

IPM Series: Shade Trees

Symptoms	Possible Causes	Controls/Comments
<p>WHOLE TREE</p> <p>Tree dies suddenly</p>	<p>Severe defoliation and wood rots: i.e. gypsy moth damage and various wood decay fungi</p> <p>Severe drought damage or long periods of standing water</p> <p>Construction equipment injury</p> <p>Severed or damaged roots: e.g. trenching, road construction damage.</p> <p>Lightning damage: bark is often damaged in a streak or band from top to roots.</p>	<ul style="list-style-type: none"> • Promptly remove dead trees to prevent disease and insect colonization. • Irrigate during dry periods or improve drainage. • Protect trees with temporary fencing. • Where possible minimize root damage by cable boring instead of trenching. • Install lightning protection on valuable specimen trees.
<p>Mature tree decline</p>	<p>Natural senescence (old age)</p> <p>Change in grade, drainage: affects oxygen exchange between roots and soil surface.</p> <p>Construction equipment injury/compacted soil</p> <p>Severed or damaged roots: e.g. from trenching, road construction damage.</p> <p>Plastic burlap or wire cages left on root ball</p>	<ul style="list-style-type: none"> • All plants have a maximum useful life and should be evaluated for esthetics and safety as they decline. • Avoid adding or removing more than 3 inches of soil or mulch within the root zone. • Protect trees from construction equipment with temporary fencing at least to the dripline. If equipment must be moved within the dripline, apply a temporary 6 inch deep layer of coarse wood chips (if possible, covered by heavy plywood) to protect the soil during the period of activity. • Minimize root damage by using a cable boring machine instead of trenching. • Remove, cut, or fold back burlap or wire as much as possible.
<p>Poor growth; failure to establish</p>	<p>Species or variety not adapted to area</p> <p>Poor plant material: pot bound, weak plants, dead roots.</p> <p>Poor site conditions: heavy clay, poor drainage, low soil fertility, low or excessive light conditions.</p> <p>Poor planting techniques: deep planting, poor soil preparation.</p> <p>Lack of proper care and maintenance: i.e. poor watering and mulching techniques.</p>	<ul style="list-style-type: none"> • Select appropriate trees for specific locations, e.g. wet/dry sites. • Inspect young trees carefully before installation. • Prevent problems by choosing species able to withstand existing site conditions. • Deep planting is a special problem of dogwood, oak and beech. • Proper irrigation is especially important for new tree establishment. Mulch no more than 3" deep; keep several inches from trunk.

Educating People To Help Themselves

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LEAVES

Leaves eaten or chewed

Early & late season caterpillars, sawflies, or leaf feeding beetles: **Gypsy moth:** an early to mid season caterpillar that should be controlled on oaks. Other early season caterpillars include Eastern tent caterpillar and cankerworms (“inchworms”).

Mid to late season caterpillars: fall webworm, red humped, yellow-necked, mimosa webworm and orange-striped oakworm.

Leaf-feeding beetles: Japanese beetles, chaffers, locust leafminer, elm leaf beetle, willow leaf beetle, etc.

Sawflies: include dusky birch, black-headed ash, mountain ash, dogwood, etc.

•Early season caterpillars such as gypsy moth should be controlled when larvae are small and before damage is extensive. (See Fact Sheet #242 on gypsy moth for specific control measures). The biological insecticide B.t. (*Bacillus thuringiensis*) is effective on small caterpillars. Hand picking caterpillars and sawflies can give adequate control of small populations on young trees. Large caterpillars, sawflies and beetles may require a residual insecticide spray if populations are causing significant damage. Control may be difficult on large trees unless spray coverage is thorough.

•Generally do not require control except on young trees or if heavy defoliation is occurring.

•Elm leaf beetle larvae may be controlled with M-Trak, a B.t. product for certain leaf-feeding beetles. It is effective against young larvae, but not adults. For other beetles, conventional insecticides may be necessary for heavy damage.

•Hand-pick sawflies if possible. B.t. products are not effective since sawfly larvae are not “true” caterpillars.

Webbed or tented foliage

Tent caterpillars, webworms, leafrollers and leaf tiers: various caterpillars found within webbed leaves or silken tents, e.g. eastern tent caterpillar, fall webworm, mimosa webworm.

•If numerous caterpillars are present, use B.t. when the caterpillars are small. Knock down or prune out webs on terminal branches and destroy caterpillars.

Leaf distortion

Leaf-hoppers: pale green to white wedge-shaped insects that cause curling and stunting of terminal leaves. Look for coarse white stippling between veins. Whitish cast skins are usually present on lower leaf surfaces. Some species may transmit the bacterial leaf scorch pathogen capable of causing scorch-like symptoms on elm, oak, sycamore, red maple and red mulberry.

Plant bugs: 1/4 inch long green or brown, cause distortion of leaves in the spring, especially on sycamore and honeylocust.

Spider mites and aphids: feeding causes cupped leaves on some plants.

Herbicide damage/drift: smaller than normal growth, twisting stems, distorted leaves.

•Small trees may be protected with sprays as needed if honeydew or stippling is a problem. Concentrate sprays on new growth, where leafhoppers feed. Use caution when spraying Japanese maples, which are sensitive to certain pesticides. For bacterial leaf scorch, prune out infected branches below symptoms and improve the tree’s vigor with standard cultural practices. Overfertilization may increase leafhopper populations.

•Trees generally outgrow the damage.

•Generally impractical to spray large trees for mites and aphids. When control is needed, use insecticidal soap or horticultural oils to minimize adverse effects on natural enemies.

•Avoid herbicide spray drift by spraying on a still day; also avoid days when the temperatures will be very high.

Bags constructed of plant material attached to branches

Bagworms: caterpillars feed on foliage and construct protective silk bags covered with host plant material.

•Spray with B.t. when bags are small from mid June to mid-July. Hand pick and destroy bags during the fall and winter.

Leaf stippling (pinpoint-sized yellow spots)

Spider mites: very tiny, “period-sized”. Present on lower leaf surfaces. Leaves yellow, eventually turn brown and drop prematurely. Webbing may be visible with high populations in protected sites.

Lacebugs: 1/4 inch long, lacy wings. Feed on lower leaf surface. Stippling on upper leaf surface is white. Black fecal spots on lower leaf surface.

Leaf-hoppers: pale green to white wedge-shaped insects that cause curling and stunting of terminal leaves. Look for coarse white stippling between veins. Whitish cast skins usually present on lower leaf surfaces. Some species may transmit the bacterial leaf scorch pathogen capable of causing scorch-like symptoms on elm, oak, sycamore, red maple and red mulberry.

- Generally impractical to spray large trees for spider mites. On small trees, if control is needed, use insecticidal soap or horticultural oils to minimize adverse effects on natural predators. Direct sprays toward the lower leaf surfaces. Releasing predatory mites to control spider mites is another option on small trees.
- Insecticidal soap sprays should be directed to lower leaf surfaces or use a systemic insecticide. Generally not necessary to control on large trees. They may require control on small trees if damage is heavy.
- Small trees may be protected with sprays as needed if honeydew or stippling is a problem. Concentrate sprays on new growth, where leafhoppers feed. Use caution when spraying Japanese maples, which are sensitive to certain pesticides. For bacterial leaf scorch, prune out infected branches below symptoms and improve tree’s vigor with standard cultural practices. Overfertilization may increase leafhopper populations.

Leaf yellowing/mottling

Air pollution damage: yellow, silver, red or purple flecking may be seen. Damage may be brownish; foliage may be thin or stunted with premature leaf drop.

Iron, magnesium, or manganese deficiency: on “acid-loving” plants, associated with high soil pH.

Excessive water: leaves become uniformly yellow and drop.

Nitrogen deficiency: older leaves uniformly yellow. Shoots long and spindly.

Low light conditions: spindly growth.

Herbicide damage: smaller than normal growth.

Viruses: symptoms may include color changes in leaves such as a mosaic or mottled pattern of light and dark green.

- No controls are available.
- Follow soil test recommendations. Newer growth may be under-sized and sparse. May cause slow growth and premature leaf drop.
- Improve site drainage.
- Follow soil test recommendations.
- Relocate plants for better sunlight exposure.
- Symptoms may also be seen on adjacent plants of different species.
- There is no cure for infected plants. Removal is the only option other than living with the symptoms. Aphid damage- symptoms can be similar.

Foliage fades, yellows, browns or wilts, often scattered throughout the canopy.

Armored scales: encrustations on branches. Scales can be scraped off.

Soft scales: appear as raised bumps on twigs and branches. Can be scraped off. Honeydew and sooty mold may be present.

Spider mites: very tiny, period-sized insects present on lower leaf surfaces. Leaves yellow and eventually turn brown and drop prematurely. Webbing may be visible with high populations.

Borers: holes and tunnels in branches.

- For either armored or soft scale infestations, prune out branches with severe symptoms.
- Spray tree with a dormant rate of horticultural oil during the dormant season to control overwintering scale insects.
- Generally impractical to spray large trees for mites. When control is needed, use insecticidal soap or horticultural oils to minimize adverse effects on natural predators or consider releasing predatory mites.
- Prune out infested branches where practical. No chemical controls are effective.

Verticillium wilt: scrape bark of recently wilted twigs and branches to look for evidence of vascular browning (streaking) that would indicate Verticillium wilt.

Mimosa wilt: only affects mimosa. Look for evidence of vascular browning (streaking) or pink spore masses on bark.

Dutch elm disease: symptoms typically appear in May as wilted branches with yellow, then brown leaves.

Cankers: caused by various fungi. Common genera include *Cytospora*, *Botryosphaeria*, *Nectria* and *Phytophthora*. Cause dark, elongated lesions with roughened bark.

Root/wood rots: numerous fungi that cause wood decay and form fruiting bodies such as mushrooms on branches or trunk.

- No sprays are effective. Prune out wilted and dead branches and irrigate during dry weather. Avoid root damage from salt or cultivation. In problem sites, select resistant alternative trees. Trunk injections may be considered for old specimen trees. However, if damage is severe, they will not prevent dieback. Fertilization can encourage new growth if enough healthy roots are available to take up nutrients.

- Remove infected trees and use resistant varieties.

- Consult a certified arborist with a tree care company.

- No sprays are effective. Maintain adequate irrigation during drought. Prune out affected branches where practical.

- Although infected trees may take several years to die, they pose a hazard and should be removed. Single infected branches should be removed promptly.

Early fall coloration; premature leaf drop

Environmental stress: drought and heat stress; poor site conditions; low temperature damage to crowns and roots, and abiotic or cultural problems.

Various insects and diseases: often an early sign of stress.

- No chemical controls needed. Improve site conditions or relocate small trees.

- Promptly remove declining or damaged trees to prevent disease or insect colonization.

Leaf scorching/marginal burning

“Pesticide burn”: includes soaps and oils. Emulsifiable concentrates are more likely to burn than wettable powders. Copper, sulfur, and Captan fungicides may cause leaf burn on various fruit trees and small fruit plants. Spruce, maple and arborvitae are more sensitive to oil sprays.

“Fertilizer burn”; **salt spray:** causes tissue desiccation or drying.

Damage from lawn herbicides: including dicamba and glyphosate, causes stunted growth.

Drought stress: affects top and outer leaves first.

Very high temperatures/sunburn: yellow, brown or white areas develop on upper sides of leaves.

Chloride toxicity: leaves yellow and brown at the tips, typically from swimming pool drainage.

Bacterial leaf scorch: affects interior leaves and those near the base of the tree first. Leaves show marginal necrosis. Symptoms are most evident on maples, elms, oaks, sycamore and mulberry by midsummer.

Locust Leafminer: heavy feeding damage causes black locust trees to appear scorched. Adult beetle is small, elongate, orange and black. Adults skeletonize leaves. Larvae mine leaves in the form of irregular blotches.

- Stressed plants are more likely to be “burned”; leaf margins are affected first. Leaves are particularly susceptible to “burn” when temperatures exceed 80°F.

- Random, irregular spots or entire “leaf burn”. Marginal “leaf burn” from roots contacting excessive salts.

- Symptoms from fall-applied herbicides may not appear until spring.

- Keep trees well watered for first 3-4 years.

- Heat reflects from buildings or paving. Irrigate to lower ambient temperatures.

- Avoid draining swimming pool water on turf or over root zone around plants and trees.

- Prune out infected branches promptly when symptoms are first noticed well below the last scorched leaf. Trees with extensive dieback should be removed.

- Control generally not recommended. To help trees better withstand the effects of defoliation, provide trees with adequate water during the summer and fertilize occasionally.

Leaf spots, blotches and blight, blisters

“Burning” from herbicide, pesticide, fertilizer or salt: necrotic spots from direct contact.

Sunburn: yellow, brown or white areas develop on upper sides of leaves.

Leaf spotting diseases: isolated, minor damage. During wet weather may blight entire leaves and cause extensive defoliation especially on crabapples, maples, and oaks.

Oak leaf blister: puckered blisters, raised yellowish-white when young, turning dark with age and later falling out leaving holes in the leaves.

Rust diseases: e.g. ash rust, cedar-apple rust, hawthorne-rust, cedar-quince rust. Bright yellow or orange fungal spots or growths.

Anthracnose diseases: e.g. dogwood, ash, hickory, maple, oak or sycamore. Anthracnose leaf spots or blotches run together and cover leaf surface. Defoliation can occur under severe conditions. Anthracnose diseases may also kill twigs, branches and flower buds.

Pear leaf blister mite on apple and pear: small, green or yellow pimples turn into reddish-brown blisters. Tiny white or light red mites can be seen on leaf undersides with a hand lens.

Eyespot gall on maple: yellow slightly raised area ringed in red on upper leaf surface, eventually turns brown; caused by an insect.

Tuliptree spot gall: purplish spots, 1/8 inch in diameter; caused by an insect.

- Use pesticides according to label directions.
- Damage due to excessive sunlight and heat or insufficient water.
- Registered fungicides may be warranted when disease conditions are severe on young trees. Prune out dead twigs and branches in dry weather and rake up and remove fallen leaves in the fall. Control is impractical on large trees. Consider replacement with resistant varieties.
- Usually only noticeable in wet years, control is impractical on large trees.
- Plant resistant varieties. Do not plant cedar trees (junipers), the alternate host of apple, hawthorne and quince rust diseases.
- Registered fungicides may be warranted when disease conditions are severe on young trees. Prune out dead twigs and branches in dry weather and rake up and remove fallen leaves in the fall. Control is impractical on large trees. Consider replacement with resistant varieties. (See *IPM Series: Dogwood* HG12)
- Apply a dormant oil spray before “bud break” in the spring.

•Controls are not necessary.

•Controls are not necessary.

Blackening of new green shoots, leaves, and flower buds

Bacterial blight: Stem lesions on green twigs start as dark streaks that quickly girdle and cause wilting and blackening of shoots- especially on holly and lilac. Fireblight is a bacterial disease on crabapple and Bradford pear.

- Avoid over fertilization and excessive pruning to prevent an over abundance of young susceptible shoots in the spring. Quickly prune out diseased shoots during dry periods, and remove the clippings from the area.

White coating on leaves

Powdery mildew: white surface growth on leaves that may cause distortion.

- Controls are generally not needed except on crabapples and dogwoods. Leaves should be raked up in the fall. Check horticultural oil labels for powdery mildew control listings.

Orange or yellow pustules on leaves

Rust diseases: upper leaf surfaces turn yellow or brown and infected leaves may drop prematurely. Rusty colored spores are usually on lower leaf surfaces.

- Controls are not usually practical. Replace with resistant varieties. Do not plant junipers (cedar trees), which are the alternate hosts of apple, hawthorne and quince rusts.

Sooty mold/sticky honey dew

Aphids: small, soft-bodied insects on young shoots, leaves and bark.

Soft scales: appear as raised bumps on twigs and branches.

Leaf-hoppers: pale green to white wedge-shaped insects that cause curling and stunting of terminal leaves. Look for coarse white stippling between veins. Whitish cast skins usually

- Healthy plants can tolerate moderate populations of aphids and scales. Conserve natural enemies. If high populations are present, spray when plants are dormant with a horticultural oil at the dormant rate.
- Small trees may be protected with sprays as needed if honeydew or stippling is a problem. Concentrate sprays on new growth, where leafhoppers feed. Use caution when spraying

present on lower leaf surfaces. Some species may transmit the bacterial leaf scorch pathogen capable of causing scorch-like symptoms on elm, oak, sycamore, red maple and red mulberry.

Japanese maples, which are sensitive to certain pesticides. For bacterial leaf scorch, prune out infected branches below symptoms and improve tree's vigor with standard cultural practices. Overfertilization may increase leafhopper populations.

Various leafminers: include maggots, small caterpillars, sawflies, or grubs. Feed between the upper and lower leaf surfaces.

- Control is difficult on large trees. Note host plant to determine identity of pest. If damage is significant, control may be warranted. "Heritage" birch is resistant to birch leafminer. Locust leafminer usually only a problem on black locust and does not require control. Handpick and destroy infested leaves if possible.

Growths on leaves, fuzzy or raised nodules

Galls: produced by gall midges, gall wasps, and eriophyid mites that are very tiny, generally not visible to naked eye. Galls may be various colors and shapes.

- Control is generally not needed. If necessary, pull off and destroy leaf galls while they are still green. Horticultural oil, dormant season sprays may help reduce overwintering mite populations.

Wilting of foliage

Drought stress: foliage wilts, droops, and drops prematurely.
Root damage: freeze, drought, or mechanical injury.
Poorly drained or wet soil: roots become oxygen-starved (drowned).
Heavy clay soils: impede root growth and limit water uptake.
Dry sites and insufficient watering: on newly transplanted trees and shrubs.

- May lead to twig and limb dieback. Provide adequate water during fall months.
- Apply winter mulches after ground freezes.
- Select suitable, well-drained planting sites.
- Improve soil before planting.
- Keep young and newly transplanted material well watered

TWIGS & BRANCHES

Twig/branch dieback

Root damage: freeze, drought or mechanical injury may affect water and nutrient uptake.
Wet, poorly drained soil: lack of oxygen in root zone causes root dieback.
Herbicide damage: kills bud tissue.
De-icing salts: causes tissue desiccation or drying.

- Prune out affected areas. Keep well-watered and use winter mulching.
- Select suitable, well-drained planting sites.
- Avoid herbicide application/drift near trees.
- Prune out damage. Soaking the affected area with one-inch applications of water 3-4 times in the spring will dissolve excess salt. Gypsum may be added to the soil to reduce high sodium levels.
- Prune out damage.
- Avoid adding or removing more than 3 inches of soil or mulch within the root zone.
- Keep mulch several inches away from the trunk of the tree and do not exceed 3 inches in depth.

Freeze injury: kills new growth.
Change in grade: changes oxygen exchange between roots and soil surface.
Excessive mulch: can encourage excessive moisture and possibility of crown rot diseases. May encourage certain species to establish roots in mulch layer rather than soil, which can lead to root death during dry weather.
Girdling roots: grow in a circular or spiral pattern around base of trunk. Eventually cuts off sap flow from the stems and leaves.

- Inspect trees regularly to detect girdling roots while they are small. Small girdling roots can be removed with a chisel and mallet. Remove several inches of the root where it contacts the tree trunk. If a large girdling root has grafted with the tree, leave it. Seriously weakened or declining trees may need to be removed.

Armored scales: encrustations on branches, especially oak.

Borers: holes and tunnels in branches.

Twig girdlers and twig pruners: fallen twigs with chewed ends in the fall.

Cicadas: deep slits made in bark during egg laying activity causing twigs to break easily in windy weather.

Verticillium wilt: cankers and split bark. Foliage fades, yellows, browns or wilts. Damage often scattered throughout the canopy. May also see scattered dieback in canopy.

Dutch elm disease: symptoms typically appear in May as wilted branches with yellow, then brown leaves.

Mimosa wilt: only affects mimosa. Look for evidence of vascular browning or pink spore masses on bark.

Cankers: Caused by various fungi. Common genera include *Cytospora*, *Botryosphaeria*, *Nectria* and *Phytophthora*. Cause dark, elongated lesions with roughened bark.

- Prune out affected branches. Apply a horticultural oil at the dormant rate before bud break in the spring to control scale infestations.
- Prevent infestations by keeping trees healthy.
- Rake up and dispose of fallen twigs with chewed ends to control twig girdlers and pruners.

• In most years damage from cicadas is minor and no control is necessary.

• No sprays are effective. Prune out wilted and dead branches and irrigate during dry weather. Avoid root damage from salt or cultivation. In problem sites, select resistant alternative trees. Trunk injections may be considered for old specimen trees. However, if damage is severe, they will not prevent dieback. Fertilization can encourage new growth if enough healthy roots are available to take up nutrients.

• Consult an arborist with a tree care company.

• Remove infected trees and use resistant varieties.

• No sprays are effective. Maintain adequate irrigation during drought. Prune out affected branches where practical.

Rapid dieback of branches, blackening or browning of shoots, blossoms or fruit. Plant appears scorched.

Fireblight: a bacterial disease that infects plants in the rose family such as crabapples, flowering cherries and pears.

• Prune out infected branches promptly a foot below visible damage. Remove root suckers and water sprouts. Select resistant plant cultivars. Reduce nitrogen fertilization. Under severe conditions, copper fungicides may be required.

Blackening of new green shoots, leaves, and flower buds

Bacterial blight: Stem lesions on green twigs start as dark streaks that quickly girdle and cause wilting and blackening of shoots—especially on holly and lilac.

• Avoid over fertilization and excessive pruning to prevent an over abundance of young susceptible shoots in the spring. Quickly prune out diseased shoots during dry periods, and remove the clippings from the area.

Foliage/twigs/limbs broken or injured

Ice, wind or hail damage or squirrels: cankers may develop. Squirrels may prune small twigs for nest building. (See also small twigs on ground.)

• Prune out affected parts and rake up twigs.

Shoots chewed and girdled, bark stripped from trunk or branches

Deer feeding and antler rubbing: worse during very cold winters. Antler rubbing from bucks.

• Where appropriate, electric fences are very effective. Repel deer by hanging one or more of the following from mesh bags on trees; small bars of soap, human hair, blood meal or mothballs. Systemic bitter tasting products may also prevent browsing.

• Prune out affected branches/twigs.

Squirrels: strip bark from twigs and branches of trees. They seek the sap and cambium layer just beneath the bark.

European Hornets: large, about 3/4 to 1 3/8 inches long. They are brown, with yellow stripes on their abdomen and a light colored face, girdle

• Prune out affected branches/twigs.

twigs and branches of trees to feed on sap. (It is the only true hornet in the United States.)

Hard growths on twigs	Twig and stem galls: caused by gall wasps. Most common on oaks. Dieback may occur.	•Prune out twig galls as they form, especially on pin and willow oak. Severely infested trees should be removed.
Whitish cottony material on twigs and branches	Woolly aphids and egg masses of soft scales: honeydew may be present.	•Healthy plants can tolerate moderate populations of aphids and scales. Conserve natural enemies. If high populations are present, spray when plants are dormant with a horticultural oil at the dormant rate.
Whitish frothy material on twigs	Spittlebugs: small sucking insects, covered with “frothy spittle” that feed on terminal twigs of host plants.	•Control is generally not warranted.
Frass (excrement/sawdust) around wounds and bark cracks. Gummosis (sap) may be present on <i>Prunus</i> species	Clearwing borers: white larvae (caterpillars) make shallow tunnels under the bark and push frass (excrement) out through holes. Frass accumulates in branch crotches, bark and base of the tree.	•Keep mulch away from trunk on <i>Prunus</i> species. Beneficial nematodes can be sprayed on infested areas of branches and trunk. However, gummosis prevents entry of nematodes into borer tunnels.
Sap oozing from trunk or branches	Natural gummosis: clear sap. Slime flux: sometimes foamy. Fermented odor may attract insects. Cankers: caused by various fungi. Common genera include <i>Cytospora</i> , <i>Botryosphaeria</i> , <i>Nectria</i> and <i>Phytophthora</i> . Cause dark, elongated lesions with roughened bark. Clearwing borers: white larvae (caterpillars) make shallow tunnels under the bark and push frass (excrement) out through holes. Frass accumulates in branch crotches, bark and base of the tree.	•Especially on <i>Prunus spp</i> (peach, cherry, plum). No control is usually necessary. Could be symptomatic of a wetwood disease. If reoccurring, consult a certified arborist. •No sprays are effective. Maintain adequate irrigation during drought. Prune out affected branches where practical. •Keep mulch away from trunk on <i>Prunus</i> species. Beneficial nematodes can be sprayed on infested areas of branches and trunk, however, gummosis prevents entry of nematodes into borer tunnels.
Water sprouts/suckers Environmental stress/	Removal of large branches and limbs/Secondary symptom of disease infection.	•Promptly pull or cut sprouts and suckers at point of attachment.
Small twigs on the ground	Twig girdlers and twig pruner beetles: in fall, fallen twigs with chewed ends appearing to be filed off evenly. Squirrels: prune twigs for nest building material. Twigs are chewed roughly on an angle.	•Rake up and dispose of fallen twigs with chewed ends to control twig girdlers and pruners. (Insects are in twigs.)
Proliferation of branches or dense bushy growth (Witches Broom)	Insects, eriophyiid mites, mistletoe, and fungal, viral or mycoplasma diseases.	•Prune out affected parts.

TRUNK/BASE

Dark, elongated lesions with roughened bark.	Cankers: Caused by various fungi. Common genera include <i>Cytospora</i> , <i>Botryosphaeria</i> , <i>Nectria</i> and <i>Phytophthora</i> .	•Keep mulch away from trunk on <i>Prunus</i> species. Beneficial nematodes can be sprayed on infested areas of branches and trunk.
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Frass around wounds and bark cracks. Gummosis may be present on <i>Prunus</i> species. Sap oozing.	Clearwing borers: white larvae (caterpillars) make shallow tunnels under the bark and push frass (excrement) out through holes. Frass accumulates in branch crotches, bark and base of the tree.	However, gummosis (sap) prevents entry of nematodes into borer tunnels.
Bark and/or wood dead, often in a streak or band	Lightning damage: plant may die suddenly.	•Install lightning protection on valuable specimen trees.
Trunk bark is cracked longitudinally, usually on south or west side	Frost/freeze cracks, sunscald: due to differential freezing and thawing of water in tree. Growth cracks: occur naturally, usually when the tree is growing rapidly.	•Heartwood may be visible and there may be oozing from the crack. Consider wrapping, or painting white latex paint on the trunks of young or vulnerable trees. •Tissue inside crack looks like developing bark (though smoother and lighter in color). As growth continues, bark covers the crack and no permanent damage occurs.
Dead zone of tissue on young thin barked trees	Herbicide damage: may occur on thin-barked trees. Damage sometimes appears a year after treatment was made.	•Be careful using herbicides, especially glyphosate and dicamba, around thin-barked or young trees. Avoid applying herbicides to the bark of these trees.
Trunk bark/wood is gouged or scarred	Lawnmower or string trimmer injury: may girdle trunk or cause dieback. Imbedded wires or collars: from tree support apparatus. Construction equipment: also causes root damage and soil compaction.	•Can lead to disease and borer problems. Mulch a wide circle around the tree but keep the mulch several inches away from the trunk and 3 inches deep. •Remove wires or collars that have become imbedded in the trunk. If it cannot be removed easily, cut the wire or collar in several places to relieve the pressure. •Protect trees from construction equipment with temporary fencing at least to drip line.
Bulging or deformity of trunk at graft union	Normal on grafted trees for scion wood to overgrow or undergrow the rootstock: large swelling near union.	•Remove any suckers that may arise.
Top of young tree breaks off at or near ground level	Failure of graft union or virus infection of graft union: incompatibility between scion wood and rootstock.	•Determine the degree of compatibility prior to planting.
Roots at tree base wrapped partly or completely around trunk	Girdling roots: cut off sap flow and may kill the tree. More likely with container-grown stock planted into heavy, clay soil. The trunk is often flat on the girdled side.	•Occurs when roots are deflected from normal growth. Can sometimes be removed with chisel and mallet. Species prone to girdling roots include maple, oak, tulip poplar and elm.
Fungal growths or mushrooms on branches or trunk	Visible evidence of wood decay: often indicative of extensive interior wood decay or root rot.	•Large trees should be inspected by a certified arborist to determine the extent of trunk damage. Trees with extensive damage should be removed promptly.
Holes in trunk	Woodpeckers/Sapsuckers: most woodpeckers peck holes into trees in search of wood boring insects. Yet many species will make holes in sound wood where no insects exist. Sapsuckers drill numerous rows of 1/4 - 3/8 inch closely spaced holes in healthy trees to feed on sap and the insects entrapped by the sap. They may feed	•To protect trees from sapsuckers, wrap barriers of 1/4 inch hardware cloth, plastic mesh, or burlap around injured areas to discourage further. This method may be practical for high value ornamental or shade trees. In orchards and forested areas it may be best to let the sapsuckers work on one or more of their

on ornamental or fruit trees. Holes may be enlarged through continued pecking or limb growth, and large patches of bark may be removed or sloughed off. Occasionally limb and trunk girdling may kill the tree.

favorite trees. Discouraging them from select trees may encourage the birds to disperse to others, causing damage to greater number of trees.

FLOWERS/FRUITS

Newly planted flowering trees and shrubs fail to bloom

Plants have not matured sufficiently: Trees often must become well established before they reproduce sexually.
Environmental stress: poor site conditions or excessive shading.

- Check references and nurseries for typical flowering/fruiting age.
- Consider transplanting to a better location or modify site conditions.

Failure to bloom, blossom drop, blasted or damaged blooms

Winterkill of buds: extended cold temperatures
Spring frost damage to buds and flowers: may leaf out without flowering. (Leaf buds are hardier than flower buds).
Stressful conditions: drought, wind, low temperatures may cause blossom drop.
Over-use of nitrogen fertilizers prior to bloom period: leads to blossom drop.
Misuse of pesticide sprays: leaf and flower buds may be killed or damaged by spraying when temperatures are below 40°F.
Severe pruning: will reduce number of blooms.
Fall, winter, or early spring pruning: removes flower buds formed the previous summer.

- Avoid marginally hardy trees.
- Avoid early blooming trees in frost prone areas.
- Tissue desiccation. Avoid siting trees in windy, exposed areas.
- Avoid overfertilization.
- Over-spraying of dormant oil, lime-sulfur and other fungicides and insecticides may damage buds and blooms.
- Follow University of Maryland pruning guidelines.
- Spring-flowering ornamental trees should be pruned immediately after bloom period.

The IPM Approach to Preventing and Managing Pest Problems

Shade trees encompass a large number of trees including oak, maple, sycamore, tulip poplar, hickory and magnolia. This publication is intended as a guide to diagnosing problems with shade trees. In many cases problems with specific types of trees are listed. To list all of the insects and diseases that affect all shade trees would be nearly impossible. Hopefully this fact sheet will help guide you through the diagnostic process, determine the type of problem and/or to a solution.

To grow trees successfully, you must keep the trees healthy. Anticipate and manage problems or prevent them altogether. When symptoms of a problem are noticed you must be able to accurately identify the problem (e.g. weed, insect, disease), monitor for changes (e.g. increasing severity) and be prepared to act. These preventive techniques and control measures may be physical (e.g., hand-picking Japanese beetles), cultural (e.g. pruning to improve air circulation) or chemical (e.g. spraying horticultural oil to control scale crawlers and aphids).

Most diseases are generally favored by wet seasons. Pest problems tend to be worse on trees that are stressed. Be aware, however, that a large number of the problems observed each season by gardeners are cultural and environmental.

These abiotic problems include insufficient water or nutrients. Space, sunlight, support, poor soil, low pH, temperature extremes, root damage from cultivation, choosing inappropriate varieties and purchasing poor quality trees also contribute to problems.

The **integrated pest management (IPM)** approach to preventing or managing pest problems is recommended and can be summarized as follows:

- **Identify the plant species or variety.**
- **Correctly identify the problem; if insect or disease, learn the life cycle and habits.**
- Learn to anticipate and prevent problems; reduce plant stress.
- **Monitor the problem for worsening symptoms.**
- **If level of damage becomes unacceptable, choose a least toxic control.**

Pesticides may still be required using the IPM approach, but you may reduce the number of sprays through monitoring and good sanitation practices

Cultivar Selection and Planting

Prevent problems before you plant your first tree by following these pointers:

- Select quality tree species with strong wood, minimal surface rooting problems, low susceptibility to disease or insect pests and tolerance of weather and soil conditions of the site. Always buy trees from a reliable nursery. Avoid poor quality bargain plants. A quality tree will be free of insects, diseases, cankers, wounds, etc. Make sure the roots aren't kinked or circling the trunk and that they aren't a solid mass (pot bound).
- Select the correct sized tree for your landscape. There are many types of trees that range in height from 25 feet to over 80 feet. Some have a spreading growth habit while others are upright. Doing a little research may prevent you from removing the tree in the future because it has outgrown its site.
- The trunk and branching pattern of a shade tree is also very important. Avoid trees with trunks that divide into multiple leaders or with branches that originate at sharp angles from the trunk. These are potential problems as they are prone to breaking when the tree becomes large. (Some exceptions are flowering cherries, clump-form birch and Japanese maples.)
- It is possible to successfully plant trees anytime during the year. However the preferred times to plant are in the early spring and in the fall. Weather conditions are conducive to root growth and establishment is more rapid and successful. (Avoid transplanting oaks in the fall.)

Planting Procedure

- Prepare the site by loosening the soil in an area five times greater than the actual planting hole. Do not dig deeper than the root ball or the tree might sink in the ground too deeply as the soil and tree settle. The sides of the planting hole should slope outwards when planting in heavy soil.
- Do not add soil amendments such as compost or peat moss directly into the planting hole. In clay soils, this practice causes drainage problems because these materials draw water into the hole. The water remains for an extended period and rots the roots. It is best to incorporate organic matter throughout the entire planting area.
- In heavy clay soils, plant the tree with the top of the root ball higher than the existing soil line. Grade the soil out gradually from the root ball to keep it secure and prevent the root ball from drying out.
- Remove the cords and cut the burlap loose from the root ball. The cords are usually plastic or nylon and if not removed may girdle the trunk. Some burlap is treated to retard rotting, and others are plastic or synthetic burlap. These should be removed.

Care After Planting

- Do not stake a newly planted tree. Research has shown that the natural movement of the trunk by the wind

actually stimulates root growth and increases trunk diameter more quickly than with trees that cannot move because of being staked. If the tree has an adequate sized root ball and is properly planted, it will not fall over or lean. Occasionally, under very windy conditions and soft soil, staking may be needed for the first season. Allow enough slack in the guy wire for some trunk movement. Use a piece of rubber hose over the wire to prevent bark damage.

- Do not prune after planting. It is not necessary to "balance" top growth with roots. The tree needs the carbohydrates in the top growth to generate root growth. Nursery trees should already be properly pruned and usually need no further pruning when planted.

Fertilizing

Trees in the landscape are fertilized to promote growth and vigor. Most Maryland soils that are not disturbed by construction have adequate nutrients to maintain healthy plants.

Shade trees, like most plants, need the nutrients nitrogen, potassium and phosphorous in the greatest quantities. The latter two are needed in relatively large amounts when the tree is young. After the trees reach maturity little fertilizer may be required. Established trees typically are fertilized once every 3 to 4 years. Decide whether you want the tree to grow rapidly. It may be wiser, because of the current size of the tree or because of its proximity to overhead wires or buildings, not to encourage rapid growth. If you are already fertilizing the lawn under the tree, the tree is probably receiving adequate levels of nutrients and additional fertilizer is not needed.

A soil and/or foliar nutrient analysis should be conducted to determine which nutrients are deficient and in many cases why they are deficient. Secondary and micro nutrient deficiencies are influenced by soil pH. The pH should be corrected if necessary, before the deficient nutrient is applied to the soil. If foliar nutrient analysis is not available, look for visual symptoms of nutrient deficiencies. Undersized leaves and short new twig growth generally indicate a nitrogen deficiency. The yearly rate of new twig growth for a tree varies with the species, soil conditions, rainfall and general environment. Young trees in good condition produce approximately 8 to 12 inches of growth on the main branches yearly. As trees mature, the growth may be only half as much and yet still be healthy. Lack of growth is usually an indication of a nitrogen deficiency. Over-fertilization, regardless of the nutrient source, can produce weak growth, making trees prone to attack by diseases and sap sucking insect pests.

Watering and Mulching

- Water newly planted trees to a 6-8 inch depth 2-3 times each week during the first growing season. This amount can be reduced if rainfall is plentiful. A small ridge of soil may be formed around each tree to prevent runoff. Remember, young trees need adequate moisture in the fall to over-winter successfully.

- Trees up to 4-5 years in age are also very susceptible to drought stress and need to be watered deeply during dry periods.
- Keep organic mulch 2-3 inches deep around your trees during the growing and dormant seasons. Mulch should be kept 6 inches away from tree trunks to prevent vole damage, borer problems, and trunk diseases.

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Protect the Bay Use Pesticides and Fertilizers Wisely

Buy “ready to use” products (RTU’s) when action is needed against weeds, pests, and plant diseases. This will keep pesticide use to a minimum and help protect the environment.

ALWAYS READ THE PESTICIDE LABEL AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS.

Mention of trade names does not constitute an endorsement by the Maryland Cooperative Extension, University of Maryland, College Park, MD.

**Have a home pest or garden question?
Call the Home and Garden Information Center**

1-800-342-2507

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