 60 ft.
Spread: 50 ft.
Growth Rate: Fast
Hardiness: -15 F
Zone: USDA 5b

General: Large rounded tree that is pyramidal in youth developing with age to a large, open, wide-spreading outline with massive branches. **Fall Color:** Poor yellow. **Flowering:** Not ornamentally important. **Growing Conditions:** Full sun to part shade, pH adaptable, urban tolerant. Easily transplanted, will grow in about anything, withstands high pH conditions and pollutants; withstands smoke and grime of cities. **Pests & Problems:** Disease resistant but canker stain can be very serious.

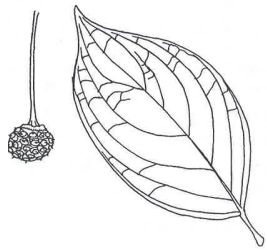
Apple Serviceberry *Amelanchier x grandiflora*



Height: 15-25 ft.
Spread: 15-20 ft.
Growth Rate: Medium
Hardiness: -30 F
Zone: USDA 4a

General: Rounded habit, bird food, edible ornamental. **Fall Color:** Yellow to orange. **Flowering:** Small white flowers from pink buds in spring; sweet berries turn magenta to purple. **Growing Conditions:** Partial to full sun, moderate water, PH adaptable. **Pests & Problems:** No serious insect or disease problems**.** Root suckers are common, and if not removed, will result in a shrubby growth habit for the plant.

Kousa Dogwood *Cornus kousa*



Height: 20-25 ft.
Spread: 20-25 ft.
Growth Rate: Slow to Medium
Hardiness: -20 F
Zone: USDA 5a

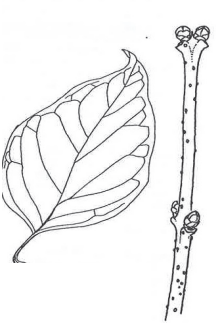
General: Vase shaped in youth, becoming rounded with age with horizontally stratified branching. Ornamental appeal in form, bark, flowering, fruiting and fall foliage color. **Fall Color:** Leaves turn red or red-purple. **Flowering:** Flowers are small and greenish-yellow and are surrounded by four large, showy, pointed bracts – which are white, but age to pink. Bloom time is early June but bracts last for about 6 weeks, making for a very long effective bloom time.
Growing Conditions: Full sun to partial shade; prefers a moist, fertile, acidic, well-drained soil high in organic matter.
Pests & Problems: Relatively problem free.

Amur Maackia *Maackia amurensis*

Height: 25 ft.
Spread: 20 ft.
Growth Rate: Slow
Hardiness: -25 F
Zone: USDA 4b

General: Rounded shape, foliage mostly toward the outer part of the canopy, short main trunk that splits into many main branches 2' to 3' from the ground, neat clean attractive form. **Fall Color:** No color develops, leaves drop green or brown. **Flowering:** Small dull, white pea-like flowers, in upright clusters 4" to 6" long in June and July. Flowers are not overwhelmingly showy but are nice for their summer appearance. As with most legume trees, heavy blooming doesn't occur each year. **Growing Conditions:** Full sun is best, seems to prefer loose, well-drained soils, soil pH is not an important factor, easily transplanted, fixes nitrogen.
Pests & Problems: No serious problems, Japanese beetles may feed on foliage; may not bloom well every year; hard to find in retail nurseries, but worth the search.

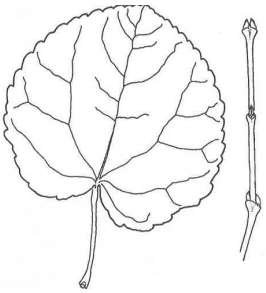
Japanese Lilac Tree *Syringa reticulate*



Height: 25 ft.
Spread: 20 ft.
Growth Rate: Medium
Hardiness: -20 F
Zone: USDA 5a

General: Large shrub or small tree. Stiff, spreading branches with rounded crown. **Fall Color:** Insignificant. **Flowering:** Prune after flowering, cut off old flower heads. **Growing Conditions:** Full sun, prefers well-drained, slightly acidic soil and transplants easily. Needs good air circulation. **Pests & Problems:** Somewhat resistant to mildew, scales and borers.

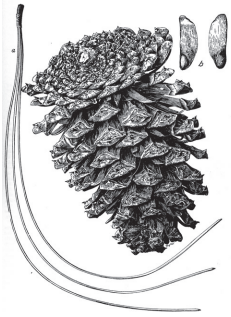
Katsuratree *Cercidiphyllus japonicum*



Height: 50 ft.
Spread: 30 ft.
Growth Rate: Medium to Fast
Hardiness: -20 F
Zone: USDA 5a

General: Large deciduous tree - some pyramidal, others wide spreading. Dense crown, coarse winter texture. **Fall Color:** Outstanding display, yellow to apricot fall color, colors early in season. Autumn leaves give off spicy, brown sugar odor. **Flowering:** Open before leaves in March -April, green and not showy. **Growing Conditions:** Rich, moist, well-drained soil, pH adaptable. Tree requires water during establishment and during dry periods. Size limits use to large spaces, not easy to transplant. **Pests & Problems:** None serious. Occasionally chewing insects eat the foliage.

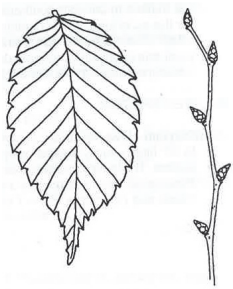
Ponderosa Pine *Pinus ponderosa*



Height: 60-100 ft.
Spread: 20-30 ft.
Growth Rate: Fast
Hardiness: -40 F
Zone: USDA 3a

General: Evergreen tree with a narrow, upright, oval form in youth opening up into irregular crown. Needles in 3's, 8-10" long with a sharply pointed apex. Thick fire resistant bark that is vanilla scented when bruised. Good windbreaker, specimen, highway buffer, or for mass plantings. **Fall Color:** Needles stay same as summer, light green in color. **Flowering:** Not ornamentally important. Produces 4" long reddish, showy, oval cones.
Growing Conditions: Full sun is best, prefers well-drained, acidic, deep, moist soil. Ponderosa Pine is drought tolerant - preferred transplant is B&B, salt tolerant.
Pests & Problems: Needle cast (although needles are great for mulch – especially on pathways), bark beetle and pitch canker can be problems.

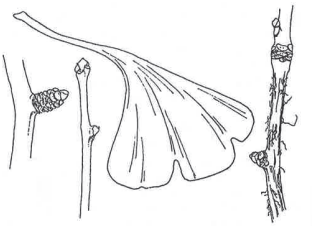
Japanese Zelkova *Zelkova serrata*



Height: 50-70 ft.
Spread: 40-50 ft.
Growth Rate: Medium to Fast
Hardiness: -20 F
Zone: USDA 5a

General: A low-branched, vase-shaped tree becoming more rounded and broad in maturity. **Fall Color:** Yellow, gold, orange, bronze, red, and purple. **Flowering:** Monoecious and ornamentally insignificant bloom occurs in April. **Growing Conditions:** Full sun, very wind and drought tolerant once established, heat tolerant and pH adaptable. Urban tolerant with reasonable pollution tolerance.
Pests & Problems: Young trees are susceptible to frost. Susceptible to some of the problems typical in elms; however, resistant to Dutch elm disease.

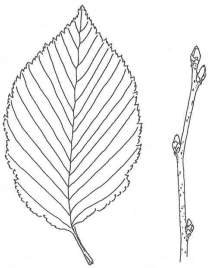
Maidenhair Tree *Ginkgo Biloba*



Height: 50-60 ft.
Spread: 30-40 ft.
Growth Rate: Slow to Medium
Hardiness: -25 F
Zone: USDA 4b

General: Large tree with medium texture and rather coarse in winter. Conical form when young, spreading lateral branches with age. Unique fan shaped leaves notched at the apex. **Fall Color:** Excellent yellow color, leaves drop quickly, especially following a freeze. **Flowering:** Not ornamental, dioecious: male – 1" long catkin in April; female – green, naked ovules. Trees may not flower until 20 years old. Seed produced on female tree only; flesh covering seed has foul smell often described as rancid butter. **Growing Conditions:** Full sun, prefers deep sandy soils and moderate moisture; is pH adaptable and of almost any other condition. Tolerant of pollution, salt, air and heat. **Pests & Problems:** Pest free. Female plants have foul smelling fruit. Slow to become established.

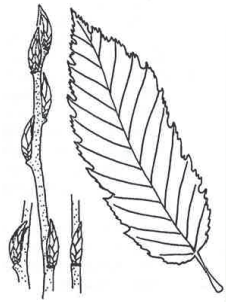
Korean Mountain Ash *Sorbus alnifolia*



Height: 40 ft.
Spread: 30 ft.
Growth Rate: Fast
Hardiness: -30 F
Zone: USDA 4a

General: Rounded habit. Flowers in spring, fruits in fall and has a long fruiting season. Good bird food, malodorous flowers. **Fall Color:** Yellow to golden brown fall color. **Flowering:** White flowers, 0.5" in diameter, borne in corymbs, 2" to 3" across, 6 to 10 flowers clustered in corymbs. Blooms in May. **Growing Conditions:** Full sun partial shade, very pH adaptable, does not withstand polluted conditions. **Pests & Problems:** Least susceptible to borer injury.

European Hornbeam *Carpinus betulus*



Height: 40 ft.
Spread: 25 ft.
Growth Rate: Slow
Hardiness: -20 F
Zone: USDA 5a

General: A deciduous, medium sized tree that is excellent for screens. Somewhat pyramidal or oval when young, mature plants are broad and rounded. Foliage is typically dense and can be pruned or hedged if so desired. A long-lived tree, difficult to transplant as large tree.
Fall Color: Yellow fall color, dark green summer foliage.
Flowering: Male and female flowers on the same plant; male flowers are 1.5" long catkins, female flowers are 1.5" to 3". Flowers are not considered showy, blooms in April.
Growing Conditions: Full sun, very soil adaptable but needs well-drained soil; can tolerate urban conditions and pollution.
Pests & Problems: Generally free of problems, can be attacked by Japanese Beetle - canker and stem die-back may occur occasionally. Narrow branch angles on upright forms may be prone to splitting in ice storms.

Arboriculture Links:

International Society of Arboriculture (ISA)

www.isa-arbor.com/home.asp

PNW ISA

www.pnwisa.org/

Spokane Conservation District Urban Forestry

www.sccd.org/forestry.html

City of Spokane Urban Forestry

www.SpokaneUrbanForestry.org

Community Canopy

www.communitycanopy.org

National Arbor Day Foundation

www.arborday.org/

Spokane Green Zone

www.thegreenzone.org/

Avista Utilities

www.avistautilities.com/safety/vegetation/Pages/default.aspx

Inland Power & Light

www.inlandpower.com/our_communityc.php?id=228

University of Florida Landscape Plant Care

hort.ifas.ufl.edu/woody/

Plant Amnesty

www.plantamnesty.org/

Washington Association of Landscape Professionals

www.walp.org/

Pest Management Links:

WSU Hortsense

pep.wsu.edu/hortsense/

WSU Spokane County Extension Master Gardener Information

www.spokane-county.wsu.edu/Spokane/eastside/

University of California IPM Online

www.ipm.ucdavis.edu/

WSU Snohomish County Vertebrate Management Links

snohomish.wsu.edu/verturl.htm

Cornell Pest Factsheets

www.gardening.cornell.edu/pests/factsheets.html

Entomology Links:

PNW Insect Management Handbook Online

insects.ippc.orst.edu/pnw/insects

Earthlife Key to the Insect Orders

www.earthlife.net/insects/orders-key.html

Key to the Big Ten Insect Orders

www.backyardnature.net/in_order.htm

University of Minnesota Tree Insects

www.entomology.umn.edu/cues/IPM-trees/IPM-trees.html

Diagnosing Links

Systematic Approach to Diagnosing

hort.oregonstate.edu/files/Research_Extension/Diagnosing_Plant_Damage/pltdiag_nonliving.pdf

Purdue Virtual Plant and Pest Diagnostic Laboratory

www.ppdl.purdue.edu/PPDL/

Recognizing Herbicide Damage

www.unce.unr.edu/publications/files/ho/2002/sp0208.pdf

Plant Pathology Links:

PNW Plant Disease Control Handbook Online

insects.ippc.orst.edu/pnw/insects

Weed Identification and Control Links:

PNW Weed Management Handbook Online

weeds.ippc.orst.edu/pnw/weeds

Spokane County Noxious Weed Control Board

www.spokanecounty.org/WeedBoard

Pesticide Links:

WSU Urban IPM and Pesticide Safety Education

pep.wsu.edu/

Washington State Department of Agriculture Pesticide Licensing

agr.wa.gov/PestFert/LicensingEd/Search/

EXTOXNET Pesticide Information Profiles

ace.orst.edu/info/extoxnet/pips/ghindex.html

National Pesticide Information Center

npic.orst.edu/

CDMS Pesticide Labels and Links

www.cdms.net/LabelsMsds/LMDefault.aspx

Plant Identification Links:

NRCS Plants Database

plants.usda.gov/

Virginia Tech Tree Identification Interactive Key

dendro.cnre.vt.edu/dendrology/idit.htm

University of Illinois Plant Identification

woodyplants.nres.uiuc.edu/

Canadian Poisonous Plants

www.cbif.gc.ca/pls/pp/

Plant Nutrition Links:

University of Florida Plant Nutrient Deficiency Database

hort.ufl.edu/database/nutdef/index.shtml

University of Nevada - Nutrient Deficiency Symptoms

www.unce.unr.edu/publications/files/ho/2002/fs0265.pdf

GLOSSARY

Absorbing roots - Extensive network of roots that absorb and transfer nutrients and water from the soil to the upper plant parts.

Adventitious - Used to describe buds, roots and shoots arising in an abnormal place - for example, shoots from the callus formed over a wound, or suckers arising from roots.

Apical bud - The tip of a growing shoot, sometimes called the terminal bud.

Bark - The outside covering of the stems and roots of trees and woody plants.

Basal - The part of the trunk or branches nearest the base, as in basal shoots, basal growth or basal leaves. It may have a different growth habit or appearance than upper parts.

Branch collar –Swollen area at base of branch where it connects to the trunk. Contains tissue that prevents decay from moving downward from the branch into the trunk.

Callus - New corky tissue formed by a plant to seal off wounds. When pruning woody plants, callus is formed from trunk or branch tissue that remains when a limb is removed. Making improper pruning cuts into the branch collar greatly interferes with a plant's ability to form callus quickly and seal off wounds.

Cambium - A layer of tissue a few cells thick underneath the bark of branches and roots. Conductive tissue, through which water and sugars move up and down in the plant, arises from the cambium.

Candle - The new terminal growth on a pine. Needles emerge from these candle-like projections.

Central leader - The trunk or central stem of a plant.

Conifer, coniferous - Any of the cone-bearing trees and shrubs, mostly evergreens with scale, needle or strap-shaped leaves and resinous wood. Includes ginkgoes and junipers which have fleshy fruits.

Crotch - The angle between the trunk and a branch, or between two branches.

Current growth - The shoots growing from buds formed the previous growing season.

Deciduous - A plant that loses all or nearly all its leaves at one time of the year, usually late autumn.

Dormancy - A period of inactivity, usually in winter, that is necessary for most plants to survive adverse conditions. Includes dropping leaves and dieback of vegetative growth.

Drainage - Water run-off below the soil surface, which is essential to prevent waterlogging and poor soil aeration. Drainage can be improved with underground drainpipe or organic soil amendments.

Drop-crotching - A method of pruning large trees in which the main branch or leader is removed by cutting it back to a lower crotch in order to reduce the height of the tree.

Evergreen - A plant that has green, functioning leaves throughout the year. Not considered deciduous, although evergreens always drop a number of mature leaves or needles every year. Includes most conifers, but also shrubs like rhododendron, holly, and Oregon grape.

Girdling roots, girdled trunk – Roots that grow circling around the trunk instead of away from it. As roots and trunk grow in girth over time, they press against each other cutting off the flow of water and sugars to and from the canopy. Girdled trunks have lost some or all phloem, cambium and xylem tissue, either from girdling roots or from mechanical damage like a string trimmer. If the girdling is severe enough, the tree will decline and possibly die.

Growth habit - Refers to the genetic tendency of a plant to grow in a certain manner. Fast/slow, tall/short, spreading/narrow, weeping/upright all describe growth habits.

Hardiness - The degree to which a plant is susceptible to cold damage. Plants hardy to specific zones can live year-round in that zone with no cold protection. In hot climates, hardiness may refer to a plant's resistance to drought.

Head back, heading - Cutting back of limbs, branches or buds to reduce the size of a tree. Generally not recommended as a good pruning practice in the landscape. Causes rapid growth of many weakly attached branches.

Heartwood - The oldest, non-living wood at the center of the trunk. Part of the xylem and functions as support.

Included bark occurs when branches grows too vigorously or at too narrow an angle to permit normal formation of the branch bark ridge. Included bark doesn't allow the branches to knit together and over a long period will cause a weak point in the tree. Included bark frequently leads to failure or tear outs under stress.

Internode - The space on a stem between two nodes (where leaf buds or leaves arise).

Latent bud - A bud that does not develop in the season it was formed. Pruning often causes latent buds to 'break' and develop.

Lateral - A branch that is attached to, and smaller than, a larger branch or trunk. Sometimes refers to horizontal branches, buds or shoots on the side.

Lateral bud - A bud on the side of a woody stem, as distinguished from an apical bud.

Leader - The uppermost, usually central and upright shoot of a woody plant and its attached branches. Also called the terminal shoot.

Node - The point on a stem where leaf, flower or shoot buds are located and break.

Phloem - A thin layer of tissue between the bark and cambium layer that conducts sugars from the leaves throughout the plant.

Root flare or root collar – The natural flare at the base of the plant where the trunk flares out into the roots. Every woody plant has one; the root collar must never be buried in planting or mulching. Plants with buried flares are at much greater risk of problems including premature death.

Sapwood - The functioning xylem that has not matured and become heartwood. Important as supporting structure of the trunk.

Scaffold, scaffold branches - The basic supporting structure or branches of a tree. Scaffold branches provide a strong base for secondary branches and usually grow from the main trunk.

Shoot - A newly developing stem and its leaves.

Stub, stubbing - The stump of a branch that remains between a pruning cut and a node on a tree or plant. Also means to cut off a limb, leaving a short stump.

Sucker - The unwanted shoots arising from adventitious buds in the roots or at the base of a plant.

Thinning - Reducing the number of shoots on a branch system to eliminate the effects of overcrowding, resulting in improved air circulation and light penetration to inner leaves.

Topping - A drastic pruning procedure that removes the tops of all branches on tree. Harmful to the tree.

Vascular tissue- Specialized plant tissue - the xylem and phloem - that conduct water and sugars throughout a plant.

Watersprout - Vigorous, soft shoots that arise from latent buds on branches or the trunk as a result of pruning. Some species of trees readily form water sprouts.

Xylem - A layer of tissue between the cambium layer and sapwood that carries water and nutrients throughout the plant from the roots. As xylem tissue matures and becomes inactive, it becomes wood, the inner supportive structure of the trunk. Xylem tissue formed during one growing season becomes an annual growth ring.

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