



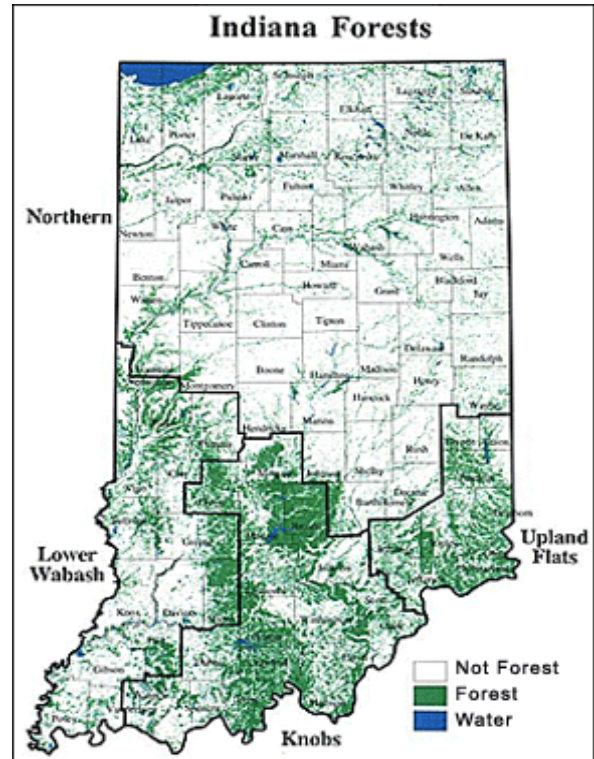
2011 Indiana

Forest Health Highlights

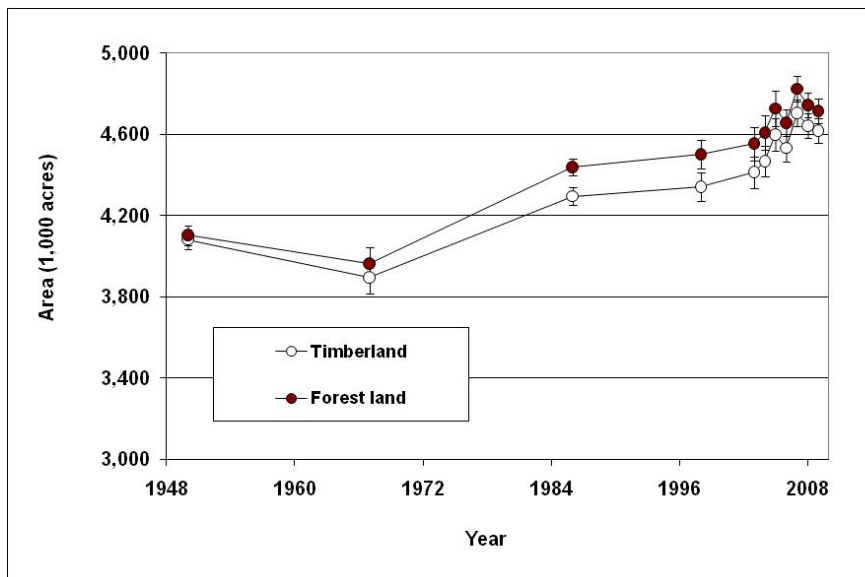


1. Indiana's Forest Resources

Approximately one of five acres in Indiana — 4.7 million acres (including reserved or low-productivity land) — is covered in forest. Forest land increased from 3.896 million acres in 1967, to 4.342 million acres in 1998, to 4.714 million acres in 2009. Private forest land is 84% and public forest land is 16% of all forest land. Indiana has surprisingly diverse forests, encompassing northern maple / beech / birch types to southern bald cypress swamps, and dominated by oak-hickory type in south central Indiana. More than 85 different tree species grow in Indiana forests. Hardwoods occupied nearly 97 percent of this area, with the remainder classified as softwoods or nonstocked. Reflecting the effect of past glaciations, forests exist in large consolidated blocks chiefly in the hilly southern part of the state. In the northern two-thirds of the state, forests generally occupy scattered woodlots, wetlands, and riparian corridors.



Indiana forest areas.



Growing Stock Volume

The total growing-stock volume on forest land has increased 7.7% since 2004. The net volume of growing-stock (trees with a DBH greater than or equal to 5 inches) on forest land in 2009 totaled 9.7 billion cubic feet, almost four times the 2.5 billion cubic feet estimated during the 1950 inventory.

Forest Products

Indiana ranks 9th nationally in total lumber production and 3rd in hardwood lumber production. Indiana forests contribute over \$16 billion annually to Indiana's economy. In 2008, Indiana's primary wood-using industry included 155 sawmills, 8 veneer mills, one handle plants, and 21 mills producing other products. Direct employment within the industry accounted for over 35,000 people and indirectly, the industry supports around 90,000 jobs. Forest-based manufacturing provided \$2.4 billion in value-added, \$7 billion in value of shipments, and a payroll of \$1.2 billion to Indiana's economy in 2008. More than two-thirds of the 68.4 million cubic feet of industrial roundwood harvested in 2008 came from south-central and southwestern Indiana. Saw logs accounted for 90 percent of the total harvest, with other minor products—primarily veneer logs, pulpwood, handles, and cooperage—making up the rest.

2. State Forest Health Issues – An Overview

The **2011 growing season's major forest health problems** are emerald ash borer and oak decline in both white oak and the red oak group. Other health problems include the heavy rains and flooding in May and June. The storms that brought the rain also included wind damage from tornados and resulted in increased foliage diseases. Following the wet spring, the summer brought extensive period of high temperatures between 90 and 100+F. A new and increasing concern is the mortality of Norway and Blue Spruce trees.

The recurring forest health issues are gypsy moth management, oak wilt in northwestern Indiana, yellow poplar mortality in southern Indiana, butternut canker, ash yellows, white pine root decline (*Proceras* root rot), aging pine plantations and aging hardwood forests.

Other future forest pests of concern (but not yet encountered) for Indiana in 2011 continue include the exotic pests – Thousand Cankers Disease of Black Walnut, Sudden Oak Death, Asian Longhorned Beetle, Hemlock Woolly Adelgid, Beech Bark Disease and Red Bay Wilt.

Also of concern are **Invasive plants** that have potential to affect and are affecting Indiana forest regeneration and biodiversity. One forest pest epidemic, forest tent caterpillar, which caused extensive defoliation and resulted in extensive forest mortality in south eastern Indiana 5-8 years ago, has increased the regeneration of tree-of-heaven to the detriment of native species. The kudzu eradication program continues to eradicate locations in southern Indiana and is moving kudzu to the Ohio River and eventually out of Indiana.

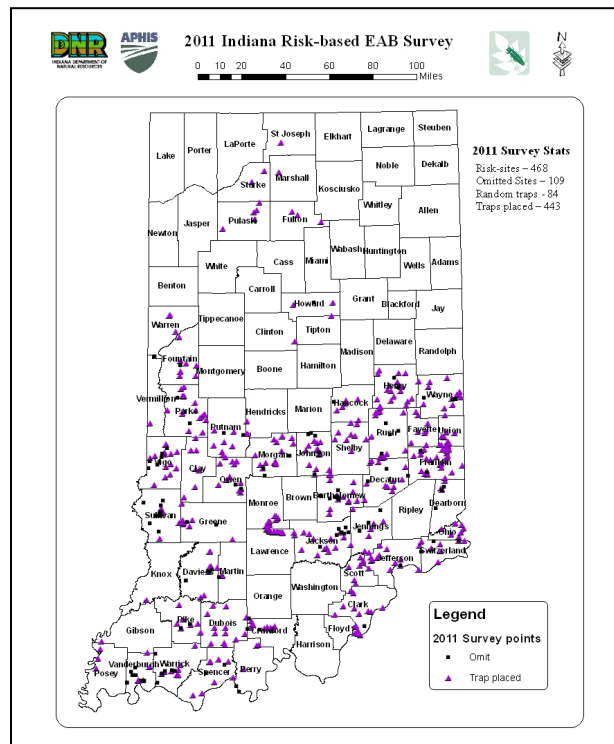
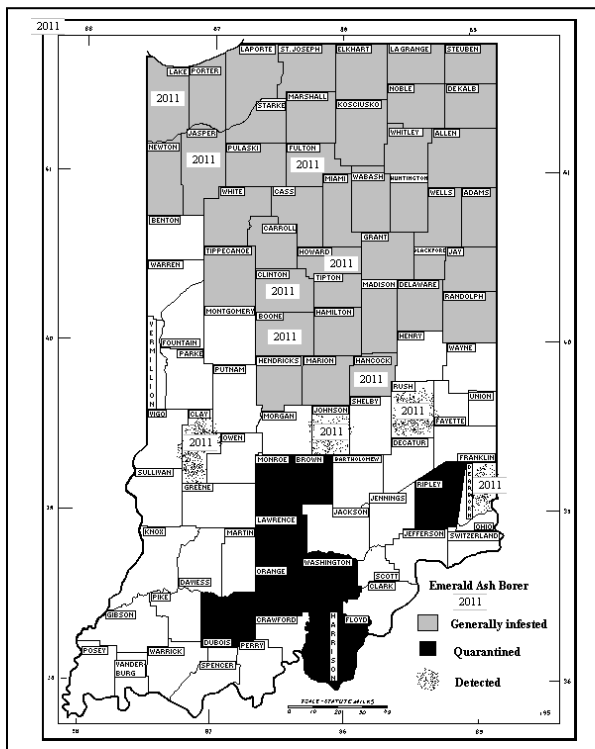
3. Exotic Insect Pests of Indiana Forests

Two exotic major insects of concern - Gypsy moth and Emerald Ash Borer - continue to dominate the state resources for monitoring and management activities.

1. Emerald Ash Borer - *Agilus planipennis* Fairmaire

Emerald ash borer (EAB) is an exotic beetle native to Asia that was discovered in southeastern Michigan near Detroit in the summer of 2002 and in northeast Indiana in June of 2004. The adult beetles feed on ash foliage but cause little damage. The larvae (the immature stage) feed on the inner bark of ash trees disrupting the tree's ability to transport water and nutrients killing the tree.

Quarantine: In 2011, EAB was detected in 11 new counties – Boone, Clay, Clinton, Dearborn, Fulton, Hancock, Howard, Jasper, Johnson, Lake and Rush. Seven of these counties are in the generally infested area of northern IN. Visual survey (6), purple panel trap (3), aerial/ground survey (1) and landowner detection (1) detected EAB in the 11 counties. Currently, 54 of the 92 Indiana counties are under quarantine or have EAB in the county. EAB is not present in 5 of the 54 counties. Indiana’s EAB quarantine is under review to determine the need to continue it and how to modify it if continued.



Survey: The 2011 survey utilized 4 field personnel, 2 from DNR and 2 USDA/APHIS to set 443 purple panel traps at high risk sites (campgrounds, sawmills, firewood dealers, tree services, and organic dumps) in uninfested counties outside of the generally infested area. DNR nursery inspectors set 16 traps at high risk sites in uninfested counties in the generally infested area in addition to doing visual survey for infested trees. Five of the purple panel traps detected EAB of which, 3 were new county detections.

The aerial survey was conducted to map new locations and expansion of the mortality over and around the areas that have obvious and extensive ash mortality. There are five areas in northern Indiana (Huntington/Wabash Counties, Allen/Adams/Wells Counties, Pigeon River (LaGrange County), Carmel/Fishers/Indianapolis, and Winchester) and one two areas in southern Indiana (Orange/Lawrence/Washington Counties and Floyd/Harrison Counties). The survey detected approximately 14,147 acres of additional mortality with greater than 5 trees/acre dead. The majority of mortality is in Huntington/Wabash Counties followed by

Orange/Lawrence/Washington Counties. Mortality increased significantly from 2010 in Carmel/Fishers/Indianapolis and Winchester infested areas.

For 2012, ash mortality is expected to increase in the above areas with most of the increase in Hamilton/Marion county as EAB is expected to be detected farther south in Marion county. EAB mortality is also expected to increase along the Wabash River west of the Huntington/Wabash infestation. Increased ash mortality is also expected in northwestern counties under Lake Michigan as initial reports of ash mortality were received in 2011 from this area.

Also, expect to detect EAB in the remaining uninfested counties of south eastern Indiana. For south western Indiana, anticipate the detection of EAB in one or two locations, but not widespread.

Hardin Ridge SLAM Project: The project identified 127 ash trees in the core area which were injected with Tree-Age (Enamectin benzoate) in the spring. The Hoosier National Forest staff surveyed the forest service land in the project area around the core area identifying the ash trees to use in future management action – lethal trees or sink trees. The information on injected trees, ash trees in the project area, and positive EAB trees was analyzed by the Michigan SLAM project staff that provided a spread model to guide management plans for the project area.

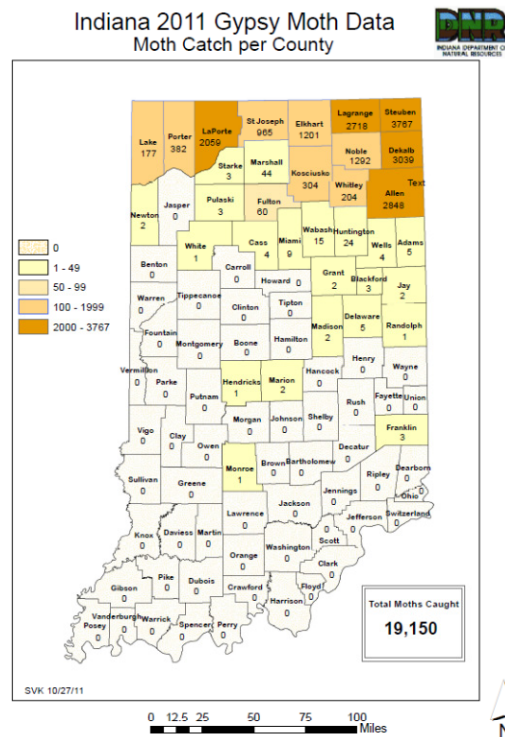
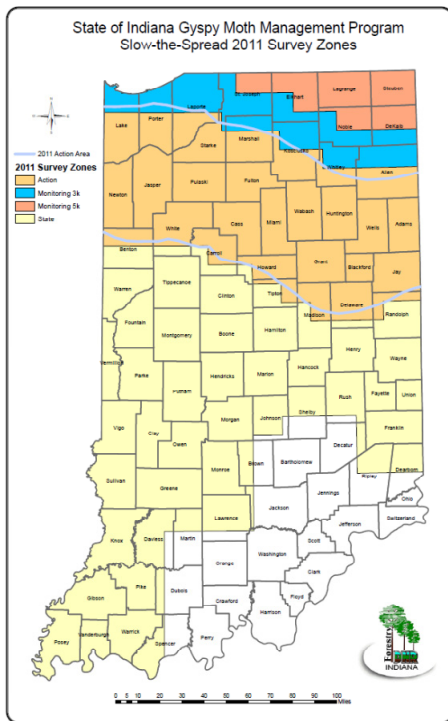
The spread model indicated spread was likely to move to the west and southwest and purple panel traps were placed by DNR surveyors outside the project boundaries. Additional traps were placed to the north to monitor a boy scout camp and a state campground. One trap south and one trap west outside of project area in the adjacent 160 grid cells detected EAB. One trap near the Boy Scout camp and inside the project area was positive. This is the first detection of EAB outside of the core area of the project site.

The information from 2011 will be used to guide management plans for 2012 which include the treatment of ash trees outside the core area with Tree-Age, creation of sink trees, delimit trapping in the core area to monitor treatment, and detection trapping around the project area.

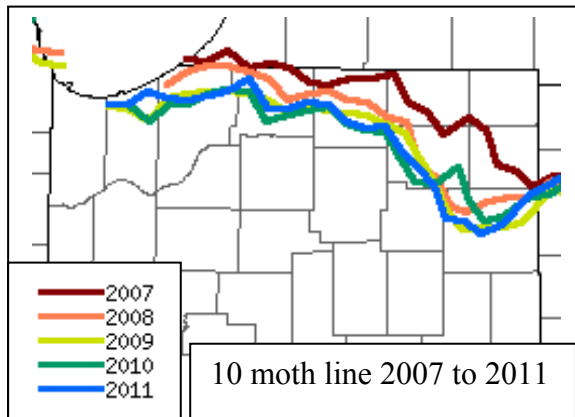
Information and web links may be found at the IDNR Division of Entomology and Plant Pathology EAB website: In addition, the website has an interactive web map showing the known EAB locations in Indiana. <http://www.in.gov/dnr/entomolo/3443.htm> . Purdue University also maintains an EAB website: <http://www.entm.purdue.edu/EAB/>

2. Gypsy Moth – *Lymantria dispar*

The 2011 Cooperative Gypsy Moth Survey completed its 24th year. The survey is part of the Slow-The-Spread (STS) Program and uses the STS protocol for its' design and operation dividing the state into three zones - the STS Evaluation Zone, the STS Action Zone, and the State Area. The survey design used fixed 5K & 3K, fixed 2K and rotating 3K, respectively, for the three zones. Across all zones, the survey set 13,337 traps all referenced by GPS. All or parts of counties in south central and south east Indiana were not included in the state area detection grid survey, however, traps were set in state campgrounds. This was done for economic reasons and because of negative trap catches in previous years. There are plans to survey these counties in 2012.



The survey detected 19,150 moths from 34 counties ranging from 1 to 3,767 moths per county (Figure 1). This year's moth catch is 8,765 fewer than last year's 27,915. Positive traps occurred in 34 counties - 30 in the STS zones and 4 in the State Area. The majority of the moth catch was in the Evaluation Zone. The Evaluation Zone, which includes the quarantined counties of Steuben, LaGrange, Elkhart, Noble, St. Joseph, Porter, Allen, LaPorte, and DeKalb (Figure 3), detected 95.4% of the moths (18,271 of 19,150). The northern third of the state falls in the Action Zone, which is below the Evaluation Zone under STS protocol. The Action Zone detected 4.5% of the moths (872 of 19,150). The majority of the Action Zone moth catch occurred in the northern and eastern parts, adjacent to the Evaluation Zone. The State Area detected 0.1% of the moths (7 of 19,150).



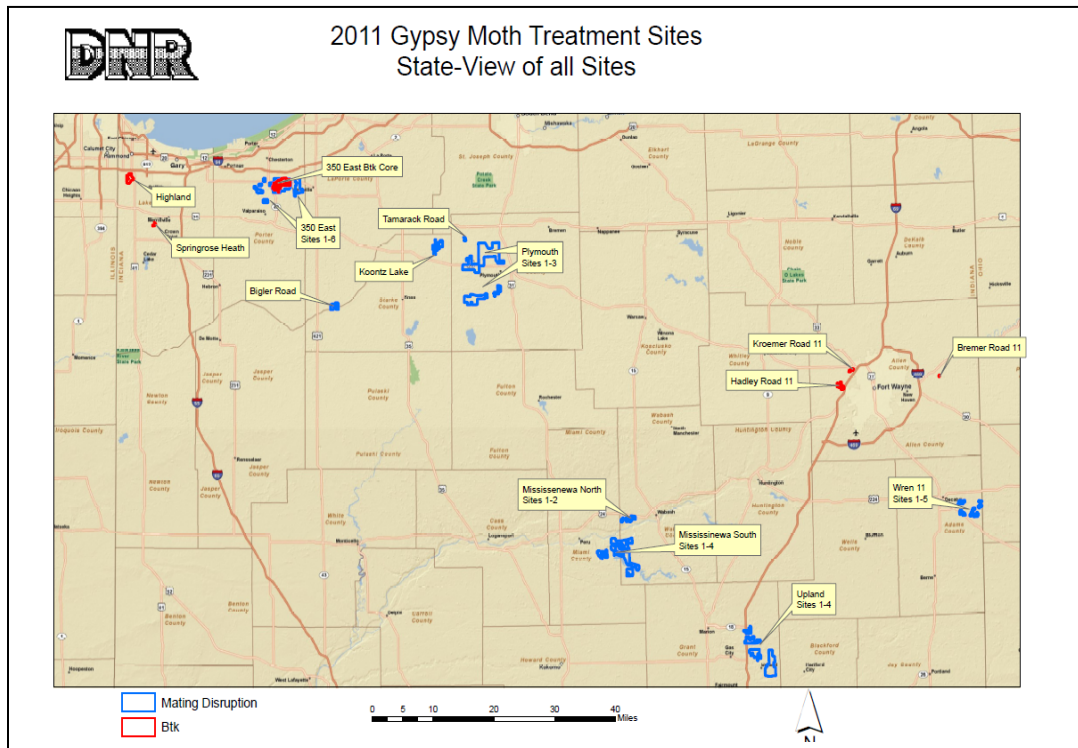
Number of male gypsy moths caught in the three survey areas from 2009 to 2011.

Year	STS Evaluation Area	STS Action Area	State Area	Total
2011	18,271	872	7	19,150
2010	16,202	11,534	179	27,915
2009	39,637	5,734	146	45,517

The moth line projected from the 2011 survey receded slightly north due to the reduced moth catch

Since the survey began in 1972, 418,290 moths have been caught in 90 of the 92 counties. Gypsy moth has not been detected in Dubois and Sullivan Counties since surveys began in 1970.

Btk (*Bacillus thuringiensis kurstaki*) treatments were conducted on 6 sites totaling 2,852 acres in three counties. Five sites were treated at 25 BIU/acre with two applications and one site was treated at 25 BIU/acre with one application for a total of 4,145 treated acres.

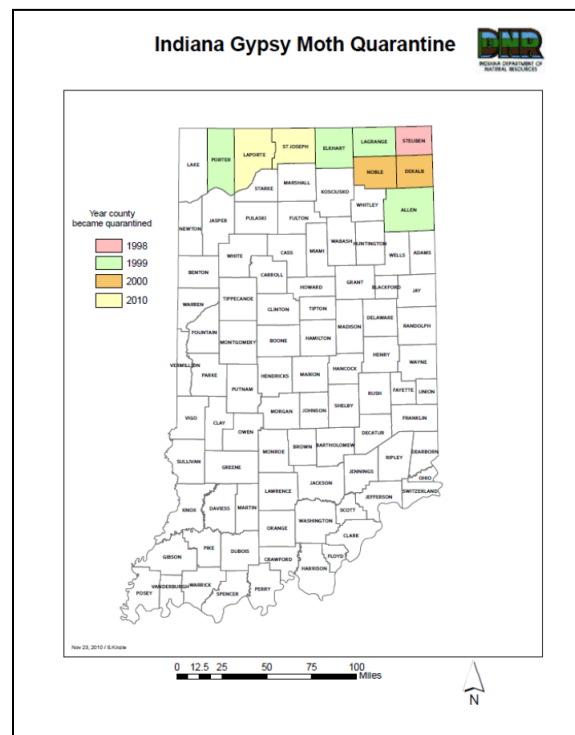


Mating Disruption treatment occurred in 10 counties on 8 sites totaling 27 individual blocks and 25,115 acres using pheromone flakes (Disrupt II, Hercon) at 6gm/acre, with the exception of two sites treated at 15gm/acre.

Aerial surveys detected no defoliation from Gypsy Moth in 2011. The last time surveys detected defoliation from Gypsy Moth was in 2009 when 70 acres of defoliation occurred in 2 counties.

Treatments for 2012 are being reviewed with seven mating disruption sites and one Btk site proposed. All sites are in the North and Northwest portions of Indiana.

There are nine counties along the northern border under state and federal gypsy moth quarantine.



3. Secondary Exotic Insect Pests of Concern

a. Pine Shoot Beetle - *Tomicus piniperda*- The USDA/Aphis survey detected Pine Shoot Beetle (PSB) in Clay and Scott Counties in 2011. PSB occurs in 71 of the state's 92 counties. With PSB present in $\frac{3}{4}$ of the state, the decision was made to remove the state PSB Quarantine and quarantine all of Indiana under the USDA PSB quarantine.

b. Granulate (Asian) Ambrosia Beetle - *Xylosandrus crassiusculus* - Populations of granulate ambrosia beetle are active in the state. No active surveying was conducted on this pest in 2011. Damage from granulate ambrosia beetles (*X. crassiusculus*) and the black stem borer (*Xylosandrus germanus*) were found in the state. During EAB investigations we found tooth pick like frass in tulip poplar and white oak trees.

c. Exotic Bark Beetle: Early Detection Rapid Response (EDRR) Survey - This survey was not conducted in Indiana in 2010 and 2011.

d. Hemlock Woolly Adelgid - *Adelges tsugae* - Hemlock Woolly Adelgid was not detected or reported in 2010 by nursery inspectors or DNR staff that monitors the native population of eastern hemlock as part of their duties.

e. Light Brown Apple Moth (LBAM) - *Epiphyas postvittana* - No survey was conducted in 2011. Indiana is currently scheduled to survey for LBAM in 2012 in conjunction with other CAPS related surveys. To date we have had no reports or confirmations of LBAM in Indiana.

f. Asian Long-horned Beetle - *Anoplophora glabripennis* - ALB was detected east of Cincinnati Ohio in 2011. This detection increased the concern for detection of ALB in Indiana. Survey of high risk sites (campgrounds and industrial areas) and of absentee forest landowners based on ALB infested zip codes was conducted. ALB was not detected and surveys will continue in 2012.

4. Non-Indigenous Plant Pathogens

1. Sudden Oak Death - *Phytophthora ramorum*

The Division of Entomology and Plant Pathology Nursery Inspectors annually survey nurseries for this disease. The purpose is early detection of *Phytophthora ramorum* (Pr) in vegetation before infection centers become fully established and more difficult to eradicate. In 2011 as in 2010, two SOD surveys were conducted. One survey involved the annual foliage sampling and the second survey sampled water sources using rhododendron leaf bait in the spring and fall.

Twenty nurseries were surveyed in 2011 sampling foliage of host plants. A total of 400 total samples were submitted for testing to Purdue Plant Pest Diagnostic Lab and all samples were negative for *P. ramorum*.

The nursery water source on the ten nurseries sampled in 2010 was repeated in 2011 using rhododendron leaf bait and submitted to Purdue Plant Pest Diagnostic Lab. Due to the late awarding of farm bill grant funds, the fall survey sample will be done in 2011 and the spring survey sample will be done in 2012. The water filtration method used in 2010 was not used in this survey. To date, no results have been reported.

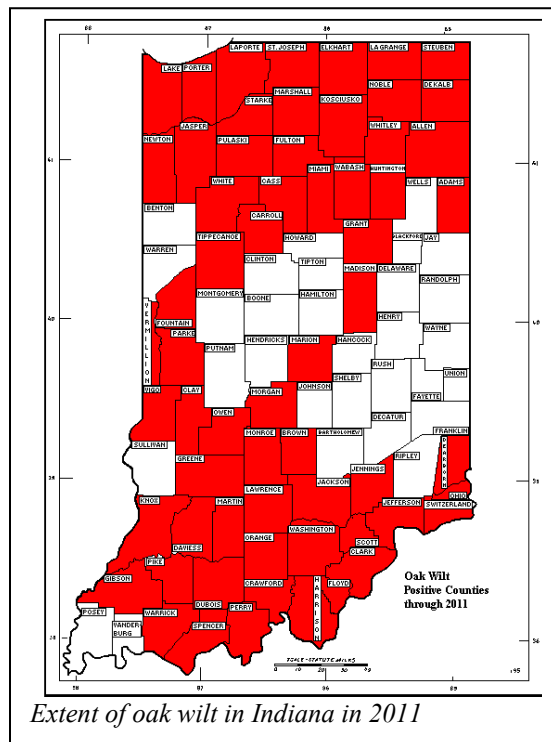
2. Dutch Elm Disease - *Ophiostoma ulmi* (syn. *Ceratocystis ulmi*)

This disease occurs across the state and continues to kill American elm in the urban and rural forests. The amount of mortality has lessened in recent years. However it is common to find dead elm when reports of dead ash are made by landowners who think they have emerald ash borer.

3. Oak Wilt - *Ceratocystis fagacearum*

Oak wilt is present in 62 counties and no new county records occurred in 2011.

Oak wilt is common in the woodlots of northwestern Indiana in the Kankakee River basin. In other infested counties, especially southern Indiana, oak wilt is spotty and difficult to separate from oak decline symptoms. In all situations, mortality occurs to red and black oak in small spots, less than 1 acre, consisting of sapling to saw timber size trees totaling less than 10 trees per spot, usually 1-5 trees. Oak wilt in white oak has not been detected in any of the reported spots.



Oak wilt is predicted to continue as a minor and localized concern in Indiana, with the exception of the sand ridge areas of northwestern Indiana where it is commonly found in black oak stands. (Correction: to 2007-2010 Forest Health Highlights which incorrectly reported 63 counties with oak wilt. It should have stated 62 counties. The 2010 map incorrectly included Sullivan County. Sullivan County has not positive confirmation of oak wilt.)

4. Butternut Canker - *Sirococcus clavigignenti-juglandacearum*

As in prior years no surveys were conducted in 2011 as the disease is present throughout the state. The Hardwood Tree Improvement Cooperative at Purdue University continues to locate and collect plant material from butternut trees for a breeding program to save the species.

5. Beech Bark Disease – Disease complex of *Cryptococcus fagisuga* Lind and *Nectria coccinea* var. *faginata* Lohman

No surveys for this disease were conducted in 2011. No reports of trees with the scale or canker and no beech mortality were received. To date this disease is not present in Indiana and is expected to first occur in northern Indiana because of its presence along Lake Michigan in the Lower Peninsula of Michigan and the recent detection in Wisconsin in counties along Lake Michigan. The concern is the possibility that infected/infested material (firewood) is brought into Indiana.

6. Red Bay Wilt – *Raffaelea lauricola* and Redbay Ambrosia Beetle, *Xyleborus glabratus* - Risk to Indiana Sassafras and Spicebush

This forest pest complex is not known to be present in Indiana. No surveys were conducted in 2011 and no reports of dying sassafras or spicebush were received.

7. Dogwood Anthracnose – *Discula destructiva*

Surveys were not conducted in 2011 and no reports of the disease were received even though the spring weather had heavy rains and cool temperatures. Dogwood anthracnose is present throughout the state and is common in southern Indiana forests.

5. Native Insect and Disease Concerns

1. Forest Tent Caterpillar – *Malacosoma disstria*

The south eastern Indiana forests defoliated between 2003 and 2006 are recovering from the defoliation and subsequent mortality. However, foresters report that regeneration in forests that experienced heavy mortality is being overtaken by Tree-of-Heaven. There were no other reports of FTC in 2011.

2. White Pine Root Decline - *Verticicladiella procera*

Procera Root Rot (White Pine Root Decline) is an annual killer of white pine windbreak, ornamental and Christmas trees. No survey was conducted in 2011 but mortality occurs in all areas of the state as landowners continue to call each year about their dying white pines.

3. Anthracnose – *Apiognomonina* spp.

The cool and wet spring brought more sycamore anthracnose defoliation in 2011 than in 2010. Anthracnose. Oaks, maples and ash also suffered from anthracnose.

4. White Oak Mortality

Reports of white oak dying continued in 2011 primarily from forested areas of south central Indiana. However, in 2011 additional reports were received for black and red oak across the state. For both oak groups, Hypoxylon canker is more common than in prior years. Armillaria root rot and Two-lined Chestnut borer are also involved. Besides the weather impacts and their role in oak mortality, additional sampling for Phytophthora spp. may be warranted to determine if they are involved.

5. Looper Complex – Linden Looper *Erannis tiliaria* and Half Winged Geometer *Phigalia titea*

Aerial surveys were completed in 2011 and no noticeable defoliation was noted.

7. Bacterial Leaf Scorch (BLS) – *Xylella fastidiosa*

A bacterial leaf scorch survey was not conducted in 2011.

8. Spruce Needle Cast Survey - *Rhizosphaera*, *Stigmina* and *Setomelanomma*

The Division of Entomology & Plant Pathology nursery inspector conducted an informal survey to provide some information for the decline of Colorado blue spruce in southern Indiana in 2011. A small sample of 15 trees with symptoms of needle cast were collected from both landscape and nursery locations.

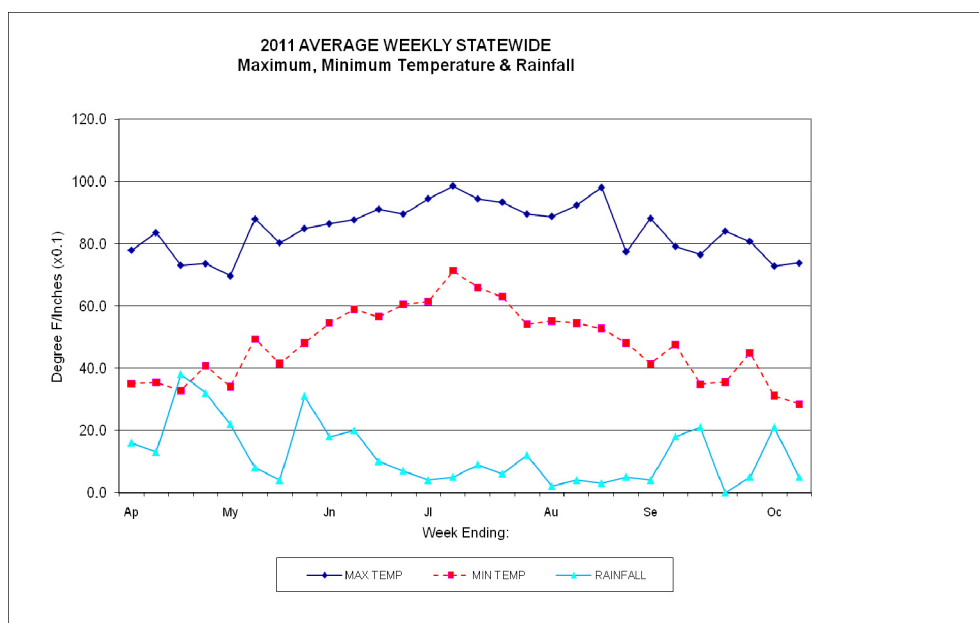
Rhizosphaera was present on all but one sample. A few of the samples had both *Rhizosphaera* and *Stigmina* fungi. One sample from Monroe County contained *Rhizosphaera*, *Stigmina* and *Setomelanomma* all on the same branch. Interestingly these trees that had all 3 diseases were 8-10 feet tall, in an old nursery and displayed very few symptoms of needle cast and little needle drop. Trees that displayed the poorest health did not have *Setomelanomma*, but had a combination of *Rhizosphaera* and *Stigmina*. There was also one tree that had severe spruce spider mite injury and another that apparently died from bark beetle activity.

Purdue University Plant Pest Diagnostic Lab reported seeing additional spruce samples with *Setomelanomma* during 2011. *Setomelanomma* also known as SNEED or Sudden Needle Drop may not always cause sudden needle drop. The dramatic spruce decline in the Monroe County area may be the result of *Rhizosphaera* and *Stigmina*; however no one has tested Koch Postulate with *Stigmina* to prove that it is truly a pathogen. We only know that it is often associated with declining blue spruce trees. The survey conducted during 2011 utilized a small sample size and only provide some insight into the spruce decline in southern Indiana. Additional samples will be collected in 2012 and the trees that were positive for all three diseases will be monitored for needle drop and the possible increased presence of *Setomelanomma*.

6. Weather-Related Issues in Indiana Forests

Ozone Damage: This survey was not conducted in 2011. Reduced funding in the Forest Health Monitoring program resulted in this survey being dropped.

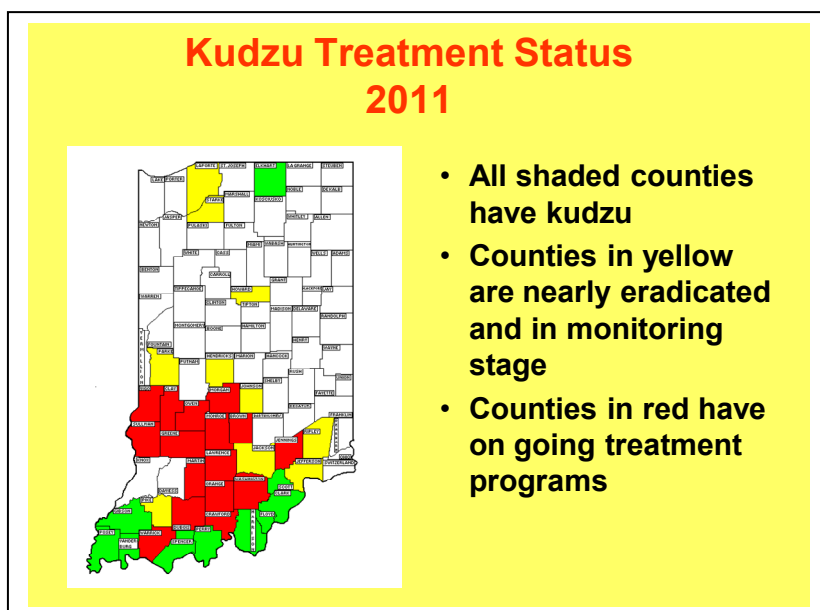
Weather – Late and Wet Spring followed by Summer Heat: The graph below shows the



maximum, minimum temperatures and average weekly rainfall during the growing season. The spring had periods of heavy rain in April into May and again from late May through June. This was followed reduced rain and hot temperatures July to mid August. Rainfall from April through late June except for mid May was averaging 0.5” with several weeks about 2.0”. This created flooding throughout the state and delayed planting of field crops. High temperatures in the 90’s were continuous through July into August. This resulted in drought conditions for some areas of the state but was not like last year’s drought conditions.

7. Invasive Plant Species

Kudzu - *Pueraria lobata* - an Asian native invasive vine is located throughout Indiana but is predominately in southern Indiana. Currently there are 133 known sites totaling 125.56 acres. Additional sites that need confirmation were reported in Crawford, Clark, Lawrence, Martin and Posey Counties. Currently, 69.2% of the sites are less than one acre.



Herbicide applications were conducted at 41 kudzu sites totaling 51.1 acres in 14 counties. Sites were treated with a combination of clopyralid, glyphosate and metsulfuron. Metsulfuron was used as tool for the first time with the project in order to kill remaining re-growth a sites that had 5 years of previous treatment. Currently, the eradication effort has achieved at least 90% suppression at 62% of the known kudzu sites and 32% of the treated kudzu sites were in monitoring stage and nearly eradicated.

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