UI Extension Forestry Information Series
Forest Health No. 1

Whats' Wrong with My Tree?

Yvonne Barkley

Part I: Cause and Effect

All tree problems are caused by something, whether that is an insect, disease, physiological problem, or misapplied pesticide. Usually it is a combination of events that cause tree decline or death.

Primary causes are usually physiological or chemically related events. These include adverse weather conditions (drought stress, ice storms), poor cultural practices, or a misapplication of a pesticide. Primary causes result in damage and/or stress, which allows secondary causes to successfully invade trees.

Secondary causes are usually living agents such as insects or diseases, which are able to successfully gain entry into trees because they have been wounded and/or stressed. Secondary causes often result in decline or death.

Physiological causes

Physiological problems are caused by non-living agents, such as:

- adverse weather conditions
- nutrient deficiencies
- poor soil drainage
- plant suitability
- mechanical injury
- pesticide misapplication

In general, physiological problems are:

- uniform throughout the plant;
- will affect most or all plants in a landscape; and
- will lack evidence of a living organism.

Adverse weather conditions, such as ice storms, are one type of physiological condition that causes tree damage and stress.

Diseases

Diseases are caused by one of three agents – fungi, bacteria, or viruses.

Fungi are non-photosynthetic, microscopic plants that need to obtain food from other plants. Fungi live in the air, on fallen debris, or in cankers and wounds on trees, and are spread by the movement of wind and water.

Most fungi reproduce by the formation of spores and gain entry to trees through natural openings, such as stomata, as well as wounds. Many are also able to penetrate healthy tissues. Free moisture or high relative humidity, poor air circulation, and warm temperatures are the best conditions for fungal growth.

University of Idaho Extension

Station Bulletin No. 96, Idaho Forestry Wildlife and Range Experiment Station, Moscow, ID

Many fungi are beneficial to man and are used to produce antibiotics, cheeses, and wine. They are also an important component of the nutrient cycle. But as a group, fungi cause more tree problems than other groups, causing damage and death by changing the way affected tissues function.

Common problems caused by fungi are anthracnose, needle blights and casts, leaf blights, casts, blotches, spots, blisters, scabs, and curls, mildews, cankers and diebacks, wilts, and even some galls.

Larch needle cast (Meria laricis) a fungal disease on western larch.

Bacteria are among the smallest living organisms, lack chlorophyll, and are dependent on other organisms for food. Bacteria live in the soil or on plant refuse and are spread by rain, man, animals, insects, equipment, and plants. They cannot actively penetrate healthy tissue and enter a tree through the stomata and wounds.

Some bacteria are beneficial and aid in decomposition, soil building, and give legumes the ability to convert atmospheric nitrogen to a form available to plants. Others have industrial uses.

Once harmful bacteria enter a tree they begin to reproduce, killing cells as they go. Some produce toxic chemicals that cause cells to grow abnormally, as in crown gall. Others poison or plug vascular or water conducting tissues, causing wilt. Bacteria also cause necrotic blights, rots, and leaf spots.

Viruses are infectious agents that are parasitic on plants and animals as well as man. Viruses spread from tree-to-tree by mechanical transmission via pruning or grafting and through insect feeding. Viruses cause leaf mottling, mosaics, yellows, distortions of leaves and flowers, and necrosis.

Thousand cankers disease is caused by a combination of Geosmithia spp. (a fungus) that is transported to trees by the walnut twig beetle (Pityophthorus juglandis).

Insects

Insects fall into four main groups and injury or kill trees in different ways.

Foliage feeders eat or mine tree foliage, which results in needles or leaves that are skeletonized, have holes, or are eaten around the edges or fully consumed, resulting in decreased function.

Foliage feeders are able to move diseases by feeding on infected tree foliage and carrying pathogens in their mouth parts or digestive systems to healthy trees where they are transmitted by feeding.

Boring and mining insects feed inside plant tissues by mining into leaves or boring into stems and trunks.

Cone-like galls caused by Cooley spruce gall adelgids.

Bark beetles are a good example of boring insects, which bore into the trunk of trees and feed and reproduce in the cambium, thereby interrupting the flow of nutrients, sugar, and water between the crown and the root system, causing tree death.

Piercing & sucking insects suck sap from leaves or stems, which produces browning, spotting, curling, wilting, or dwarfing.

Damage is caused by the removal of sap from the

tree as well as injury to plant tissues. They can also vector pathogens in the same way foliage feeders do.

Gall makers inject chemicals into plant tissues while feeding, causing then to grow abnormally and produce a gall. Galls can be unsightly but do not often cause death.

Part II: The Diagostic Process

As with many things in life, knowing the process and vocabulary that goes with a job, hobby, or skill enables people to better understand and communicate with each other. Artists work with color, texture, tone, hue, and highlight to create a painting; auto mechanics know how to find and fix your pressure differential valve; and cooks flambé and sauté your food into tonight's delicious dinner.

The process and language of diagnosing tree problems is as specialized as those used by artists, mechanics, and cooks. Part of the diagnostic process depends on information provided by landowners and managers, and knowledge of the process and vocabulary by the person providing the information greatly increases the chance of a correct diagnosis.

What kind of tree is it?

The first thing we will want to know is what kind of tree it is. Knowing the genus and species of the tree in question is integral in making a correct diagnosis. If unknown by the landowner, identifying your tree is the first thing a diagnostician must do before proceeding onto the next step.

Knowing what species we are working with allows us to begin separating out the thousands of problems that occur on trees. For example, there are insect and disease problems that occur on pines that do not occur on spruce or fir trees. Additionally, many ornamental plants, like junipers, can have hundreds of varieties, some of which are yellow, and when yellow are healthy; others that are green, and when yellow are not healthy.

Describe the symptoms

A symptom is any noticeable change in the form or function of a tree which serves as an aid in diagnosing a problem. We are interested in not only what is happening to the leaves, but also the branches and trunk. Descriptive terms such as wilting, drooping, off-color, and dead-looking are recognizable by most, but other terms are more specialized.

Here is a short glossary of terms used when describing tree symptoms:

- *Bronzing* – tissue that becomes bronze in color.
- *Canker* – localized dead areas on branches and trunks.
- *Cambium* – creamy, moist layer of cells found between the bark and the wood that gives rise to new growth.
- *Chlorosis* – light green to yellow appearance of foliage due to absence of chlorophyll.
- *Crown* – the branches and foliage of a tree.
- *Cultural practices* – activities that help maintain tree health; include pruning, fertilization, irrigation, and proper planting techniques.
- *Frass* – insect droppings; often resembles sawdust.
- *Gallery* – passage or burrow that bark beetles excavate in the cambium layer for feeding and egg laying purposes.
- *Gouting* – swelling at nodes or the base of buds; caused by insect feeding.
- *Interveinal chlorosis* – yellowing of the tissue between the veins of a leaf; veins remain green.
- *Mottling* – foliar symptom characterized by irregular light and dark areas.
- *Necrotic* – dead, discolored tissue.
- *Nodes* – joints on a stem where leaves and buds riginate.
- *Physiological disorder* – tree problems caused by non-living factors

Frass

Galleries

Gouting

Shepherd's crook

- *Shepherds crook* – stem with one end being hook-shaped.
- *Sunscald* – bark and cambium injury caused by an increase in exposure to the sun's rays.
- *Vein clearing* – leaf veins that are light green or yellow while the rest of the leaf remains green.

Describe the pattern of the symptoms

The pattern of symptoms helps us to separate out insect and disease problems from physiologically caused ones. For example, did the symptoms start at the bottom of the crown and work their way up or from the top and worked their way down? Are the symptoms on the interior portions of the branches or do they start at the branch tips and move inward? Are you seeing similar symptoms on other plants in your landscape?

Additional information

Any additional information that you can provide will be of use, such as past and present weather conditions, what is going on in the surrounding areas, and any cultural practices you have used to maintain your landscape's health.

How to collect a sample

You will often be asked to send in a sample and some pictures of the tree in question. Here are some universal steps to follow when collecting a sample:

1. Collect plant materials that are showing symptoms. If possible, include several samples that show a progression of symptoms from mild to severe.
2. Pictures should be a mix of close-ups of symptoms and long shots of the tree and its surroundings. These can be included with the sample or sent electronically to the person you are working with.
3. Place insects in sturdy containers like pill jars. Place foliage in unsealed plastic bags with a flat piece of cardboard. DO NOT add moist paper towels as this causes samples to mold in transit.
4. Pack samples, as well as your name, phone number, and email address, in a box or envelope with enough padding to prevent damage and mail ASAP. If hold-over periods are unavoidable, keep samples refrigerated.

Part III: Controlling Tree Problems

Healthy, vigorous trees are able to withstand threats better than weakened, stressed trees and the best way to control problems in trees is to prevent them. Regrettably, nature has a way of not giving us much say in the matter. So, how do you make the decision to treat tree problems and what do you treat those problems with?

Economic thresholds

Treatment decisions can be made by looking at economic thresholds. The economic threshold is the level of damage where the benefits of the treatment are equal to or less than the cost of the treatment. If damage levels are below the threshold, the cost of treatment exceeds the benefits and the landowner sustains a loss by applying the treatment.

Types of Treatment

The goal of any type of treatment or control measure is to favor the health of the tree and not favor the problem. Landowners in urban environments or with small acreages have more options for treatment than those with large acreages, where size and numbers of trees make many treatments economically unfeasible.

There are three types of control treatments:

1. Cultural controls are activities that foster tree and landscape health and vigor.
2. Biological control is the use of natural enemies or agents to suppress pest populations.
3. Chemical control involves the use of some type of chemical, usually a pesticide.

Many insects and diseases overwinter in fallen leaves and nuts.

Cultural controls

Maintaining your trees in peak condition allows them to protect themselves from insect and disease attacks, as well as unseasonal frosts and freezes. Cultural controls on forestland sites are known as silvicultural practices.

Silviculture is the art and science of growing trees. Recommended silvicultural practices are the same as the cultural practices listed below, just on a much grander scale.

Common cultural control activities start with selecting the right trees for the site, using resistant varieties, and planting trees correctly. Yearly maintenance activities can include spring fertilization, supplemental irrigation, pruning, and thinning.

Practicing good sanitation, which is the removal of fallen branches, nuts, fruits, and leaves, eliminates common overwintering areas for many insects and diseases. Compost piles in many areas of Idaho do not get hot enough to kill pathogens or insect eggs, so burning refuse is best, if possible. If not, dispose of plant materials at your local recycling center or waste management transfer station.

Biological controls

Natural enemies include predators, parasitoids, and pathogens. Use has increased as new agents are discovered for particular problems and applied to landscapes.

One of the most commonly used biocontrol agent is Bacillus thuringiensis (BT), which is used to control a wide variety of insect pests. Other methods include the release of sterile males, which compete with wild populations and decrease future generations by preventing fertilization.

Pheromone traps are also gaining in popularity. Natural insect attractants or repellents are put into traps which then release a message into the environment. These messages allow insects to communicate such information as the location of fertile females or that a site is fully occupied and that there is no room for more individuals to mate or feed there.

Chemical controls

Pesticide products must be toxic to the pest or pathogen but not toxic to the plant or to off-target organisms such as people, pets, beneficial insects, bees, and fish. Pesticides must be used according to label directions or they will not work and timing the application correctly is of paramount importance.

Some pesticides are for insects and some for diseases, particularly those caused by fungi. There have different modes of action, which is how the chemical kills or breaks an organism's life-cycle.

Federal law prohibits the use of a pesticide in any manner inconsistent with the product label. All pesticides should be considered poisonous to people and should be handled and stored with great care.

Fungicides

Many foliar plant diseases are not fatal, so fungicides are used primarily to keep a tree looking good. Contact fungicides are applied to emerging leaves to prevent fungal strands from penetrating healthy tissues and do not control existing problems.

Ladybug larvae are voracious natural enemies, capable of eating hundreds of aphids a day.

Anthracnose, shown here on sycamore, can be controlled with a commonly available fungicide.

Complete coverage is important, as is the timing of the application.

Systemic fungicides are taken up by the tree and stop already established infections as well as prevent new ones from occurring. They tend to have limited range of control, so an accurate diagnosis is key to success.

Insecticides

Insecticides work in different ways and can either be eaten or kill on contact. Insecticides that are ingested are often combined with bait or attractants and are most effective against chewing insects. Contact insecticides are best used for insects with piercing and sucking mouth parts. Systemic insecticides are applied to the soil or injected into the tree, where the chemical is then distributed through the tree. These products work well for a wide variety of insects.

For more information

There are many on-line resources for finding control recommendations for your tree problems. We use the Pacific Northwest Handbooks for Insect, Plant Disease, and Weed Management, available on-line at:

- Insects - http://insects.ippc.orst.edu/pnw/insects
- Diseases - http://plant-sisease.ippc.orst.edu/Default.aspx
- Weeds - http://insects.ippc.orst.edu/pnw/insects

Where to find help

The University of Idaho Extension Forestry Tree Clinic that is available to Idaho landowners for problems on both urban and woodland trees. Contact Yvonne Barkley at (208) 885-7718 or yvonnec@uidaho.edu for more information.

Idaho Department of Lands Private Forestry Specialists are available to help Idaho landowners with their woodland trees. You can find your local IDL office at http://www.idl.idaho.gov/bureau/ForestAssist/contact/bfa_contact.htm

About the Author: Yvonne Barkley is an Extension Forestry Specialist at the University of Idaho Extension, Moscow, ID.

Images provided by Bugwood.org.

Bark beetles can cause mortailty to thousands of trees over the course of a growing season.