Missouri Forest Health Update

Missouri Department of Conservation

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Forest Entomologist's Notes

Storm Damage - The most significant forest health event since the last issue of the *Update* was a huge storm on May 8 that moved across southern Missouri spawning thunderstorms, tornadoes and extreme straight-line winds over an unusually large area. Straight-line winds of up to 90 mph did most of the damage, breaking and uprooting trees in swaths that covered hundreds of acres. In all, the Missouri Department of Conservation estimates the extent of the damage at 204 million board feet of timber on 113,000 acres. That does not include areas with light damage, which covered approximately twice as many acres. Damage extended across private, state and federal land ownerships. Although damage ranging from moderate to severe occurred in 36 counties, three-quarters of the destruction fell on six counties: Reynolds (28,351 acres), Madison (17,854 acres), Shannon (10,944 acres), Dent (9,920 acres), Iron (9,514 acres) and Bollinger (8,473 acres) counties. The Missouri Forest Products Association said statewide damage from the storm equals approximately one-third of Missouri's annual timber harvest.

Broken and uprooted trees damaged in May 8 windstorm (Madison County)

Red Oak Borers Emerging – A healthy specimen of an adult red oak borer was recently found wandering the halls of the Conservation Department's Resource Science Center in Columbia. It was an effective reminder that these borers that emerge almost exclusively in odd-numbered years are now out looking for mates and stressed red oaks on which to deposit their eggs. The storm-damaged surviving red oaks of southern Missouri will likely provide attractive hosts. Time will tell what additional impacts we see on these stressed forest stands.

http://www.na.fs.fed.us/spfo/pubs/fidls/Red Oak Borer/redoak.htm

Emerald Ash Borer

Report It If You Find It! – By now, many people have heard about the emerald ash borer (EAB) being found in Missouri last year. Some folks have assumed that means that it is widespread and we no longer need to remain vigilant. Wrong! As of this date, EAB has only been found in Wayne County in southeastern Missouri. Suspects found in other locations should be reported immediately so that their identity can be confirmed and appropriate actions taken. If you find half-inch long green beetles that you suspect of being EAB or find declining ash trees with 1/8" D-shaped holes and other symptoms that indicate an EAB infestation, please do the following. First, compare what you are seeing with photos of EAB, other green insects, and EAB-infested trees at these web sites: www.eab.missouri.edu and http://mdc4.mdc.mo.gov/Documents/19156.pdf

Emerald ash borer adult
Forestry images – David Cappaert

If you still suspect you've found EAB, then report it either by calling Missouri's EAB toll-free phone line (866-716-9974) or by reporting online at: www.MissouriConservation.org/10985

More States Find EAB Infestations – Officials in Minnesota, Kentucky and New York announced in the past several weeks that they have for the first time detected EAB populations in their states. This brings the total number of confirmed infested states to thirteen. In Minnesota, an EAB infestation has been found in the urban forest of St. Paul. See this web site for details: http://www.mda.state.mn.us/plants/pestmanagement/eab.htm
In Kentucky, EAB has been found in at least 6 counties, and the State has quarantined 20 counties: http://pest.ca.uky.edu/EXT/EAB/welcome.html
In New York, an EAB infestation was detected in the western part of the state near the Pennsylvania border: http://nyis.info/Insects/EmeraldAshBorer.aspx

Additional EAB news came from Wisconsin and Iowa. In April 2009, an EAB population was discovered in Vernon County in southwestern Wisconsin along the Mississippi River and close to the border between Minnesota and Iowa. Other EAB infestations had been detected last year north of Milwaukee on the other side of the state. Subsequent investigations of the newly detected site in southwestern Wisconsin have indicated the infestation extends at least five miles along the east side of the river and has likely been present for several years.
http://emeraldashborer.wi.gov/index.jsp

Minnesota and Iowa counties adjacent to the Wisconsin infestation have since been surveyed, but no EAB-infestations have been reported. A single EAB larva was reported from Clayton County in northeastern Iowa. However, subsequent surveys of the area have revealed no infested trees.
http://www.extension.iastate.edu/pme/EmeraldAshBorer.html

Monitoring to Detect EAB Populations – Annual EAB monitoring efforts are underway in Missouri. The primary survey technique uses a 1 ft. x 2 ft. purple prism-shaped trap with a sticky outer surface and a lure that imitates volatiles from a stressed ash tree. Over 700 of the

sticky traps were hung in ash trees in Wayne County by the U.S. Department of Agriculture (APHIS Plant Protection & Quarantine) in an attempt to determine how far the known infestation has spread. The Missouri Department of Agriculture has placed 259 sticky traps at 60 additional high-risk sites around the state (campgrounds, mills, and other sites receiving firewood or ash logs). Traps will be retrieved over several weeks during late July and August and examined for presence of EAB adults.

EAB survey efforts at other selected sites involve visual examinations of declining ash trees or employing "detection trees" (ash trees stressed by removing a section of bark around the trunk in spring) that are felled in fall and examined for EAB.

EAB Control Recommendations – A new bulletin from the national EAB program is available online that describes the latest technology for chemical control of EAB: *Insecticide Options for Protecting Ash Trees from Emerald Ash Borer*. Along with understanding available control options, it is very important to know when it is appropriate to consider using chemical controls. It is the recommendation of both the authors of that bulletin and the multi-agency Missouri EAB Action Team that insecticides not be used for preventative treatment unless EAB has been found in the same county or within 15 miles of the subject trees.
http://www.emeraldashborer.info/files/Multistate_EAB_Insecticide_Fact_Sheet.pdf

EAB Research – A new web site provides information on EAB research by the USDA Forest Service: http://devel.nrs.fs.fed.us/disturbance/invasive_species/eab

Ambrosia Beetles – Several species of native and exotic ambrosia beetles are resident in Missouri. These tiny wood borers have specialized relationships with fungi (the "ambrosia") that provide food for developing larvae. Activity by the non-native **granulate ambrosia beetle** (GAB), *Xylosandrus crassiusculus,* has increased in Missouri in recent years. At the Conservation Department, we first started receiving reports of GAB attacks in 2002. The term "Asian ambrosia beetle" is no longer preferred for this species because several Asian species of ambrosia beetles are present in the U.S. This species and other ambrosia beetles are known for producing "frass sticks," the stick-like accumulations of insect wastes and wood particles that extend from holes in the bark.

Frass sticks produced by granulate ambrosia beetles tunneling within black walnut log

The GAB attacks a wide variety of host trees. We know of confirmed GAB attacks in Missouri on black walnut, oak, plum, peach, and paper mulberry. Additionally, frass sticks have been observed on: red maple, sugar maple, Japanese maple, northern red oak, yellow poplar, American elm, Chinese chestnut, golden raintree, and mimosa. The presence of frass sticks is not definitive evidence of GAB, but it is likely that GAB was

involved in many of these attacks. Frass sticks had not been reported prior to 2002, when the first GAB reports were received.

The number of reported GAB attacks has fluctuated from year to year. There was a general increase in reported attacks this spring, but especially in black walnut plantations in southwestern Missouri (Jasper, Newton and Lawrence Counties). In one plantation, one-third of walnut seedlings planted last fall were attacked and killed by the GAB this spring.

The primary control technique for GAB infestations is sanitation, i.e. removal and destruction of infested trees and limbs. In nursery and landscape settings, several insecticides are labeled for use as protectants on nearby unattacked trees.
http://www.ces.ncsu.edu/depts/ent/notes/O&T/trees/note111/note111.html
http://www.uaex.edu/Other_Areas/publications/PDF/FSA-7064.pdf

Japanese Beetles, Green June Beetles and Their Relatives - We will likely see high populations of many types of scarab beetles this summer, because of last year's high precipitation levels and relatively mild summer temperatures. Scarabs include Japanese beetles, green June beetles, chafers, and other June-beetle-like insects. These beetles deposit their eggs in soil in mid-summer. Grubs feed on plant roots or decaying organic matter. Egg hatch and young grub survival are highest when adequate soil moisture is available. Adult beetles emerging now developed from eggs deposited during last year's mild summer.

Japanese beetles are considered to be present throughout most of Missouri. The University of Missouri Japanese beetle monitoring program reports results from traps placed around the state:
http://ppp.missouri.edu/pestmonitoring/jb/index.cfm
Web sites listed below provide control information. One thing to keep in mind – the Japanese beetle traps sold widely in stores can cause more problems than they cure. They are so attractive at bringing in large numbers of beetles, that plants along the beetles' path and around the trap are heavily attacked. Traps should only be used where they can be placed in an isolated area at least 100-200 ft from target plants, in an attempt to draw beetles away from those plants.
http://www.ca.uky.edu/entomology/entfacts/ef451.asp
http://www.mobot.org/gardeninghelp/plantfinder/ipm.asp?code=67

We have been receiving several reports of "swarms" of the green June beetle in eastern Missouri, particularly in Jefferson, St. Francois and Ste. Genevieve counties. These large, green and tan, shield-shaped beetles are not a serious pest like Japanese beetles, although they can occasionally feed on ripening fruits. The adults attract attention because of their noisy low-level flying behavior while feeding and searching for mates.
http://www.ces.ncsu.edu/depts/ent/notes/forage/gjbnote02/note02.htm
http://www.uark.edu/ua/arthmuse/greenjune.html

Browning Oaks: Galls and Skeletonizers – Several factors can cause browning of oak leaves at this time of year, sometimes leading to whole trees turning brown. Various leaf diseases are possible (see discussions in Pathologist's Notes), and at least two insects are common causes of browning oaks this summer. Leaf damage from jumping oak galls was widespread in eastern Missouri in 2008. Reports are coming in again of noticeable damage in a few areas. These

pinhead-sized galls are formed on the lower surface of white oak leaves by a very tiny wasp. When gall populations are heavy, leaves turn brown and may drop prematurely from trees. Damage is not a serious threat to tree health, but is an additional stress on the tree. Gall wasp populations usually drop back to low levels in one or two years. No controls are effective or recommended.
http://ppdl.org/dd/id/jumping_oak_leaf_gall-oak.html

The shingle oak skeletonizers have returned, particularly in western Missouri. Every few years we see outbreak populations of these small moth larvae that feed on the lower surfaces of leaves leaving a lacy skeletonized upper leaf layer. They specialize almost exclusively on shingle oaks, although a few other oaks also may be used as hosts. Leaf damage is severe enough to cause entire tree crowns to lose their green color.


Skeletonized shingle oak leaves

It is believed that a complex of a few unidentified moth species is involved, rather than a single species. The oak skeletonizer (*Bucculatrix ainsliella*) that is common in eastern states may not be involved in these outbreaks on shingle oaks in Missouri.

The heaviest damage so far this year has been reported from Johnson and Lafayette Counties with additional reports from Carroll and Dade Counties. Past major outbreaks occurred in 1983, 1991, and 1996-1997. The 1996-1997 outbreak was also centered on Johnson and Lafayette Counties. Noticeable defoliation was observed in 2004 in southeastern Missouri (Ste. Genevieve, Perry, and Cape Girardeau Counties).

Although heavy skeletonizer damage puts stress on shingle oaks, it usually is not expected to kill the trees. Maintaining tree vigor through proper forest stand management or proper care and watering of ornamental trees will help those trees withstand stresses such as insect attack during the hot, dry weeks of late summer.

Small Twigs Dropping From Oaks: Kermes Scale – In late summer and fall, a common cause of pencil-diameter branches and twigs falling from oaks, hickories and other hardwoods is damage caused by twig girdlers and twig pruners (longhorned beetles):
http://extension.missouri.edu/publications/DisplayPub.aspx?P=G7276

But when smaller twigs are found dropping from oaks in mid-summer, another cause should be considered. Kermes scale infestations can severely affect branch health causing stunted leaves, branch "flagging" (browning) and dieback, and small twig drop. The scales are rather bizarre looking. Smaller females look like dark reddish-brown helmets. The older females are tan

spheres with dark markings and are larger, up to 3/8" diameter. They may be overlooked as some kind of gall or strange bud. These are soft scales, so they excrete honeydew, the sticky sweet substance which can coat branches and turn black with sooty mold. I recently confirmed a Kermes scale infestation on a northern red oak in Clay County. Small twig drop from oaks has been observed in several northwestern Missouri locations, but the cause in those cases has not yet been determined.

Effective control of Kermes scales involves either applying contact insecticides when crawlers are present or applying a systemic insecticide (e.g., imidacloprid soil drench) in fall or early spring. Timing of crawler activity varies with the species of Kermes scale. See these web sites for photos and more details:

http://www.forestryimages.org/images/768x512/1326001.jpg
http://www.oznet.ksu.edu/dp_hfrr/extensn/problems/kermes.htm
http://www.oznet.ksu.edu/news/sty/2004/kermes_scale0827041.htm

Insects and Mites to Watch For in July/August

- **Spider mite** populations build up when hot, dry weather persists.
- **Walnut caterpillars** feed in colonies on walnut, pecan, hickory and other hardwoods. Damage increases with feeding by second generation.
- Other defoliators causing defoliation only in late summer are of minor concern, because impact on tree health is minimal at this late stage of the growing season.
- Webbed colonies of **fall webworms** appear on several hardwood species, but especially walnut and persimmon.
- Defoliation by **yellow-necked caterpillars** and other **late-season caterpillars** may appear on various hardwood trees.
- A variety of **stinging caterpillars,** capable of causing skin irritation or painful rash**,** appear in late summer. Many feed on hardwood tree foliage.

Forest Pathologist's Notes

This spring we have certainly had adequate moisture for tree growth, and with wet weather comes increased severity of many plant diseases. Anthracnose diseases are widespread this year in many parts of the state. Also, the effects of last year's wet weather is now very apparent on many conifers, especially Scots pine, Austrian pine, blue spruce, and Norway spruce. Reports received of needle casts and needle blights on these coniferous species have been widespread as well this year. Looking to the future, with the wet weather this spring, these coniferous species will not likely get much relief, and we may see a resurgence in the severity of these diseases again next year.

Anthracnose Leaf Diseases - Anthracnose diseases are rampant this year, and have been reported on sycamore, ash, oak, and maple. The technical definition of anthracnose is an array of diseases caused by acervuli-forming fungi (order Melanconiales) and characterized by sunken

lesions and necrosis. These diseases usually manifest themselves as a foliar disease, but some also cause twig cankers and potentially could lead to overall decline of trees.

Anthracnose diseases overwinter in a variety of locations such as twigs, buds, and largely in fallen infected leaves. Overwintering fruiting bodies begin to produce spores in the spring when conditions are favorable. The primary prerequisites of anthracnose disease outbreaks in our region are wet weather and moderate temperatures that occur from bud break until most leaves are fully expanded. Leaves are most susceptible to infection as they expand throughout the spring. As healthy tissues of the leaf expand, the infected necrotic tissues on the leaf do not, resulting in the distorted appearance seen on most species. Secondary disease cycles occur throughout the spring when conditions are favorable, and rain then disseminates the spores throughout the canopy.

Chemical control is usually not warranted unless there are repeated infections leading to defoliation. When feasible, a good technique to lessen the impact of the disease is to rake and burn the fallen infected leaves. The effectiveness of the rake and burn technique may be reduced depending on the pressure from surrounding wild trees that are infected and producing spores.
http://www.na.fs.fed.us/Spfo/pubs/fidls/anthracnose_east/fidl-ae.htm

Dothistroma Needle Blight - We have received many reports and samples of Dothistroma needle blight on Austrian pine, which appears to be especially severe following last year's wet weather. Dothistroma needle blight, also known as red-banded needle blight, is caused by the fungus *Dothistroma pini*. The initial key symptoms of this disease are reddish-brown needle spots bordered by a yellow halo. Needle blighting follows later in the season, when the outer portion of the needle beyond the spot turns brown, and the inner portion remains green. Symptoms commonly are initiated and are more severe low on the northern side of trees. This is largely due to the higher moisture in that section of the canopy, which allows for better infection of needles.

Dothistroma needle blight on Austrian pine

The fungus overwinters on infected needles in the canopy of susceptible pines. Fungal fruiting bodies form in the fall, but most do not begin to produce spores until the following spring. Spores are dispersed throughout the growing season largely through rain drop dispersal. Spores are only capable of infecting older needles, and this year's needles are only susceptible after midsummer. Light green needle banding symptoms generally do not show up until fall, but may appear as soon as four weeks after infection. As the infection grows the fungus produces a toxin that kills host tissue ahead of the fungal colonization, causing the yellow coloration surrounding the lesions.

A good cultural practice that may reduce disease pressure is to simply rake up and burn fallen infected needles, which will continue to produce spores. Dothistroma needle blight is also easy to control with copper fungicides, and Bordeaux mix has proven high efficacy. Chlorothalonil fungicides are also registered for control of this disease. Normally, one application of fungicide in early June will provide good protection, but in severe cases two applications should be applied, once in mid-May and again mid-June.

http://www.na.fs.fed.us/spfo/pubs/fidls/dothistroma/doth.htm

Eastern Redcedar Mortality Update - Eastern redcedar is thought to be one of the most well adapted tree species in the Midwest, able to withstand the harshest of droughts and resist severe pests. However, throughout this year many redcedars have been observed to die rapidly and in varying patterns. Trees that had died would be next to completely healthy trees and growing in the same soil conditions. Initial field observations indicated the root rot pathogen *Heterobasidion annosum*, the causal agent of Annosum root rot, as the cause. However it became apparent after several field visits that Annosum root rot was causing only some of the mortality.

Dead redcedars among apparently healthy redcedars
Jason Jacobson photo

Trees that were rapidly dying were heavily infested with bark beetles, but bark beetles usually require a weakened tree to overcome host defense mechanisms. Blue stain fungi were occasionally associated with beetle brood galleries, but on only a minority of samples collected. Other attempts to consistently isolate a pathogen that may have weakened trees to allow bark beetle attacks came out inconclusive. Further investigation indicated that other factors may be responsible for weakening redcedars and allowing bark beetles to cause eventual tree mortality.

Proper sanitation should be used when infested trees are discovered. Trees that are already heavily infested with bark beetles will not recover and should be destroyed as soon as possible to reduce emerging beetle populations. Hopefully these bark beetle attacks in redcedar are somehow related to the unusual weather events that have led up to their abundance and the problem is only temporary.

http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7421.html

Bacterial Leaf Scorch –Bacterial leaf scorch (BLS) symptoms will soon begin to crop up as the summer wears on. Dr. Gerry Adams with the Michigan State University, Department of Plant Pathology and Plant Biology is continuing a survey for BLS with the help of us here in Missouri. The object of the study is to determine new hosts and relative distribution of the bacteria. Dr.

Adams requests: "Leaf scorch samples are needed from throughout the Midwest. We want any scorch on any host so please don't try to discriminate between bacterial or environmental scorch—we work on that in the lab. Mulberry is a good host …. but we still need lots of oaks (red and white). We just found positive swamp oaks this last year."

If you have a suspect sample please contact Donna Brandt, our forest health technician, at Donna.Brandt@mdc.mo.gov or send the sample to our lab (Forest Health Lab: BLS Survey, 1110 S. College Ave., Columbia, MO 65201). Please include as much of the information listed below as possible. (GPS is not necessary, as cross streets or address will do; accurate species ID not crucial, etc.). We will return the sample diagnoses as soon as they are made available to us.

BLS sample information requested:

- urban, rural, or forest;
- tree species or common name;
- your contact information;
- location information – state, country, city, street address;
- GPS Coordinates WGS 84: (or indicate datum & format used)
- size class (dbh): sapling <5", pole 5-11", large > 11";
- crown symptoms: percent of foliage affected by scorch symptoms;
- percent dieback: low<5, moderate 5-20, high> 20.

More BLS Information: http://na.fs.fed.us/fhp/bls/

Diseases to Watch For in July/August

- **Cedar-apple rust** causing orange leaf spots on apple and crabapple.
- **Apple scab** on crabapple appears as olive brown leaf lesions.
- Maple, ash, and oak **anthracnose** symptoms continue to appear.
- **Oak wilt** symptoms begin to appear on red oak group oak.
- **Dutch elm disease** causes flagging of branches on American elm.
- New tip dieback on Austrian and Scotch pine from **Diplodia** tip blight.
- **Tubakia leaf spot** causing blotching symptoms begins to appear on oaks.
- **Redcedar mortality** as drier summer conditions develop and additional trees may begin to die.

Compiled by Rob Lawrence, Forest Entomologist, and Mark Schall, Forest Pathologist, Missouri Department of Conservation.