Lake States
Forest Health Watch

Northeastern Area

May 1, 2005

About this newsletter…

The Forest Health Protection unit of the Forest Service located in St. Paul, Minnesota produces this newsletter. Our intent is to keep Federal land managers in the Upper Great Lakes region abreast of forest health related issues such as insect and pathogen outbreaks. We need your assistance, please contact us with your observations.

What to expect in 2005…

So, what does our crystal ball see for this coming summer?

Jack pine budworm – The Wisconsin DNR reported expanding jack pine budworm activity in northwestern Wisconsin in 2004. Jack pine budworm populations tend to rise over a 2-3 year period before declining. We would expect more jack pine budworm defoliation this summer. In addition to northwest Wisconsin, watch for budworm outbreaks across the U.P. An outbreak in northwest Minnesota, in the Bemidji area, appears to be subsiding. Budworm caterpillars clip needles. These needles collect in silk webbing and turn brown giving infested trees a characteristic "burnt look" that can be readily seen from a distance in late June and early July. Expect about 5-10 percent tree mortality and 10 percent top-kill following an outbreak. If outbreaks persist, more extensive mortality can occur. For further information see: http://www.na.fs.fed.us/spfo/pubs/howtos/ht_jack/ht_jack.htm

Budworm larvae

Frost Damage – Early April brought very warm weather across the region, this resulted in early leaf emergence on many tree species. The warm weather has been followed more recently (late April) by some very cold evenings with temperatures dropping well below freezing. Frost damage is a common occurrence in our northern forests, often it is localized into small depressions where cold air drains. However, in some years we can have frost damage over much larger areas. Frost injury can show up in several different ways including black or brown colored foliage or new growth that is often curled or twisted. Balsam fir, oaks, red pine, and black ash seem to be very prone to frost injury. Most trees recover fine from frost damage, though repeated frost damage can stunt trees and make them more prone to other pest problems.

Black ash decline – Region-wide decline in black ash has been very evident over the past 2-3 years, in many areas we have had several decline episodes since the early 1990's. Some recovery was noted last year but damage was so extensive that it will take a number of years before these stands again appear healthy. Drought conditions that occurred 2-3 years ago probably led to the most recent decline episode. Trees growing in wet soils, such as black ash, often suffer during prolonged droughts. These trees develop shallow root systems that cannot cope with a rapid drop in soil moisture.

Black ash decline

Spruce budworm –This early season defoliator of white spruce and balsam fir has been locally active in the region, especially in northern Minnesota. Last summer we observed relatively high populations in northern Wisconsin white spruce plantations. This activity is likely to continue into the coming spring.

Early Spring Insects and Diseases…

The following are some of our more commonly reported tree problems in early spring.

Anthracnose diseases of hardwood trees are widespread in eastern North America. The most common symptom of this disease are dead areas or blotches on infected leaves. However, classic symptoms are not always seen, especially on ash trees. Anthrachnose on ash often causes leaf drop to occur with few or no spots on the fallen leaves. In most cases, anthracnose is simply an aesthetic concern and not a serious health problem for trees. For more information see: http://www.na.fs.fed.us/spfo/pubs/fidls/anthracnose_east/fidl-ae.htm

Birch leafminer – The small adult leafminers will be active as bud break occurs on white birch. Soon after bud break you should see small spots on the leaves where the developing eggs are located. Larvae will start to develop blister like mines (see photo). High populations can make landscape trees very unsightly. Unfortunately, insecticides are often required to avoid damage. Applying a systemic product through the soil seems to work best, but this must be done prior to bud break. If leaves are already expanded, a foliar application using an insecticide with some systemic activity is the best way to kill the eggs and young larvae. If the leaves turn brown, homeowners should no longer spray as most of the damage has already occurred. For more information see: http://www.na.fs.fed.us/spfo/pubs/howtos/ht_birch/ht_birch.htm

Introduced basswood thrips – Thrips are tiny insects that scrape and damage newly developing leaves when they are still in the bud stage. Thrips feeding causes very early season defoliation on basswood. Under close inspection you should see aborted buds and shredded leaves. Trees appear to have a "ragged" appearance (see photo). The timing between thrips emergence from overwintering in the soil and bud development seems to be the key for determining the amount of damage in any given spring. Damage is intensified if the thrips get to the buds before the leaves expand. For more information see: http://www.na.fs.fed.us/spfo/pubs/howtos/ht_bassthrips/ht_bassthrips.htm

Larch casebearer -- Larch casebearer is a tiny caterpillar that feeds on larch needles. Half-eaten needles make infested trees appear burnt from a distance. Close inspection should reveal tiny cases made of hollowed needles. The caterpillars live inside these cases. Casebearer activity has been reported for the last several years.

Eastern tent caterpillar – This is one of our earliest and most common leaf feeders in the upper Midwest. Eastern tent caterpillar forms a characteristic silk tent on cherry, apple and plum. Other tent-making caterpillars, such as the fall webworm, uglynest caterpillar or cherry scallop shell moth, appear later in the summer on cherry and their tents enclose foliage. The eastern tent caterpillar tent is very neat in comparison and does not enclose leaves.

A tent formed on cherry by the eastern tent caterpillar

Balsam twig aphid – These whitish-coated aphids can be found infesting the new growth of balsam fir early in the spring. Feeding damage causes the new needles to curl and distort (see photo). The damage is cosmetic and not a tree health concern. However, Christmas tree growers often become concerned since the curled needles can persist throughout the year. Several predators including lady beetles attack the aphids and generally keep the aphid populations well in check.

Updates on exotic pests…

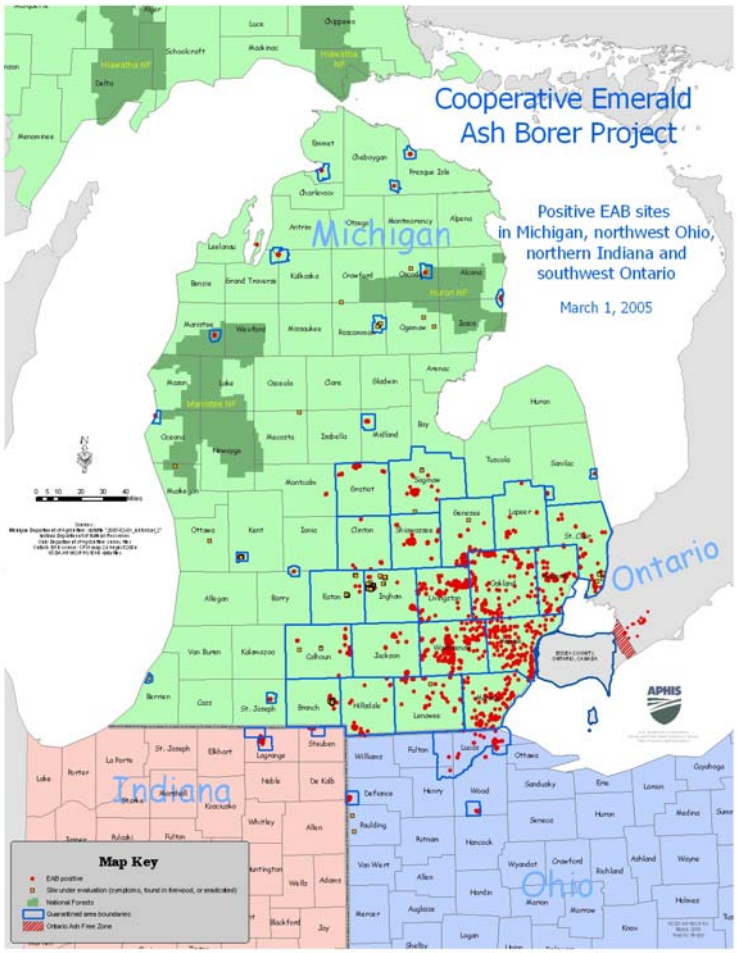
Not much has changed over the winter months on the status of our major exotic forest insect and disease concerns in the Great Lakes region. For updates as of late last year please check our December 2004 edition of this newsletter found at: http://na.fs.fed.us/spfo/pubs/newsletters/lsfhw/index.shtm

The December 2004 newsletter includes updates on gypsy moth, sudden oak death, beech bark disease, hemlock woolly adelgid and emerald ash borer. We have included below another update on emerald ash borer.

Emerald ash borer (EAB) has been found across a large area in southeast Michigan where the existing EAB quarantine has been expanded to 20 counties. A number of smaller quarantine areas have been established around infestations found in lower Michigan counties and around infestations found in northeast Indiana and northwest Ohio. Many outlying populations have apparently been established through the movement of infested firewood. There are literally millions of dead ash trees in southeast Michigan and some of this wood is being moved as firewood. This insect is proving to be a tremendous tree killer, with all of our native *Fraxinus* (ash) susceptible. Two locations were found last summer on or in very close proximity to the Huron-Manistee National Forest.

For emerald ash borer status in Indiana http://www.entm.purdue.edu/EAB/
For emerald ash borer status in Ohio http://ashalert.osu.edu/
For emerald ash borer status in Michigan http://www.emeraldashborer.info/index.cfm

In 2004, our Field Office conducted visual surveys at recreation areas on Federal Lands across the Midwest. Additional surveys on state and private lands were conducted by many of our cooperating state partners with Forest Service financial assistance. No evidence of EAB was observed in Illinois, Iowa, Missouri, Wisconsin or Minnesota. If interested in more information on these surveys please contact our office. Additional survey efforts are likely this coming summer. We welcome any reports of recently dead or dying ash. Send reports to skatovich@fs.fed.us



Any idea what's going on here???

The photo to the right shows the root system of a young red pine, planted 4-5 years before it was removed from the ground. The tree is showing a classic J-root caused by poor planting technique. The seedlings root system was twisted and distorted when the tree was planted. The tree planter basically jammed the seedling into the planting hole and did not allow the roots to spread out and extend downward. Often times, these stressed young trees are very prone to attack by opportunistic pathogens such as Armillaria root disease or diplodia canker. Many insects such as root collar weevil also thrive on these trees.

Interestingly, these trees can grow relatively well for several years but eventually a drought or other stress event occurs. Stressed trees need a healthy, fully developed root system to survive a dry period and suddenly the trees begin to decline and die. A good tug on the top often pops the trees readily from the ground and reveals the damaged root system. Unfortunately, this is quite common. Quality planting is a key step in pest management. Poorly planted trees are not only a concern in forest plantings but also in landscape trees. For more on this topic see the feature article at the end of this newsletter.

Quiz…

Test your knowledge. These photographs are of an invasive plant, can you name the species? Ignore the leaves in the photo on the right hand side, focus on the structure in front of the leaves.

Quiz answers…

All three photographs are pictures of garlic mustard, an invasive plant generally found in moist or nutrient rich woodlands. The first photograph shows the white flowers that appear in early spring. The middle photo shows a cluster of garlic mustard plants prior to flower development. The final photograph shows the characteristic seed pods that can be observed in late summer, fall and winter. Individual seeds are small and black in color, each plant can develop a large number of seeds.

Galls…

Swellings, bumps, and abnormal growths are often observed on trees and shrubs. We refer to these as galls. Galls are pathologically developed plant tissues induced by some type of parasitic organism. The stimulus for the plant tissue development appears to be growth-regulating chemicals produced by the parasite, these chemicals cause cells to enlarge or proliferate in large numbers. The parasite itself can be a pathogen such as a bacteria, fungi or viruses; an insect such as an aphid or one of many tiny fly or wasp species; nematodes, or one of many mite species. The mites involved tend to be from a group called the eriophyid mites, these are very small animals. About 95 percent of the known galls of the world are caused by insects, nematodes or mites, the remaining 5 percent by pathogens.

The structures or galls that are formed are very characteristic in shape and color, they can be used to identify the specific organism that is causing the gall to form. Good reference books are invaluable. Unfortunately, good references are hard to find. Ephraim Felt published a book titled "Plant galls and gall makers" in 1940 (reprinted in 1965) that is the most complete book on insect galls. This book is hard to find. A good general reference book that includes the more common insect galls is "Insects that feed on trees and shrubs" by W. Johnson and H. Lyon.

Landscapers, homeowners, and foresters often observe galls and submit samples for identification. Though common and often very abundant, galls are rarely injurious to trees. The exception to this would be twig or stem galls, especially on smaller trees. Small trees can be overwhelmed by galls and killed or deformed. On occasion, twig galls can be very numerous on larger trees causing twig and branch mortality that may lead to tree decline. Because they rarely cause injury, control is rarely justified. Further, because the causal organisms are often protected within plant tissue, control can be difficult. For insects and mites, it is important to time an insecticide application when egg laying is occurring. This obviously is well before the point where the galls themselves become visible. Sanitation, or removal of the galls may be helpful in some situations. (photos contributed by J. O'Brien)

Elm cockscomb gall caused by a midge (small fly).

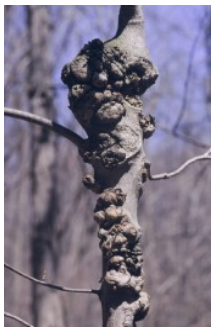
Oak apple gall caused by a tiny wasp.

Eyespot galls on red maple caused by a midge (small fly).

Ash flower gall caused by an eriophyid mite.

Maple bladder gall caused by an eriophyid mite.

Black knot on cherry caused by a bacteria.



Hickory *Phomopsis* galls caused by a fungus

Eastern gall rust on jack pine, caused by a fungus

Watch those woodpeckers…


Tamarack


Hemlock


Green ash

In late winter and early spring, woodpecker activity can be a great way to locate wood borer or bark beetle infestations. Woodpeckers are very efficient at locating insects under the bark of trees. In their quest to eat the larvae they often knock large quantities of bark off, exposing the colored phloem or sapwood of infested trees. Pieces of bark often litter the ground, this can be very obvious with snow on the ground. A few of our more important forest pests that can be found this way include eastern larch beetle attacking tamarack (left photo), hemlock borer (center photo), and emerald ash borer (right photo).

Another common observation related to woodpeckers are large oval-shaped holes in trees. These are most often formed by pileated woodpeckers. In most of these instances, the woodpeckers are after carpenter ant colonies that have formed nests within decayed wood inside the tree.

Aerial survey maps…

The Forest Service Forest Health Protection unit along with cooperators in the state forest health groups, conduct annual surveys for forest insect and disease outbreaks. Each Lake State National Forest along with most other Federal properties are flown annually and damage is recorded onto maps. This information has been gathered for many years, in some cases since the 1950's in Michigan, Minnesota and Wisconsin. This past year we made a leap forward in making the information more accessible. You can now access the annual survey data on our web site at:

http://www.na.fs.fed.us/spfo/fhp/maps/aerial.shtm

We encourage you to visit that site and take a look at the information available. Hopefully, we will begin to get historical data added soon. If you have questions or suggestions for improvement of the site or about the surveys please contact Quinn Chavez at qchavez@fs.fed.us

State Forest Health Reports…

Our state cooperators in Michigan, Minnesota and Wisconsin annually put together a report called forest health highlights. These reports are an excellent record of the major insect and disease activity within each state. Much of the information is directly relevant to Federal lands in the Lake States. They are developed in cooperation with the Forest Service, Forest Health Monitoring (FHM) program, and can be accessed at the FHM web site:

http://fhm.fs.fed.us/fhh/fhmusamap.shtm

Upcoming forest health workshops…

Insect and Disease Training Session, Ottawa National Forest, June 21-22, 2005, Watersmeet area. This will be FHP sponsored 2-day training session covering updates on exotic threats as well as information on how to identify and manage traditional forest pests. For information contact our office.

Publications and resources…

Almost all of our publications are available via our home page found on the World Wide Web. This can be accessed at:

http://www.na.fs.fed.us/spfo/

Copies can be obtained by contacting our office at the address or phone number listed to the right.

For More Information

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Feature Topic: Buried Root Systems Affect Long-Term Tree Health and Stem Girdling Root Formation

By Gary R. Johnson and Richard J. Hauer
Gary is a Professor of Urban and Community Forestry at the University of Minnesota and Rich is an Instructor in Urban and Community Forestry at the University of Wisconsin, Stevens Point.

During the last few decades increasing numbers of landscape trees have been declining and dying prematurely. In many of these cases the depth to the main lateral roots from the soil surface is correlated with premature tree loss. There are numerous explanations for why main lateral roots systems in the landscape are not near the surface. Three possible explanations are (1) nursery culture (e.g., planting and cultivation, (2) tree planting (e.g., deep holes, root balls sinking into backfill) and, (3) changes to the established tree root environment (e.g., fill over roots, excessive mulch, water table change, soil compaction). However, scientific studies to document the predominant causes are just beginning. Regardless of the plethora of potential causes, when tree root systems are placed into environments not suitable for growth they will decline and die prematurely over time if they cannot adapt.

Why do roots grow where they do?

Tree roots need oxygen and water in order to survive and grow. Because of those basic requirements, the majority of woody plants grow in the upper 3 feet of most soils. And specifically, the majority of fine roots - those roots that absorb more than 90% of the water and minerals required for plant growth - usually grow in the upper 12 inches of most soils. In soils that are low in soil oxygen - compacted clayey soils or water-soaked soils - all roots may be confined to the upper few inches, rarely penetrating deeper than a couple of feet.

When the roots of trees and shrubs are buried too deep, their health and condition are often affected over time, and sometimes immediately. Health refers to their growth rate, leaf color, ability to recover from diseases and damage, and ability to withstand adverse environments. Condition refers to their structural integrity: sound stem wood that is free of decay, cracks or weak points; supportive root systems; and canopies that are free of large amounts of dead wood.

A properly grown, planted or established tree or shrub normally will have the first main order roots at or slightly below the soil or mulch level. The root collar flare is the transition area between stem wood and the first, main order roots. In natural plantings, the root collar flare is clearly visible above the soil line, or may be slightly covered by leaf litter. When root systems are buried, less soil oxygen and water is available to the roots, and the roots must grow closer to the surface where there usually is a more reliable source of both. The energy that a newly transplanted tree or shrub must use to grow new roots and develop a normal, expanded root system must be used to grow upward before it can grow in a normal outward direction.

Effects on tree health and stem girdling roots

Some, maybe many, plants survive artificially deep root systems and live normal lives after developing a normal root system. Others begin a long, slow decline of health and condition. Since tree roots require oxygen for respiration to consume stored energy (sugars) for survival and growth, oxygen deficiencies impair the respiration process and make trees less efficient at using stored energy, less healthy, and more susceptible to secondary pests. Often these plants die of secondary problems, indirectly related to the dysfunctional root system. If root systems are abnormal, the health of the plant is stressed or strained to a point that the plant becomes abnormally vulnerable to common site stresses. Whereas healthy plants can survive most periodic droughts or defoliation due to insects, stressed plants may die from the additional stresses placed on them.

In addition to the decline in health and condition of trees, burying root collar flares may create another adverse condition. Tree root systems may respond to oxygen limitations by growing into oxygen sufficient areas, typically near the soil surface. The ascent of the roots to the surface often causes roots to

lose their normal outward radiating pattern. Roots that have grown up toward the soil surface often wrap around or grow against the buried stems. As these roots enlarge over the years, along with the normal enlargement of the buried stems, the roots begin to compress and restrict the development of stem tissues. Stem girdling roots affect normal stem tissue expansion, resulting in abnormal and compressed bark and woody tissue and affect tree transport processes. This creates a weak point in the tree's stem and leaves the tree more vulnerable to stem breakage during windstorms. A study of tree failure during windstorms in Minnesota demonstrates this point. Approximately 30 percent of trees (600 surveyed trees in '97-'98) that failed completely (the entire tree went down) and were at the edges of storms were caused by deep root systems. In littleleaf linden alone, 73 percent of the complete failures were caused by deeply buried (4 inches or more of soil over the first main order root) root systems accompanied by stem girdling roots. "Edges of storms" are areas outside the direct paths of straight-line windstorms or tornadoes. In addition to the risk of complete tree failure there is a general decline in the remaining root system. The compression makes it more difficult for the roots to move water and minerals up to the foliage, and more difficult for the tree to move photosynthates ("food") to the roots. Over time, the root system declines in health and the aboveground canopy and foliage likewise declines. As root collar flares are increasingly buried, more of the stem tissue is buried and out of sight, so these below-ground problems go undetected.

Research conducted in the Forest Resources Department at the University of Minnesota has revealed that buried root systems of street trees are alarmingly common. In five randomized studies, it was found that the main order roots of sampled individuals of sugar maple, green ash, linden, common hackberry and thornless honeylocust were buried with 1-11 inches of soil (total number sampled was approximately 100 trees per species). When the trees were then condition rated (a numerical evaluation of the condition of the stems, canopies and foliage), there was a direct relationship between declining tree condition and depth of soil over the roots for maples, lindens and ashes. In other words, as main order roots were covered by more and more inches of soil, the condition of all three tree species further declined.

Prevention is the solution!

How deep is too deep? Based on the previous studies, as little as one inch of soil over the origination point of the first main order root (a.k.a., root collar/trunk flare) can disguise stem girdling roots until it is too late. With sugar maple in particular, the significant decline in health began when the soil depth was 4 inches over the origination point. Regardless, there is no biological reason to bury stems. Healthy trees growing in native forests have visible root collar flares at the soil line. Therefore, it is not logical to believe that planting deeper is better.

To prevent early decline or sudden failure during windstorms, make sure that those first, main order roots that originate at or near the soil line are planted at that depth in the landscape. Make certain that those roots are at the top of the soil ball of balled-in-burlap trees and containerized trees before you dig the planting hole. Either dig down through the top of the soil ball with a trowel until you find those first roots, or probe down with a stiff wire to find the depth of soil over the roots. If there are 4 inches of soil over the roots of the purchased plants, dig the hole 4 inches shallow and scrape off the excess soil before mulching the newly planted tree or shrub. These few minutes of care at planting time will help ensure that you enjoy a healthy, long-lived landscape tree or shrub.

For additional information see **A Practitioner's Guide to Stem Girdling Roots of Trees** at http://www.extension.umn.edu/distribution/naturalresources//DD7501.html.