



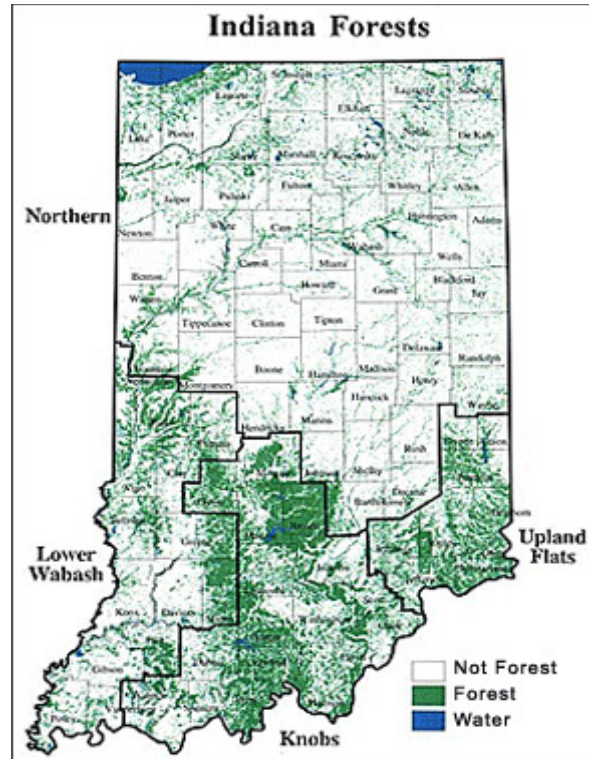
2010 Indiana

Forest Health Highlights

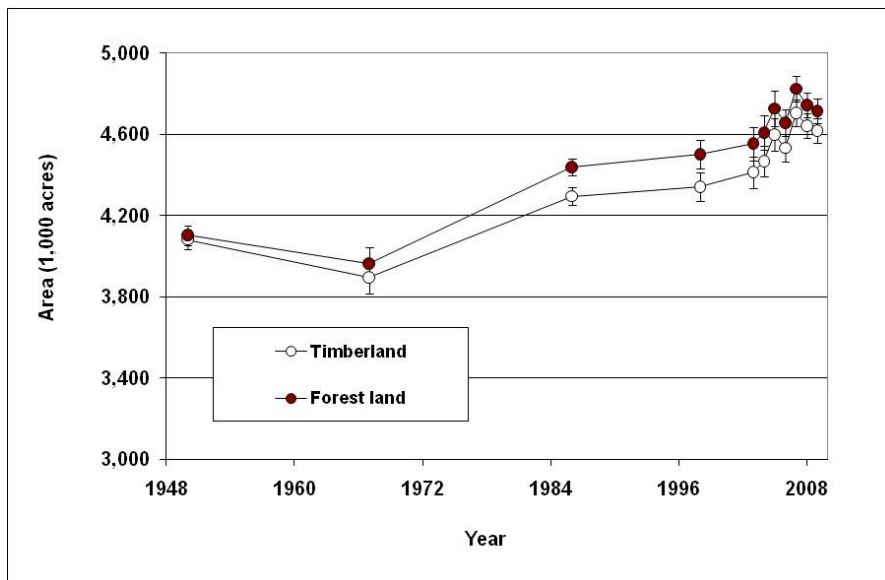


1. Indiana's Forest Resources

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 \$17 billion annually to Indiana's economy. In 2005, Indiana's primary wood-using industry included 212 sawmills, 13 veneer mills, two handle plants, one pulp mill, and eight mills producing other products. Direct employment within the industry accounted for over 38,000 people and indirectly, the industry supports over 90,000 jobs. Forest-based manufacturing provided \$3.77 billion in value-added, \$8 billion in value of shipments, and a payroll of \$1.4 billion to Indiana's economy in 2006. More than two-thirds of the 84.2 million cubic feet of industrial roundwood harvested in 2005 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 **2010 growing season's major forest health problems** are gypsy moth and emerald ash borer. Other health problems include the spring floods and the summer drought that continues into the fall and winter.

The recurring forest health issues continue to be oak wilt mortality in northwestern Indiana, white oak mortality in southern Indiana, butternut canker, ash yellows, white pine root decline (*Proceras* root rot), aging pine plantations and hardwood forests.

Other future forest pests of concern (but not yet encountered) for Indiana in 2010 continue include the exotics – Sudden Oak Death, Hemlock Woolly Adelgid, Beech Bark Disease and Red Bay Wilt. Of recent concern is Thousand Cankers Disease of Black Walnut that was detected in Tennessee in July of 2010.

Also of concern are **Invasive plants** that have potential to affect Indiana forest regeneration and biodiversity. Currently, the kudzu eradication program continues to eradicate locations with the goal to remove kudzu from 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. Gypsy Moth – *Lymantria dispar*

The 2010 Cooperative Gypsy Moth Survey completed its 23rd year of the statewide survey. 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 (Figure 1). The survey design used fixed 5K, fixed 3K, fixed 2K and rotating 3K, respectively, for the three zones. Across all zones, the survey set 13,713 traps all referenced by GPS. Fifteen counties in the state area were not trapped this year, compared to twenty one

counties not trapped in 2009, mostly for economic reasons, but also because of negative trap catches in previous years. There are plans to survey these counties in 2011.

Figure 1: STS Action/Evaluation Zones for 2010

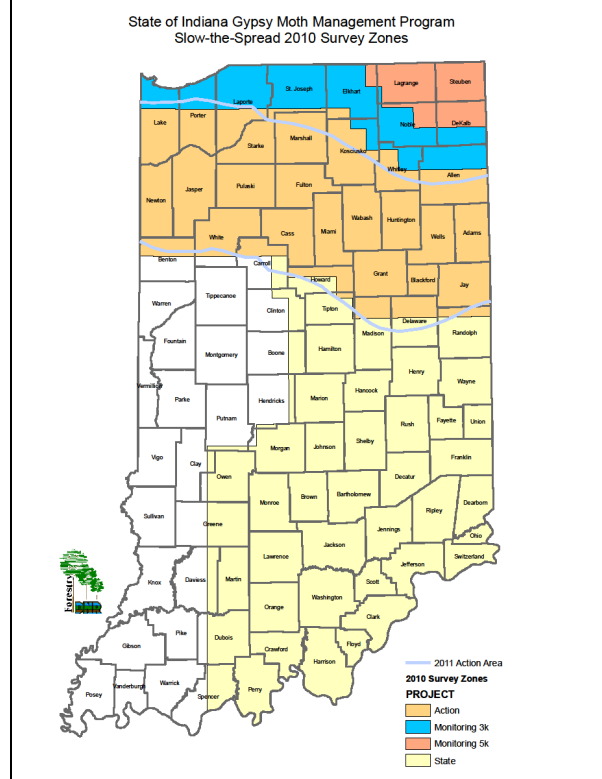
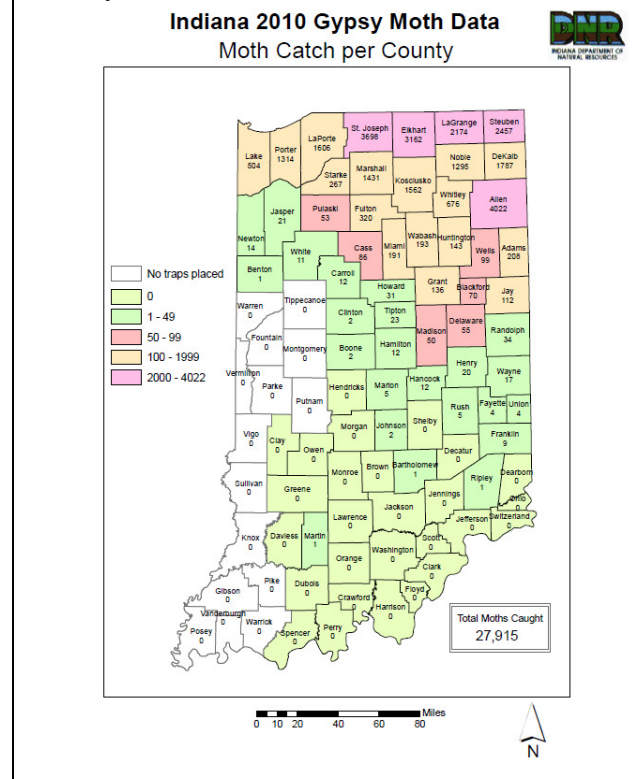


Figure 2: Number of male moths caught per county in 2010



The survey detected 27,915 moths from 52 counties ranging from 1 to 4,022 moths per county (Figure 2). This year's moth catch is 17,602 fewer from last year's high number of 45,517 (Table 1). Even though the moth catch is significantly lower than 2009, STS data indicates a slight spread into counties south of the action zone. Positive traps occurred throughout the Action Zone with most of the positive traps in the central area of the Action Zone.

Table 1: Number of male gypsy moths caught in the three survey areas from 2008 to 2010.

Year	STS Evaluation Area	STS Action Area	State Area	Total
2010	16,202	11,534	179	27,915
2009	39,637	5,734	146	45,517
2008	42,726	321	82	52,129

The results of the 2010 survey found that the majority of the moth catch was in the Evaluation Zone (Table 1). The Evaluation Zone, which includes the quarantined counties of Steuben, LaGrange, Elkhart, Noble, St. Joseph, Porter, Allen, and DeKalb, detected 58.0% of the moths (16,202 of 27,915). The northern third of the state falls in the Action Zone, which is below the Evaluation Zone under STS protocol. The Action Zone detected 41.3% of the moths (11,534 of

27,915). The majority of the Action Zone moth catch occurred in the northern and eastern parts, adjacent to the Evaluation Zone. The State Area detected 0.6% of the moths (179 of 27,915).

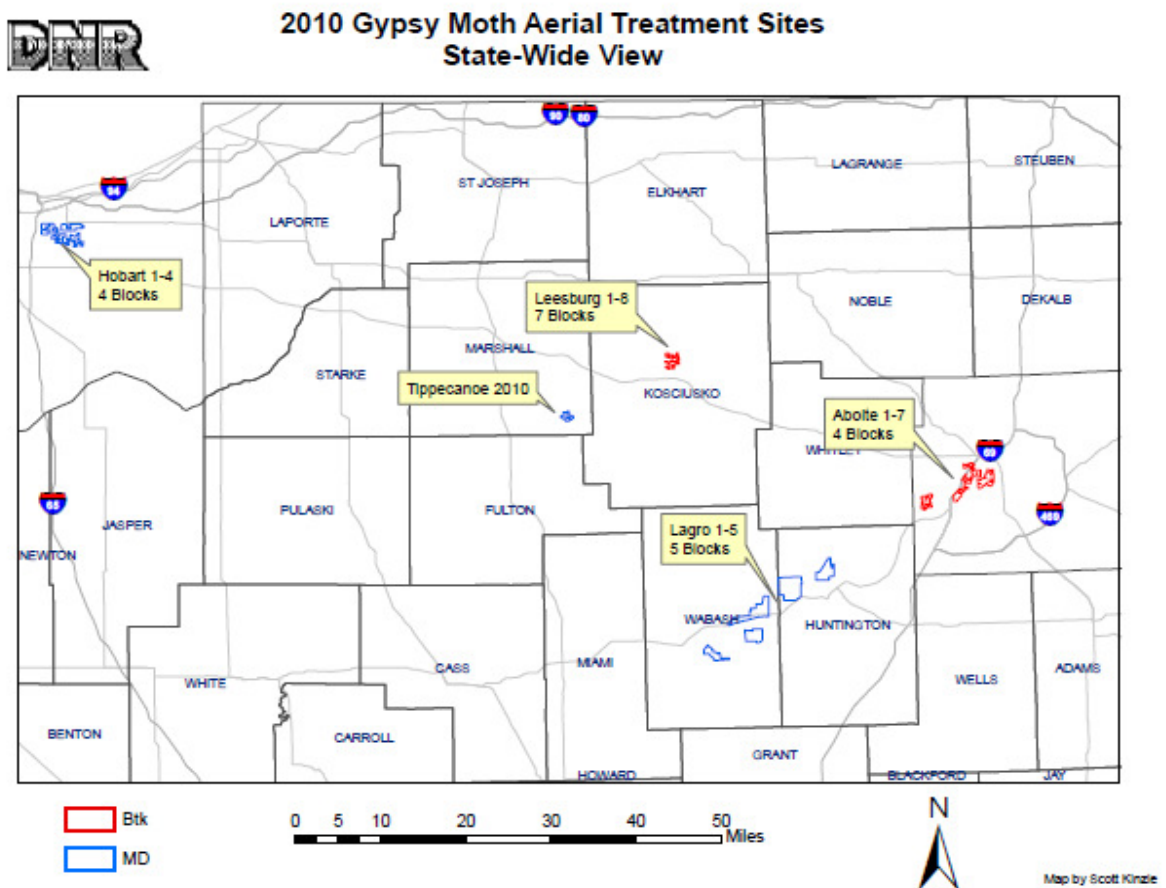
Since the survey began in 1972; 419,040 moths have been caught in 90 of the 92 counties. Gypsy moth has not been detected in Dubois and Sullivan Counties since surveys began in 1970.

Btk (*Bacillus thuringiensis kurstaki*): Treatments to slow-the-spread and development of gypsy moth were conducted on 2 sites divided into 11 blocks totaling 5,111 acres in two counties (Figure 3). All 11 blocks were treated with Btk at 25 BIU/acre with two applications each for a total of 10,222 treated acres.

Mating Disruption: One site with 4 individual blocks totaling 3,750 acres was treated with pheromone flakes (Disrupt II, Hercon) at 6 gm/acre. Two sites divided into 6 individual blocks totaling 9,343 acres were treated with SPLAT at 6 gm/acre (Figure 3). All total 13,093 acres were treated for mating disruption.

Aerial surveys detected no defoliation in 2010, compared to 70 acres of defoliation in 2 counties in 2009.

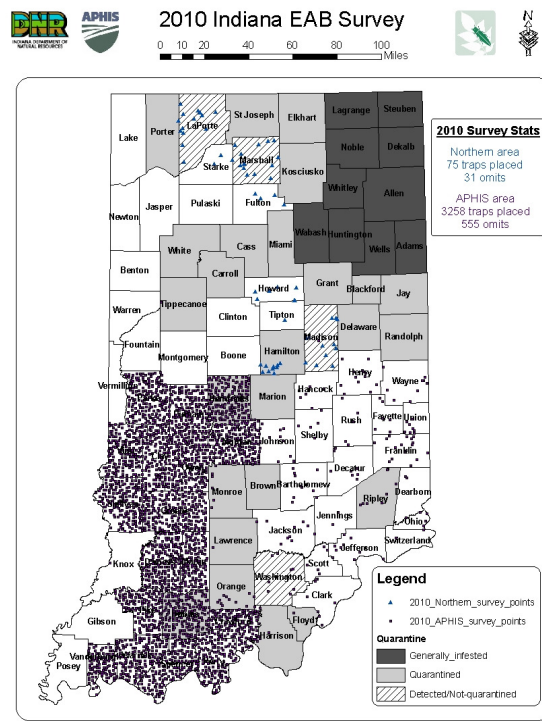
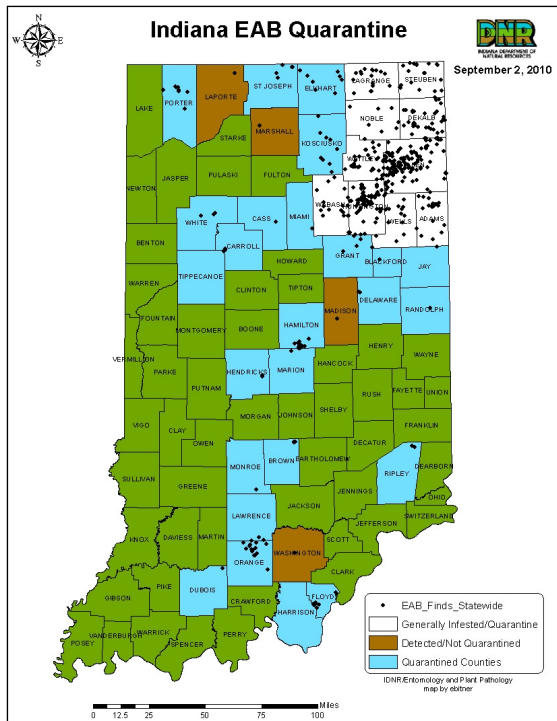
Figure 3. 2010 Treatment Sites



2. Emerald Ash Borer - *Agrilus 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 2010 EAB was detected in eight new counties – Cass, Carroll, LaPorte, Hendricks, Madison, Marshall, Tippecanoe and Washington. Currently, 39 of the 92 Indiana counties are under quarantine or have had EAB detected. Currently Indiana's EAB quarantine is under review to determine need to continue with the state quarantine.



Survey: The 2010 survey season utilized 21 field personnel, 13 from DNR and 8 USDA/APHIS. Aphis surveyors deployed 3,258 purple panel trap in the south western portion of the state on a 1.5 x 1.5 mile grid. DNR surveyors also set 75 purple panel traps in the northern and south eastern area of the state focusing on high-risk sites (sawmills, campgrounds and composting sites). In addition to the panel traps, several complimentary survey methods were also employed: (1) DNR nursery inspectors conducted visual surveys of suspect ash; (2) Delimitation within infested townships, especially outlier infestations, was conducted; and (3) an aerial survey mapped mortality caused by EAB.

The aerial survey of infested counties detected ash mortality in 701 woodlots/forests totaling 23,400 acres with greater than 5 trees/acre dead. The majority of mortality occurred in Huntington County (285 woodlots/forests & 10,525 acres). Other counties with >1,000 acres of woodlots/forests with mortality are Adams, Allen, DeKalb, LaGrange, Orange, Randolph and Steuben.

Hardin Ridge SLAM Project: In the winter of 2008 Emerald Ash Borer (*Agrilus planipennis*) was identified in the Hardin Ridge Recreation Area of Hoosier National Forest. An initial visual

survey identified 54 heavily infested trees that were removed and chipped according to IDNR regulatory requirements. In a cooperative effort, the USFS and Indiana DNR started the SLAM (SLOWing Ash Mortality) project in 2009. Survey protocols determined a survey area totaling 36mi². Sixteen girdled detection trees per square mile were selected within the immediate 9mi² core zone around the initial known infestation. Around this core zone 4 trees per square mile were selected for girdling. In all 208 detection trees were girdled for survey purposes. The survey was completed in 2010 with 28 trees positive. 25 trees ranged from 1-100 larvae per tree; 2 trees ranged from 100-200 larvae per tree and 1 tree had 200+ larvae. All were located in the core area with the majority in the Hardin Ridge Campground. Over the winter of 2010/2011 the ash resource will be surveyed and treatment plans developed for implementation in 2011.

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/>

3. Secondary Exotic Insect Pests of Concern

a. Pine Shoot Beetle - *Tomiscus piniperda* - Yearly surveys for pine shoot beetle are conducted by USDA/APHIS personnel using Lindgren funnel traps in southern Indiana to detect new infested counties. No other surveys were conducted for the beetle or its damage. No new county detections occurred in 2010. *T. piniperda* occurs in 66 of the state's 92 counties.

b. Granulate (Asian) Ambrosia Beetle - *Xylosandrus crassiusculus* - Populations of granulate ambrosia beetle are wide spread in the state. No active survey was conducted on this pest in 2010. Late season infestation was reported on honey locust in nursery stock and harvested black walnut logs in Parke and Sullivan Counties

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

d. Hemlock Woolly Adelgid - 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) - No survey was conducted in 2010 for Light Brown Apple Moth. To date we have had no reports or confirmations of LBAM in Indiana.

f. Asian Long-horned Beetle – A few reports of the beetle were received in 2010 from landowners and homeowners. All were investigated and found to be native wood borers.

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 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-one nurseries were surveyed in 2010 sampling foliage of host plants. A total of 400 total samples were submitted for testing to Purdue Plant Pest Diagnostic Lab with 123 samples ELISA positive for *Phytophthora*. All samples were PCR negative for *P. ramorum*.

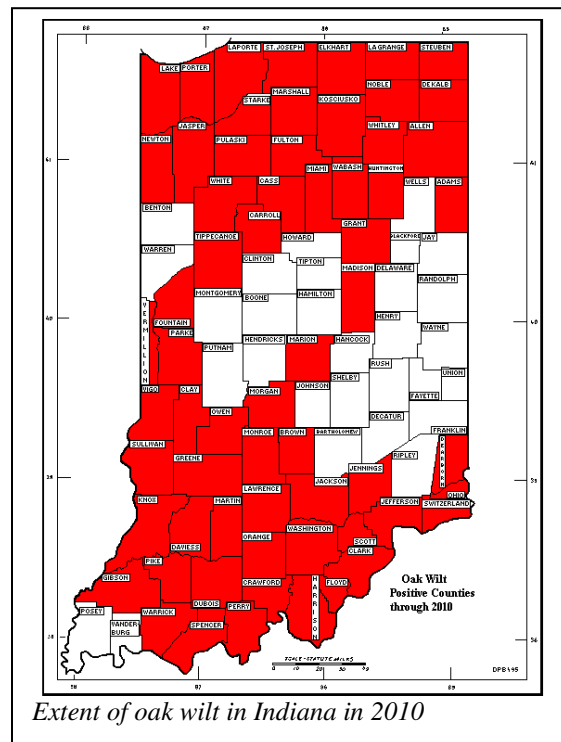
The nursery water source on ten of the twenty-one nurseries was sampled using rhododendron leaf bait and submitted to Purdue Plant Pest Diagnostic Lab. The water filtration method of sampling the water source was used on one of the ten nurseries. All samples were negative for *P. ramorum*.

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

As in 2009, the incidence of DED killed elm is slowing in 2010 when compared to prior years. Symptoms of the disease are seen in July and are scattered across the landscape. Standing dead forest, fence row and urban elms of all sizes are common across the state. This slowing may be from the reduced number of elms to support beetle populations resulting in lower numbers of beetles and greater separation of live trees to attack. Predation and parasites are also believed to be involved in the slowing of disease incidence.

3. Oak Wilt - *Ceratocystis fagacearum*

Oak wilt is present in 63 counties and no new county records occurred in 2010. The aerial forest pest detection survey recorded 100 acres of forest with oak wilt in 2010, however the survey was not specifically surveying in an organized manner for oak wilt. Thus, there are more acres with active oak wilt than the 100 acres reported by the aerial survey.



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.

4. Butternut Canker - *Sirococcus clavigignenti-juglandacearum*

As in prior years no surveys were conducted in 2010 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 2010. 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 in Michigan and the possibility that infected/infested material (firewood) is brought into Indiana.

6. Red Bay Wilt – Risk to Indiana Sassafras and Spicebush

This forest pest complex is not known to be present in Indiana. No surveys were conducted in 2010 and no reports of dying sassafras or spicebush were received.

7. Dogwood Anthracnose – *Discula destructiva*

Dogwood anthracnose is present throughout the state. The disease is common on flowering dogwood in southern Indiana forests, but not as common in northern Indiana because of the limited presence of flowering dogwood in the forests. The wet spring and early summer did not result in reports of flowering dogwood dieback or mortality from this disease. No survey for this disease was conducted in 2010.

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. Aerial surveys did not detect any defoliation or additional mortality.

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 2010 but mortality occurs in all areas of the state.

3. Anthracnose – *Apiognomonia* spp.

Although the spring and early summer had weekly rains in May and June, the temperatures were warm and no defoliation of sycamore and other hardwoods was observed or reported.

4. White Oak Mortality

Reports of white oak dying continued in 2010 primarily from forested areas of south central Indiana. As in prior years, Two-Lined Chestnut Borer (*Agrilus bilineatus*) is involved in the decline and death of the white oak.

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

Aerial surveys were completed in 2010 and no noticeable defoliation was noted.

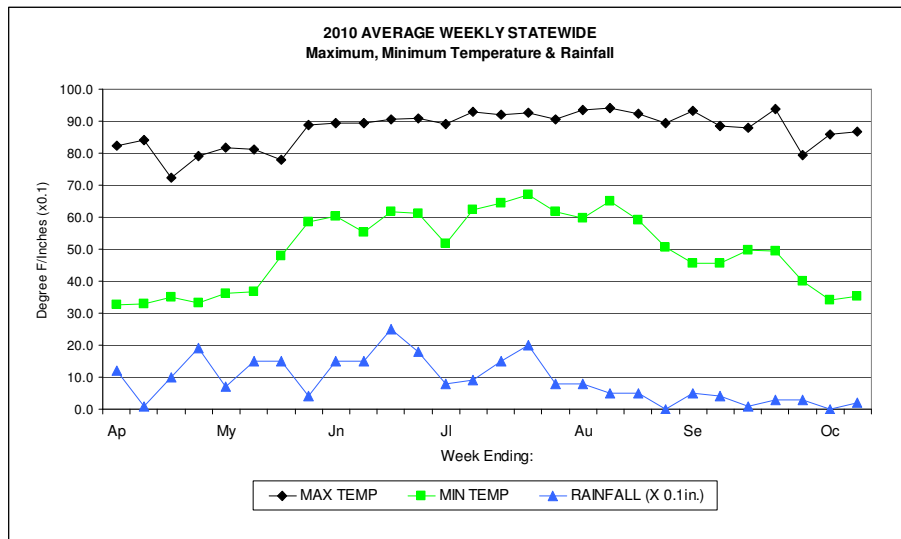
7. Bacterial Leaf Scorch (BLS) – *Xylella fastidiosa*

A bacterial leaf scorch survey was not conducted in 2010.

6. Weather-Related Issues in Indiana Forests

Ozone Damage: Indiana conducted the national ozone biomonitoring survey for vegetative damage. Twenty four biosites were surveyed during late July and early August, 2010. Ozone damage incidence was very low across the sites in southern Indiana. Severity of damage when found was light to moderate. Ozone damage incidence was slightly higher in northern Indiana with severity light to moderate. The weekly rains during May and June followed by the drought starting in July may be the reason for the low incidence of damage on sensitive plants.

Weather – Wet Spring – Summer/Fall Drought: The graph below shows the maximum, minimum temperatures and average weekly rainfall during the growing season. The spring was warm with maximum temperatures averaging 80F followed by 90F through the summer into the



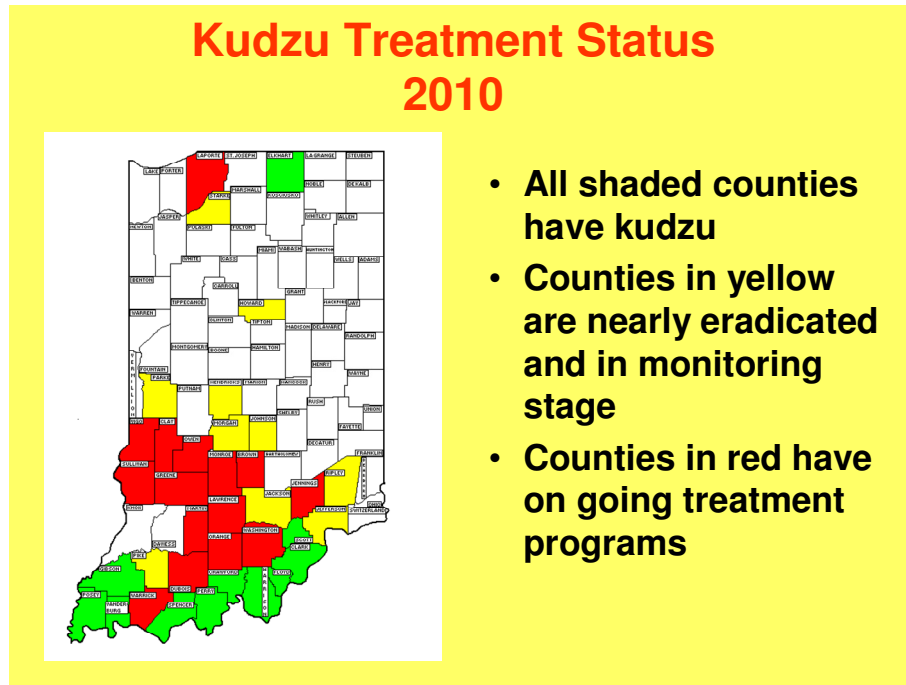
fall. Rainfall during the spring through late July was averaging 1.0” or more per week followed by weekly averages of <0.5” per week. The growing season weather created flooding in the spring especially in southern Indiana. The wet spring produced good foliage color and observations during aerial surveys in June that the forests were in excellent condition. The rains stopped in July. The heat returned and a drought condition developed. This has produced burn bans in October across the state with the majority in southern Indiana. Although under a drought, tree and forest mortality has not started but is anticipated to occur next spring should the winter also be dry with limited rain and snow. This drought may be similar to a drought that started in the late

summer and fall of 1987 and continued through 1988 which resulted in tree mortality over the following 5-7 years.

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 121 known sites totaling 117.06 acres. Additional sites that need confirmation were reported in Jennings, Lawrence, Hendricks, Marion, St. Joseph, Sullivan, and Vanderburgh Counties. Every year additional sites are confirmed in the state as more awareness of Kudzu results in reports of 'new' sites.

Herbicide applications were conducted at 47 kudzu sites totaling 46 acres in 19 counties. Sites were treated with a combination of clopyralid and/or glyphosate depending on the presence of surface water. The 2010 growing season got hot early and provided an extra 6 weeks of growing for Kudzu. This resulted in regrowth on sites that had little or no kudzu growth in 2009 indicating that suppression and eradication efforts in prior years were not as successful as desired.



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