



Street Tree Assessment Team (STAT)

Tree Care Manual

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Introduction

This manual contains information on the typical visual inspection and practical work tasks a tree specialist might consider when dealing with newly planted and young trees on a city planting project. The basic information is provided in **Section A**, with further detail provided in subsequent sections. The appropriate timing and frequency of tree inspections and work tasks is contained in the **STAT Schedule** document within the STAT folder on this webpage.

Regular visual assessment of the health and condition of the trees is the fundamental purpose of the STAT Program. Providing information to the City Arborist from regular visual inspections is the most important STAT activity. *Please note that any practical work tasks on city trees (or at tree sites) that you feel are necessary, should always be agreed jointly with the City Arborist.*

Volunteers are not expected to conduct systematic inspections with reference to all the items in this manual but should use the manual and associated documents as time and interest permit. The manual concentrates on the care of newly planted, young and small trees (generally trees with a stem diameter of 6-inches or under), however Section C. (provided for interest only) details some standard tree hazards to look for in large mature trees growing on or around the city highways.

Notes:

1. This manual is a work in progress and will be updated periodically. Constructive criticism of its contents by STAT volunteers is strongly encouraged.
2. Please feel free to ask the City Arborist for additional information/ explanation of the Manual contents.
3. Additional information on tree health is also available on the STAT webpage: *Diagnosing Tree Problems, Iowa State University, ISU Extension Service*. The Missouri Forestkeepers Network also has good, concise information on tree health (*Tree Stressor Identification Cards*) at www.forestkeepers.org/

A. Inspection & Care of Newly Planted and Young Trees.

These are the two golden rules of tree care:

1. *Careful inspection of the entire tree and its surroundings is the most important task in tree care*
2. *Looking and doing nothing to assist a tree is often the best thing you can do*

It is important to note that most trees will not look fully healthy in the first few years after planting; the loss of a significant proportion of their roots during transplanting is the main reason. A transplanted 2" caliper tree (standard city planting, stem diameter measured 6" above grade) frequently requires as much as 5 years to restore the appropriate balance between root and shoot development. Transplanted trees have a high mortality rate, and even a well cultivated and cared for tree planted in an ideal situation may die and will often suffer branch death or dieback and premature leaf fall. Detailed below are some of the main things to look for in your inspection:

1. Woody parts of the tree (trunk, branches, twigs).
 - a. Look for physical damage or lesions that have exposed the wood underneath the bark. Lesions may be caused by winter sun exposure (sunscald), or by fungal, bacterial or insect attack. These attacks are often enabled by hidden stress factors (see Section B) and/or the delicate condition of the tree during the first few years after transplanting.
 - b. Look for heavy insect activity and insect egg masses. Egg masses are often hidden under branches. Many insects are quite beneficial to trees, but some other insects seem to want too much of the young tree. (see Section B & ISU fact sheet: Diagnosing Tree Problems).
 - c. Look for resin, gum or liquid weeping from the tree. This will often be a sign that the tree is under attack from insects or an internal fungus or bacteria.
 - d. Loose, dead bark may be removed carefully from around a wound or lesion with a sharp knife. This will assist wound closure and remove habitat for insect or fungal activity. It is important to note that some tree species have naturally peeling bark plates.
 - e. Fungal conks/brackets and toadstools on the woody parts of young trees are unusual, but will signify significant amounts of dead tissue and likely tree mortality. Growth of lichen or moss on bark is common and is not harmful to the tree.
 - f. Look for dieback in the tree crown. Only dead branches and twigs should be removed and you must know how to identify dead tissue. (See Section E for pruning information)
 - g. If the tree is guyed or tied to stakes look to see if the securing wire, rope, plastic, or fabric is restricting the growth of the tree stem or damaging/ causing abrasions to the bark. Trees should not be tied for more than 2 years, unless under exceptional circumstances.
 - h. All tree protection material on the stem of newly planted trees (paper, burlap/hessian, plastic or cardboard) should be removed by the end of March each year. Re-installation (if necessary) should not take place before complete dormancy resumes.
2. Foliage (leaves, buds).
 - a. Look for leaf damage, and insect activity on the leaves. There are a multitude of insect and fungal diseases that affect the leaf, normally these appear as holes, unusual growths,

- changes in color or deformation of the leaf; changes in color can also denote drought, waterlogged soil, chemical spray damage and nutrient deficiency. (see ISU fact sheet)
- b. Look to see if the tree crown is full and bushy with full leaf development, or is patchy and thin. If there is dieback in the crown is there a pattern to the dieback? Bagworms cause serious defoliation problems on evergreen and deciduous trees within the city.
 - c. Look at the vitality and color of the foliage, and compare with similar species. Because leaves have a short life, damage to the leaf is often not as serious as damage to the woody parts. However, leaves are also sensitive indicators of serious stresses – such as a lack of water, nutrient deficiency, or fungal attack within the woody parts of the tree.
 - d. Look to see if the tree is producing a healthy supply of buds during the late summer. In winter the supply of buds and the flexibility of the small twigs are the best way to find out whether the tree has a healthy living crown.
3. Roots, Root flare and rooting area. What happens on the ground within 3 feet of a newly planted tree often determines whether a tree lives or dies.
- a. The most common cause of death for young city trees is weed-whip or mower damage to the base of the stem (trunk); no better way of killing a tree has been devised. The scarring caused by weed-whip damage to the lower stem and root flare is not hard to identify. If you only ever do one thing for a newly planted or young tree it should be to remove all weeds and turf within 3-ft of the trunk; mulching is the best way to make this manageable. When removing grass and weeds the soil can be loosened, but no digging should take place. Removing turf grass and weeds as far as possible from the tree trunk also greatly helps the young tree by reducing competition for water and nutrients.
 - b. Be aware also that compacted soil around the tree will severely restrict root growth in young trees, so note any activity (including frequent pedestrian activity) that has compacted the soil around the tree. Excavation adjacent to the root ball of a newly planted tree may kill it, particularly if roots are left exposed and allowed to dry or freeze.
 - c. Look to see if you can clearly see a root flare or taper at ground level; this is the natural point of transition from stem to root. If you cannot find this point the tree may have been planted too deeply. Suckering shoot growth from the base of the stem may also be a sign of overly deep planting. Trees that are planted too deep may survive in the short term but generally do not flourish. Deep planted trees often have roots growing above the root collar which can lead to serious problems (see d. below).
 - d. Look for crossing and girdling roots around and above the root flare. When the tree is growing strongly these may be carefully exposed and then removed with hand pruners. As the tree attains semi-maturity root pruning will become less and less practical.
 - e. It is often sensible to leave tree stakes in the ground for a few years after the tree ties or guys have been removed. This protects the establishing tree somewhat from vandalism and rogue mowing machinery. However after trees have reached a stem diameter of about 4 inches the stakes should be removed (remove in winter during root dormancy).
4. Tree size and growth rate. Measuring the stem diameter in young trees is done at a point midway between the ground and the lowest branch. Height is measured from ground level to the tip of the topmost shoot (visual estimates are fine). In the fall look for the length of shoot extension on the topmost shoots (this is the new annual growth at the ends of the branches in the upper crown); newly planted trees may only grow a few inches a year for the first few years, but this should increase to a few feet per year in succeeding years and may become yards per year as the tree enters the vigorous semi mature stage.

B. Further information on Tree Health

The presence of insects, fungus or bacteria acting as pathogens can affect tree health, however these organisms are often symptoms of an underlying stress factor often occurring at or below ground level. By identifying the visual symptoms of damage, you may be able to assist in the diagnosis of the disease and/or underlying stress problem. Typically an unhealthy tree will have a number of stressors and disease pathogens acting together.

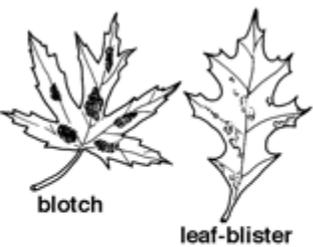
General Stress Problems

Trees deal with environmental stresses, such as shading and availability of water and nutrients in their native environment, by adjusting their patterns of growth and form to reflect available resources. Although trees are adapted to living in difficult conditions in nature, there are stressful situations particular to urban landscapes to which they are biologically unsuited and will make them particularly susceptible to ill health, disease and insect infestations.

Transplanting a tree from the nursery to the street subjects the tree to sudden stress, and this is often compounded by inappropriate nursery cultivation, transportation and planting practices. Other general stresses particular to the urban street environment in Columbia are: a) soils of heavy clay and low in organic matter, b) disturbed and compacted soils, c) soils with a high Ph, d) sites strongly exposed to wind and sun, e) weed and grass competition, f) high levels of salt in the soil and salt spray in the air.

Checklist for Diagnosing Health Problems

1. **Accurately identify the plant.** Because many insects and diseases are plant-specific, this information can quickly limit the number of suspected diseases and disorders. In addition, some tree species react to common diseases in different ways.
2. **Look for a pattern of abnormality.** It may be helpful to compare the affected plant with other plants on the site, especially those of the same species. Differences in color or growth may present clues as to the source of the problem. Non-uniform damage patterns may indicate insects or diseases. Uniform damage over a large area (perhaps several plant species) usually indicates disorders caused by such factors as physical injury, poor drainage, or weather.
3. **Carefully examine the landscape.** The recent history of the property and adjacent land may reveal problems related to excavation, soil compaction and grade changes. The number of species affected may also help distinguish between infectious pathogens that are more plant-specific as compared to chemical or environmental factors that affect many different species.
4. **Examine accessible roots and soil.** Note root color: brown or black roots may signal problems. Brown roots often indicate dry soil conditions or the presence of toxic chemicals. Black roots usually reflect saturated soil or the presence of root-rotting organisms. Soils that are waterlogged or polluted by fuel hydrocarbons have their unique smell.
5. **Check the trunk and branches.** Examine the trunk thoroughly for wounds/lesions because they provide entrances for pathogens and wood-rotting organisms. Wounds/lesions can be caused by frost, sunscald, drought, fire, mowers and other machinery, rodents and deer, as well as a variety of insects, micro-organisms and other environmental factors.
6. **Note the position and appearance of affected leaves.** Dead leaves and twigs at the top of the tree are often the result of root stress (physical damage or soil environment deficiencies). Twisted or curled leaves may indicate viral or fungal infection, insect feeding, or exposure to herbicides. The size and color of the foliage may tell a great deal about the plant's condition.



Specific Diseases

Three things are required for a disease to develop:

- the presence of a pathogen (the disease-causing agent)
- plant susceptibility to that particular pathogen
- an environment suitable for disease development

Plants vary in susceptibility to pathogens. Many disease-prevention programs focus on the use of pathogen-resistant plant varieties; for example Elm cultivars of native species are routinely planted to provide protection from Dutch Elm Disease. However, even if the pathogen is present and a susceptible plant host is available, the proper environmental conditions must be present over the correct period of time for the pathogen to infect the plant.

Examples of infectious agents include insects, fungi, viruses, and bacteria. These agents often occur within the soil itself and both within and on the exterior of the tree and are often very difficult to diagnose. Bark and boring beetles cause physical damage to the tree and often carry the spores of fungi to exposed internal tissue. Many fungal spores and bacteria are simply carried to trees by wind and rainfall and encounter exposed tissue. Some are serious health problems and others temporary seasonal occurrences. Symptoms include discoloration and/ or dieback of branches, weeping lesions on woody parts, conks and toadstools, and discoloration and/or deformation of the leaves.

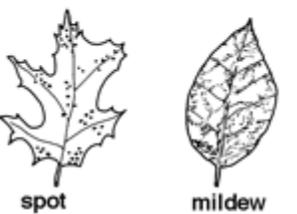
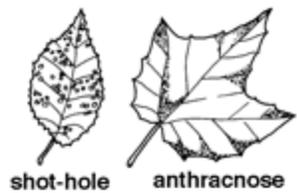
Further information on tree disease can be obtained on the internet through the Extension Services of the major midwest universities and through state and federal forestry agencies. (see also the document: ISU Diagnosing Tree Problems)

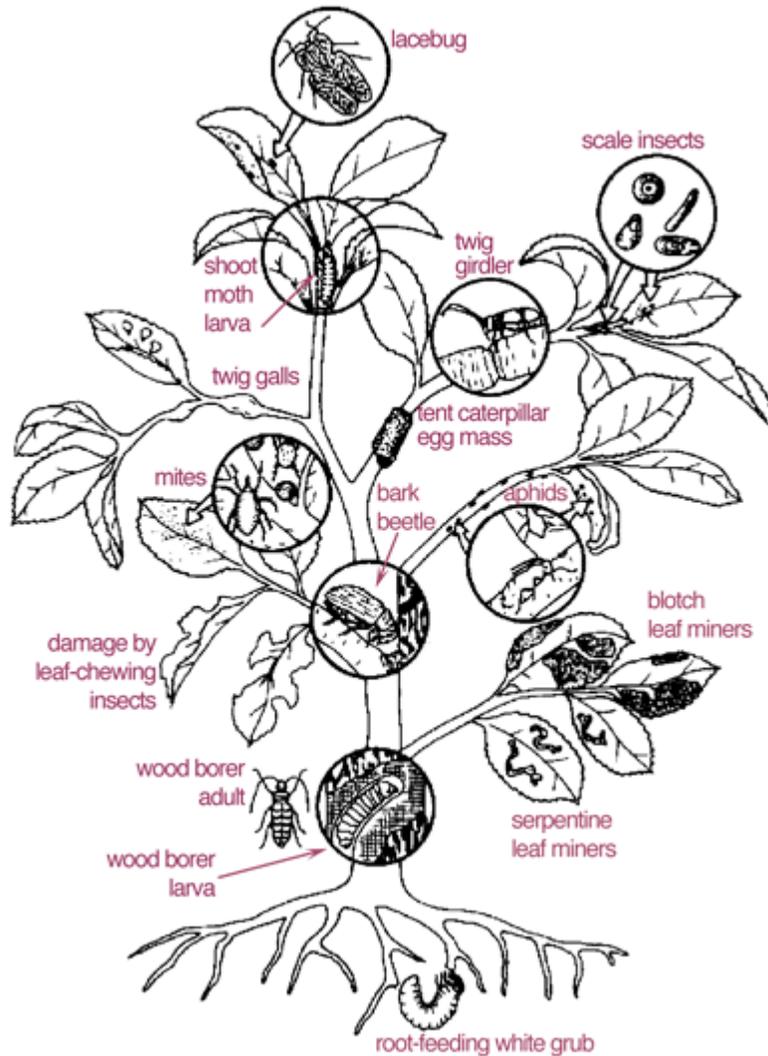
Insects causing Injury and Disease

Some insects can cause direct injury and damage to trees and shrubs, and some also act as vectors (carriers) of viruses and fungi which can cause more serious health problems. By defoliating trees or sucking their sap, insects can retard plant growth and diminish the production of starch reserves. By boring into the trunk and branch wood, they interfere with sap flow and remove areas of cell division (the cambium) causing localized wounds (cankers). Trees are often only susceptible to serious insect attack when underlying environmental stressors reach a critical level.

It is important to remember that most insects are beneficial rather than destructive. They help with pollination or act as predators of more harmful species. Therefore, killing all insects without regard to their kind and function can actually be detrimental to tree health.

Insects that cause direct damage to the tree may be divided into three categories according to their method of feeding: chewing, sucking, or boring. Insects from each group have characteristic patterns of damage that will help you determine the culprit and the proper treatment. Always consult a specialist if you have any doubt about the nature of the insect problem or the proper treatment .





Chewing insects eat plant tissue such as leaves, flowers, buds, and twigs. Indications of damage by these insects are typically: uneven or broken margins on the leaves; skeletonization of the leaves; and tunneling (mining) within the leaf. Chewing insects can be beetle adults or larvae, moth larvae (caterpillars), and many other groups of insects. The damage they cause (leaf notching, leaf mining, leaf skeletonizing, etc.) will help in identifying the pest insect.

Sucking insects insert their mouth parts into the tissues of leaves, twigs, branches, flowers, or fruit and then either feed on the sap within the plant vessels or extract the contents of plant cells. Some examples of sucking insects are aphids, mealy bugs, thrips, and leafhoppers. Damage caused by these pests is often indicated by discoloration, drooping, wilting, leaf spots (stippling), honeydew, and a general lack of vigor in the affected plant.

Boring insects spend time feeding beneath the outer bark of a tree usually in the phloem and cambium. Some borers do damage in their adult form and some as larvae. Other borers, known as bark beetles, mate at or near the bark surface, and adults lay eggs in tunnels beneath the bark.. Boring insects can easily girdle and kill the branches of a young tree, and they frequently carry fungal spores which can germinate and flourish as a result of the beetle damage.

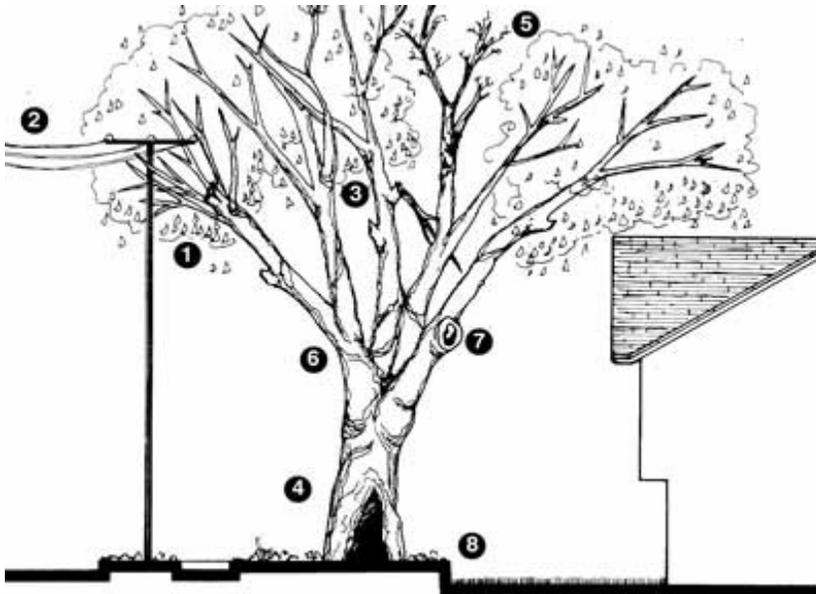
C. Large Tree Hazard Checklist

When examining larger trees for actual or potential hazards, consider these questions:

- Are there detached branches hanging in the tree?
- Are there large dead branches in the tree?
- Does the tree have cavities or rotten wood along the trunk or in major branches?
- Are mushrooms or fungal brackets/ conks present at the base of the tree?
- Are there cracks or splits in the trunk, limbs or where branches are attached?
- Have any branches fallen from the tree?
- Have adjacent trees fallen over or died?
- Has the trunk developed a strong lean?
- Do many of the major branches arise from one point on the trunk?
- Have the roots been broken off, injured, or damaged by lowering the soil level, installing pavement, repairing sidewalks, or digging trenches?
- Has the site recently been changed by construction, raising the soil level, or installing lawns?
- Have the leaves prematurely developed an unusual color or size?
- Have trees in adjacent wooded areas been removed?
- Has the tree been topped or otherwise heavily pruned?

Examples of Defects in Large Urban Trees

1. Regrowth from topping line, line clearance, or other pruning creating weak branch attachments; 2. Pruning wounds and damaged branches if electrical lines are adjacent to the tree; 3. Broken or partially attached branches; 4. Open cavities in trunk or branch; 5. Broken or partially attached branches; 6. Branches arising from a single point on the trunk; 7. Decay and fungal bodies present in or around old wounds; 8. Severed or smothered roots caused by adjacent excavation or changes in grade or soil level.



D. Proper Mulching Techniques

Mulching is one of the most beneficial things we can do for the health of a tree as long as it is done correctly. Mulches are materials placed over the soil surface to help retain moisture, improve the soil structure, and protect the tree from damage. Mulch can also help direct water to the tree roots and minimize weed competition. Properly applied, mulch can also give landscapes a handsome, well-groomed appearance.

Benefits of Proper Mulching

- Helps maintain soil moisture. Evaporation is reduced, and the need for watering can be minimized. Mulch can direct rainfall to, and contain water around, the root zone.
- Helps control weeds. A 2 to 4-inch layer of mulch will reduce the germination and growth of weeds.
- Mulch serves as nature's insulating blanket. Mulch keeps soils warmer in the winter and cooler in the summer.
- Many types of mulch can improve soil aeration and structure (aggregation of soil particles). This will also improve drainage over time.
- Some mulches can improve soil fertility. Pine needle mulch contains a significant amount of nutrient value for trees.
- Mulching around trees helps facilitate maintenance and can reduce the likelihood of damage from "weed whackers" or the dreaded "lawn mower blight."
- Mulch can give planting beds a uniform, well-cared-for look.

Trees growing in a natural forest environment have their roots anchored in a rich, well-aerated soil full of essential nutrients. The soil is blanketed by leaves and organic materials that replenish nutrients and provide an optimal environment for root growth and mineral uptake. Urban landscapes, however, are typically a much harsher environment with poor soils, little organic matter, and large fluctuations in temperature and moisture. Applying a 2- to 4-inch layer of organic mulch can mimic a more natural environment and improve plant health.

The root system of a tree is not a mirror image of the top. The roots of most trees can extend out a significant distance from the tree trunk. Although the guideline for many maintenance practices is the drip line—the outermost extension of the canopy—the roots can grow many times that distance. In addition, most of the fine, absorbing roots are located within inches of the soil surface. These roots, which are essential for taking up water and minerals, require oxygen to survive. A thin layer of mulch, applied as broadly as practical, can improve the soil structure, oxygen levels, temperature, and moisture availability where these roots grow.

Not Too Much Mulch

As beneficial as mulch is, too much can be harmful. The generally recommended mulching depth is 2 to 4 inches. Unfortunately, many landscapes are falling victim to a plague of over-mulching. A new term, "mulch volcanoes," has emerged to describe mulch that has been piled up around the base of trees. Most organic mulches must be replenished, but the rate of decomposition varies. Some mulches, such as cypress mulch, remain intact for many years. Top dressing with new mulch annually (often for the sake of refreshing the color) creates a buildup to depths that can be unhealthy. Deep mulch can be effective in suppressing weeds and reducing maintenance, but it often causes additional problems.



"Mulch volcanoes" cause many problems for trees.

Problems Associated with Mulching

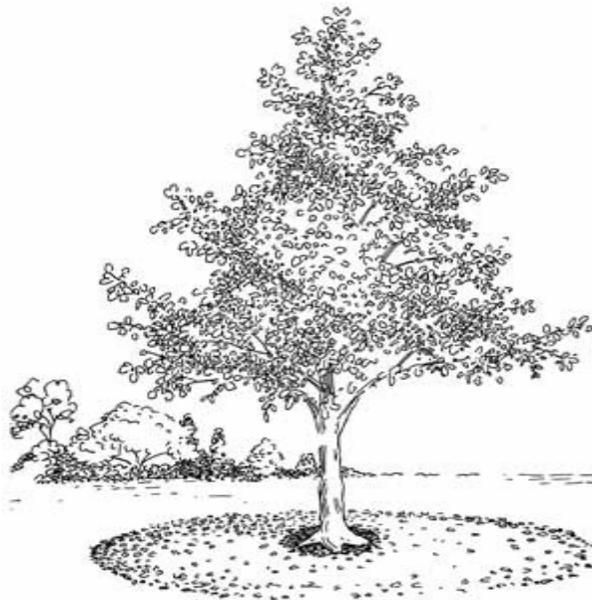
- Piling mulch against the trunk or stems of plants can rot the stem bark and wood tissue and may lead to insect and disease problems.
- Mulch piled against the tree can encourage root growth upward into the mulch and this in turn may result in stem girdling and/ or a weak and exposed mature root system.
- Mulch piled high against the trunks of young trees may create habitats for rodents that chew the bark and can girdle the trees.
- Thick blankets of mulch can become matted with bacterial and fungal residue and tissue and may prevent the penetration of water and air. In addition, a thick layer of fine mulch can become like potting soil and may support weed growth.
- Anaerobic "sour" mulch may give off pungent odors, and the alcohols and organic acids that build up may change the soil Ph and may be toxic to young plants.
- Newly chipped or shredded wood is nitrogen 'deficient' during the early period of breakdown by bacteria, and can cause nitrogen shortage for a newly planted tree. Use aged mulch if at all possible, even though it may not look as nice. Don't remove old mulch when adding new.

Proper Mulching

It is clear that the choice of mulch and the method of application can be important to the health of landscape plants. The following are some guidelines to use when considering applying mulch.

- Inspect plants and soil in the area to be mulched. Mulching is normally beneficial, but it may not be appropriate if: a) the tree is large enough to shade out weeds and grass; b) the tree has thick bark and is large enough to have a root system extending beyond the mulch ring; c) the soil is saturated; d) a mulch ring will prevent access to water flowing from a drainage channel.
- If mulch is already present, check the depth. Do not add mulch if there is a sufficient layer depth in place. Rake the old mulch to break up any matted layers and to refresh the appearance. Some landscape maintenance companies spray mulch with a water-soluble, vegetable-based dye to improve the appearance.
- If mulch is piled against the stems or tree trunks, pull it back at least 6-inches so that the base of the trunk and the root crown/ flare are exposed.
- Organic mulches usually are preferred to inorganic materials due to their soil-enhancing properties. If organic mulch is used, it should be well aerated and, preferably, composted. Freshly chipped mulch can cause nutrient deficiencies in plants. Avoid sour-smelling mulch.
- Composted wood chips can make good mulch, especially when they contain a blend of leaves, bark, and wood. Avoid using non-composted wood chips that have been piled deeply without exposure to oxygen. For well-drained sites, apply a 2 to 4-inch layer of mulch. If there are drainage problems, a thinner layer should be used. Avoid placing mulch against the tree trunks. Place mulch out to the tree's drip line and beyond if possible.

Personal view: In theory the most important role of mulch for young trees is to: i) prevent competition from weeds and, ii) to help retain water in the soil close to the root ball. In urban areas, the most important reason for mulching trees is to prevent landscapers damaging the trees with string mowers.



Mulch wide—not deep.

E. Pruning

Pruning Newly Planted Trees

Pruning of newly planted trees should be strictly limited. Only broken and torn branches should be removed until the tree is properly established and growing strongly. Corrective pruning to remove competing leading shoots, or crossing, rubbing or narrow branches, should be left until establishment is attained and the tree is growing vigorously (often 5 – 10 years after planting).

The belief that trees should be pruned when planted to compensate for root loss is misguided unless the root loss is particularly severe. Trees need their leaves and shoot tips to provide food product and the hormones that stimulate new root production. Unpruned trees usually establish faster with a stronger root system than trees pruned at the time of planting.

Pruning Young Trees

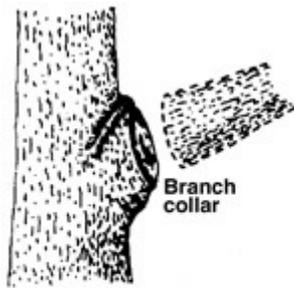
After a tree is properly established and growing strongly some pruning of live tissue may be appropriate. If a tree will have to share space with people, houses and vehicles as it grows to maturity, pruning may be essential in developing a tree with a strong structure and a crown form appropriate to its immediate environment. Trees that receive the appropriate pruning measures while they are young will require little corrective pruning when they mature. Keep these few simple principles in mind:

The Golden Rule: Never prune a tree without having a carefully thought out reason to do so

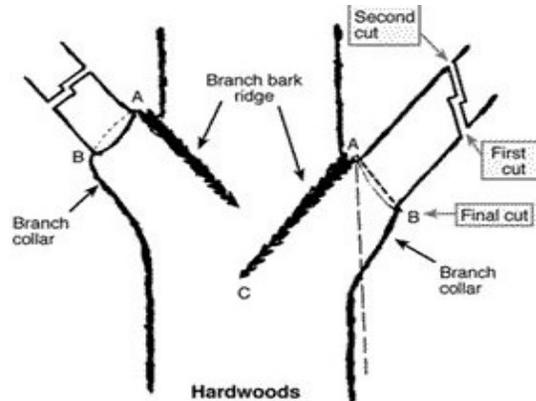
- Each cut has the potential to change the growth pattern of the tree. Always have a purpose in mind before making each cut.
- Always think about the health effects of pruning cuts. In particular never remove more than 20% of the crown in any year, and find the best time of year to prune for your tree species.
- Proper technique is essential. Poor pruning can cause damage that affects the long term health of the tree. Learn where and how to make the cuts before picking up the pruning shears.
- Trees do not heal the way people do. When a tree is wounded by pruning, it must cover over the wound with new annual growth rings in order to compartmentalize and contain the damage. As a result, the wound is contained within the tree forever and will always be a weak point within the tree.
- Small cuts do less damage to the tree than large cuts. For that reason, proper pruning (training) of young trees may be critical to its survival. Waiting to prune a tree until it is mature can create the need for large cuts and create wounds that the tree cannot easily close.
- *Please remember that newly planted trees should not be pruned unless it is to remove dead or badly damaged branches and twigs. Young trees (those that are fully established and growing strongly) may be pruned carefully if there is a good reason to do so, and the work is approved by the City Arborist.*
- The **Missouri Department of Conservation (MDC) Basic Pruning Guidelines** are a good source for detailed information on the exact location for pruning cuts.

Making the Cut

Where you make a pruning cut is critical to a tree's response in growth and wound closure. The diagram below shows the 'branch collar' and the 'branch bark ridge'. Be able to identify these areas and always protect them when you make a cut. Because the branch collar contains trunk or parent branch tissues, the tree will be damaged unnecessarily if you remove or damage it. In fact, if the cut is large, the tree may suffer permanent internal decay from an improper pruning cut. If a permanent branch is to be shortened, cut it back to a lateral branch or bud. Inter-nodal cuts, or cuts made between buds or branches, may lead to stem decay, sprout production, and misdirected growth.



Pruning cuts should be made just outside the branch collar.



Wound Dressings

Wound dressings were once thought to accelerate wound closure, protect against insects and diseases, and reduce decay.

However, research has shown that dressings do not reduce decay or speed closure and rarely prevent insect or disease infestations. In fact, wound dressings can prevent the development of the new wood that is necessary to seal pruning wounds. Most experts recommend that wound dressing not be used unless protection from a specific disease is recommended.

Pruning Tools

When pruning trees, it is important to have the right tool for the job. For small trees, most of the cuts can be made with hand pruning shears (hand pruners) and lopping shears. The scissor-type, or bypass blade, are preferred over the anvil type. They make cleaner, more accurate cuts. Cuts larger than one-half inch in diameter should be made with lopping shears or a pruning saw.

Never use hedge shears to prune a tree. Whatever tool you use, make sure it is kept clean and sharp.



Cuts made along a branch should be made at a lateral branch or bud.



Bypass pruning shears



Never use hedge shears to prune your trees.

F. Protecting the Tree Stem.

Tree stem protection can be very useful in defending the young stem bark of newly planted trees from a number of agents. In Columbia, squirrel and deer damage can be a problem, but our worst problem is sunscald. Sunscald is caused by exposure of the stem to strong sunlight, normally from the southwest, during winter months. The following means of stem protection are to be differentiated from similar equipment designed to promote the growth of seedlings (i.e. typically plastic 'Grow Tubes'). Tree protection material can be: wrapped hessian/ burlap; paper wrap; vinyl spiral wrap; plastic, cardboard or paper tubes; plastic/ wire mesh; and even white latex water based paint. The general reasons for installing tree stem protection are the following:

1. Protection from physical damage during transport and installation.
2. Protection from physical damage caused by mowing equipment, particularly rotary string mowers (weeding and mulching are however the preferred means of protection).
3. Protection from direct sunlight during winter months (causing sunscald in many species).
4. Protection from animals (notably deer, rabbits, squirrels and voles).
5. Protection from herbicide spraying and salt spray from vehicles.

The appropriate type of protection material will depend on the particular problem to be prevented. However, once the tree has been planted in the ground, white plastic tubing (insulated and flexible) is the ideal protection for most problems.

The downside to tree protection material, is that it can also damage the tree if it is not installed and removed properly. Material should be removed and, if necessary, replaced annually. Materials can provide a haven for insects & fungi, and prevent the drying of bark after rainfall.

Below are some text and photos from tree protection manufacturers showing the problems associated with tree protection equipment and their securing materials.



Figure 1: Stem girdled by wire.



Figure 2: Overly moist bark.

Tree Protection Discussion.

Secured incorrectly, any tree wrap can be a detriment. Most problems occur due to three common situations:

1. The wrap is applied too tightly to the stem, allowing no air space between the material and the stem,
2. The material is left on too long, and
3. The material is attached to the stem with another material that does not decompose soon enough to avoid stem girdling (constriction) [Fig. 1].



Figure 3: Nylon cord attached for too long and girdling the stem.

Any material that is applied directly to stem tissues may trap moisture, which may lead to more cases of stem diseases, decay, and infestations of certain insects that can damage stem tissues [Fig. 2]. Most commonly, the insects that prefer tightly wrapped stem conditions are woodborers and wasps with wood-boring larvae. It has also been observed that tightly wrapped stems have larger lenticels, which may or may not be a health issue. Leaving a tightly attached, synthetic or rot-proof wrap on the stem for too long, or using synthetic materials to attach the wrap to the stem may girdle the stem [Fig. 3].

As the stem expands during the growing season - even the first growing season - the rigid materials may constrict the stem tissues. This may restrict water, nutrients and/or photosynthates from normal movement within the stem, or weaken the stem physically. Other protectants such as paint and slaked lime may chemically damage the stem tissues.



Figure 4a: The start of a frost canker

A wrap that minimizes temperature changes within the stem environment should be the most helpful in preventing sunscald or frost cankers [Fig. 4a-c]. Research has also shown that wraps with reflective material on the outside and insulation on the inside considerably moderated temperature fluctuations in the air surrounding the stem as well as the stem tissues.

Wraps should not be left on tree stems for more than one year. Never attach wraps to stems with materials (synthetic twine, plastic, wires) that will not decompose within a year.

Materials Available

Numerous materials have been used to protect tree stems. The most commonly used materials include:

- Paper wrap (e.g. Kraft paper)
- Latex paint
- Plastic guards
- Foylon
- Burlap
- Homemade guards
- Cardboard

Guards and wrapping materials may be purchased at lawn and garden centers or made at home.



Figure 4b: Intermediate stage.



Figure 4c: Resulting frost canker.



Figure 5: Plastic guards protect stems during transport.



Figure 6: Rabbit damage to tree.

Plastic guards can be used to prevent physical damage to trees [Fig. 5]. They can prevent the bark from animal, lawnmower and weed whip damage [Fig. 6, 7]. Squirrels, voles and rabbits like to nibble on the basal areas of tree stems.

Even small mechanical injuries can eventually result in the death of the tree when decay fungi or disease pathogens enter through the wounds. A simple alternative to guards is the installation of a mulch ring around the base of the tree [Fig. 8].

Mulch has other benefits, too, but the most important is to eliminate the need to mow or trim around the base of the tree. If mulch is not available, hand weeding within a few feet of the tree stem will discourage mowers from working near a tree.



Figure 7: This tree has twice the protection with wire cage outside and plastic tubing on the inside.



Figure 8: Mulch rings benefit trees in many ways.

Installation of Wraps & Guards

Wraps.

Stems should be wrapped from the bottom (near soil line) to the top (first set of branches) to keep water from seeping in between the wrap and stem. The top should be attached with a stretchable material, such as masking tape or light twine that will decompose naturally within a year [Fig. 9a & b]. Never use fiber-reinforce tape, nylon cord or wires to attach the wrap to the stem. They could girdle the stem. Wraps may be installed any time but they must be removed within a year. Wraps are commonly constructed of Kraft™ paper, vinyl spiral wraps, and corrugated tubes. Wraps should be attached from the soil line to the first set of branches. Monitor wraps and remove or re-install within one year.



Figure 9a: Start wrapping at soil line.



Figure 9b: Wrap to first set of branches and secure with maskingtape.

Guards. A guard can be constructed out of common household items, such as hardware cloth or purchased from lawn and garden stores. Install the guard loosely to prevent accumulation of moisture, growth of bacteria and fungi, and damaging-insect habitat. Secure the guard to itself (not to the tree stem) with wire or zip ties. Guards should be loose enough to allow air to flow through the space between the stem and the guard [Fig. 10]. This will allow the guard to better moderate the ambient stem conditions, especially temperature and humidity. Many guards have holes in them to aid in this process. Like wraps, guards may be installed any time, but may cause girdling and excess stem moisture conditions if left on for too long. Guards, like wrapping materials, should be removed within a year or at least removed and re-installed on a regular basis – not just before the stem out-grows the guard diameter [Fig.11-13]. Check the guard frequently for tissue compaction.



Figure 10: Arborjacket (left) and tree shelter



Figure 11: Starting a spiral wrap.



Figure 11b: Finished spiral wrap.



Figure 12a: Arborjacket before installation.



Figure 12b: Arborjacket being installed and inserts connected.



Figure 13a: Tube guard being installed- note: be careful not to scrape bark with sharp edges of tube.



Figure 13b: Plastic tie connecting tube guard together.



Figure 13c: Installed tube guard

Any use of guards or other stem protection materials can best be summed up by a statement made by Bonnie Appleton, who has researched and authored several articles on stem protection: "Regardless of the reason for using a trunk protective material, there is no point in providing protection at planting if the material used may eventually damage the tree because of improper material selection, or non-removal. Timely readjustment or removal is mandatory, for both tree growth and aesthetic reasons." [Fig. 14-15]



Figure 14: Chicken-wire guard left unattended too long.



Figure 15: This stem has outgrown its protection, notice mower damage.

END