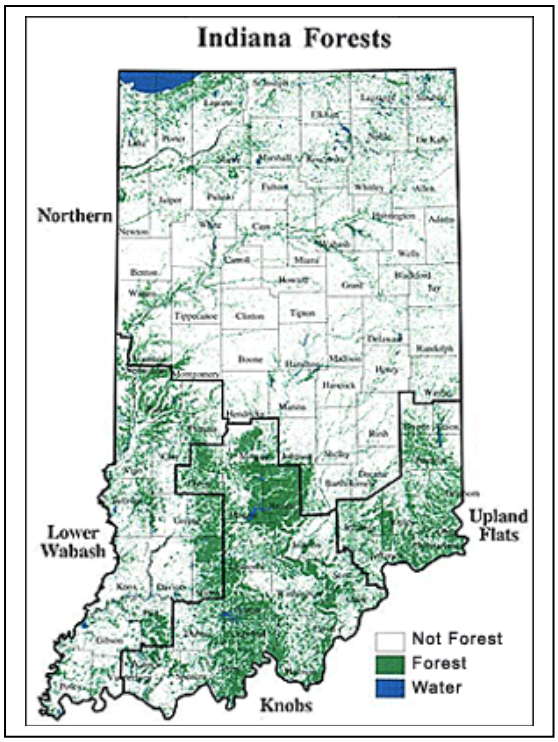
Indiana Forest Health Highlights 2003

THE FOREST RESOURCES

Indiana's economy gains over $9 billion annually from its forests. Over 54,000 Forest-based manufacturing jobs annually generate payrolls of over $1.4 billion. Indiana forests continue to develop, with state woodlands growing more than 2 times the volume removed. In 2000 an estimated 97 million cubic feet of wood was harvested to produce sawtimber, veneer, handles, pulp, and cooperage. Additionally, Forest-based recreation and tourism expenditures contribute $1 billion to the state economy.



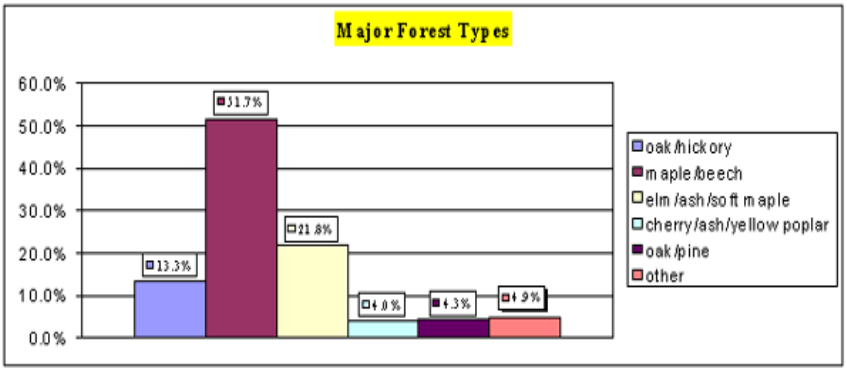
Approximately one of five acres in Indiana — 4.5 million acres — is covered in forest. Since 1907, forestland has increased approximately 430,000 acres, and from 1967 to 1998, the volume of timber increased from 3,800 to 6,900 million cubic feet. More than 85 different trees grow in Indiana forests. Hardwoods account for 95% of the forest that is identified into 13 forest types.

Indiana Forest Statistics	
Total acres	22,957,400
Forested acres	4,501,300
Percent forested - all land	20%
Percent timberland - all land	19%
Percent timberland - forest land	96%
Reserved forest = 159,100 acres / 3.5% forest land	

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's timberland is quite productive. Annual net growth of the state's forests averaged 60 cubic feet per acre, with average timberland yielding 157 board feet per acre each year. Acre per acre, Indiana's growing stock volume is 11 percent greater than neighboring Michigan's, with board foot volumes 300 percent greater. Indiana's per-acre standing sawtimber volume dwarfs other states in the region, with nearly double the board feet volume

per acre (4,380 board feet versus regional average of 2,328 board feet) of the average found in Michigan, Wisconsin, Minnesota, Illinois, Missouri and Iowa. Moreover, stumpage sales are reported to average $ 0.33/board foot, reflecting the state's quality and high-value species mix.



INDIANA FOREST HEALTH ISSUES IN 2004

The 2003 growing season encountered the following major forest health problems of Gypsy Moth, Forest Tent Caterpillar, and Looper Complex. In addition to these, Conifer Bark Beetles, White Pine Root Decline (Procera Root Rot), and Decline/Death of Hickory, Yellow-Poplar & Ash were also forest health problems of a lesser degree. Recurring chronic conditions of Indiana forests include perennial appearances by Oak Wilt, Ash Yellows, Dutch Elm Disease, and Butternut Canker. 2003 saw the decline of former issues such as Eastern Tent Caterpillar and Jumping Oak Gall. Growing concern for introduced exotic agents included Sudden Oak Death, Emerald Ash Borer, and Sirex Woodwasp.

MAJOR FOREST HEALTH ISSUES

INDIANA RECORDS ITS FIRST-EVER GYPSY MOTH *(Lymantria dispar)* DEFOLIATION

For the first time, noticeable defoliation by gypsy moth was detected during an aerial defoliation survey. Two acres of defoliation occurred in Allen County. The area is a wooded park area at Parkview Hospital in Fort Wayne. Burlap banding and mass trapping was employed to accommodate concern about pesticide application near air intake vents next to the hospital. The burlap banding collected several 5-

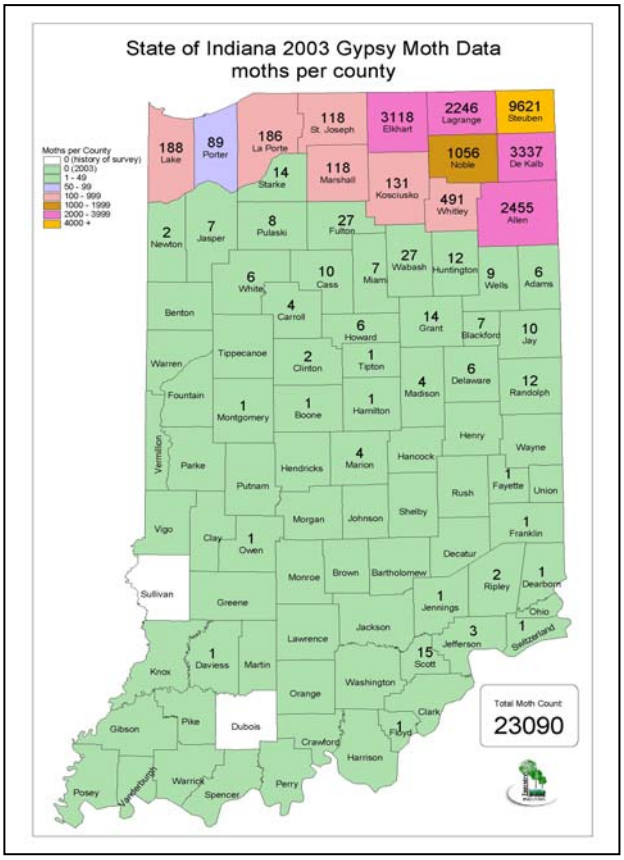
Number of male gypsy moths caught in the three survey areas from 2001 to 2003

Year	STS Evaluation Area	STS Action Area	State Area	Total
2003	14,607	8,425	58	23,090
2002	9,018	6,752	27	15,797
2001	10,475	3,523	33	14,031

gallon buckets of caterpillars and the mass trapping totaled over 30,300 moths in 130 traps.

The results of the 2003 survey found that the majority of increase in moth catch compared to 2002 came in the Evaluation Zone (see table). The Evaluation Zone, which includes the quarantined counties of Steuben, LaGrange, Elkhart, Noble, Allen, and DeKalb, detected 63.3% of the moths (14,607 of 23,090). The northern third of the state falls in the Action Zone, which is below the Evaluation Zone under STS protocol. This area detected 36.5% of the moths (8,425 of 23,090). The majority of the moth catch in the Action Zone is located in the eastern part of the state directly under the Evaluation Zone. There was an increase in the number of 1 - 2 moth detection traps in the Action Zone compared to 2002. The State Area detected 58 moths, primarily 1 - 2 moth detection traps. The State Area had one delimit in Scott County that accounted for 15 of the 58 moths. The other delimits in the state zone were negative.

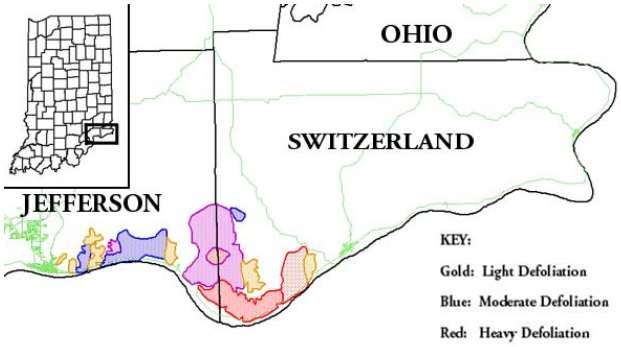
Treatments to eradicate and slow the spread and development of gypsy moth were conducted on 16 sites in 9 counties . Nine sites totaling 690 acres were treated with two applications of Btk at 30 BIU/acre/application. Two of the sites treated with Btk were inside mating disruption sites. Nine sites totaling 8,920 acres and two sites totaling 7,981 acres in six counties received one application of pheromone flakes for mating disruption at 6 and 15 grams, respectively, in June. Delimit surveys to monitor treatment success found two Btk blocks (Brookwood & Churubusco) failed. This was due to rain shortly after the second application at the two sites. Delimit surveys of the 6 gram mating disruption did not detect moths within the treatment boundaries.



The moth lines projected for 2004 remain static across the state with no significant change from the moth lines for 2002 and 2003. The gypsy moth survey and management program in Indiana continues to compress the distance between moth lines, thus slowing the spread of gypsy moth in

Indiana. Since the survey began in 1972, 241,758 moths have been caught in 90 of the 92 counties. One new county record occurred in 2003, in Daviess County.

FOREST TENT CATERPILLAR – *Malacosoma Americana*



2003 Forest Tent Caterpillar defoliation in southeastern Indiana

The first year of noticeable defoliation by Forest Tent Caterpillar (FTC) occurred in the southeastern counties of Jefferson and Switzerland. FTC defoliation ranged from light to severe with the majority of acres defoliated in the light to moderate class. The defoliation in the two counties occurred on the forested bluffs immediately north of the Ohio River and extended north from the bluffs inland for 3 to 5 miles. The defoliated area is a diamond-shaped area bounded by the Ohio River on the south, the city of Madison on the west and the picturesque river town of Vevay on the east. A total of 19,007 acres were defoliated in 2003.

The primary species defoliated included the oaks and sugar maple. Other defoliated species include black cherry and hickory. Mortality should occur during the second expected year of defoliation especially if there are stress conditions such as drought.

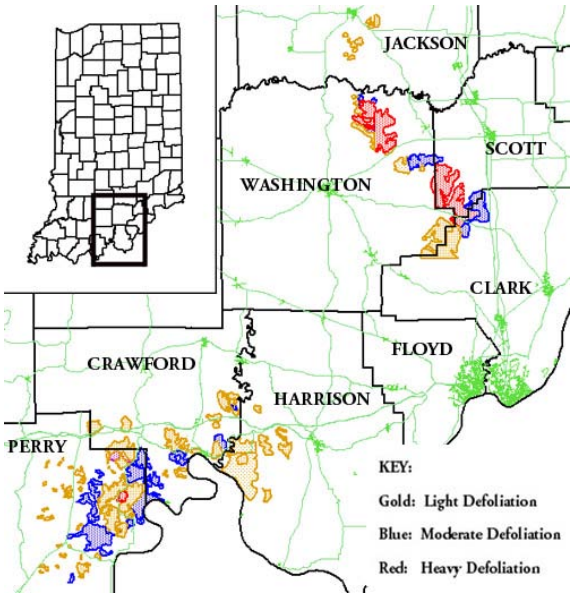
Defoliation is expected in 2004, increasing in area and intensity before natural control starts to occur. The last time FTC defoliated the forests of Indiana was in the late 1970's and that epidemic peaked in the second year and collapsed after the third year.

LOOPER COMPLEX – Linden Looper *Erannis tiliaria* and Half Winged Geometer *Phigalia titea*

Loopers throughout southern Indiana defoliated a total of 89,252 acres in 2003, the first year that this infestation was measured by aerial survey. This occurred

Loopers have been surveyed in Indiana since 1980 using trap trees. During this period, up to 68 looper habitat locations were annually surveyed, using 3 trap trees per plot. Female loopers, entangled on the trap's sticky bands when they climb trap trees to mate and lay eggs, serve as a predictor of that year's imminent defoliation.

The highest numbers of loopers were observed 24 years ago, with a high point of more than 43 females being caught per tree in the 1980 trapping season.



2003 Looper defoliation in south-central Indiana

Past experience of looper infestations show that they first plague extreme southern Indiana and eventually move in a wave as far north as Morgan-Monroe State Forest, south of Indianapolis. As in the past, the 2003 looper defoliation has commenced in areas where it first started in the 1979 – 1982 infestation.

Population collapse in the southern part of the epidemic is expected to start after 2004. Natural parasites and predators will cause the collapse, possibly being enhanced by cool, wet weather. Tree mortality is expected to become noticeable starting in 2004 because of the defoliation.

SECONDARY FOREST HEALTH PROBLEMS FOR 2003

CONIFER BARK BEETLES AND PINE PLANTATION MORTALITY.

Pine stands were planted on Indiana's public lands primarily from the 1930's to the 1950's. Many of these stands were never thinned and were planted with species that were outside of the their native ranges. The main purpose in these plantings was to stabilize steep soils from erosion, and secondarily serve as a nurse crop for emergent hardwoods. As these trees approach up to 70 years in age, they are in declining health and subsequently have been attacked by bark beetles of the genuses *Ips* and *Dendroctonus*. Pine stands primarily of red, shortleaf and loblolly pines have been affected throughout south-central

USDA, Forest Service, S&PF

Procera Root Rot tends to affect single trees in windbreaks

Indiana on public lands. Older-growth native Virginia pine at the Clark State Forest fire tower and other locations has also been affected. Stands of affected pines are found as scattered individuals or in small groups, affecting at most several acres. This is expected to expand in scope and severity as insect populations build into an increasing base of favorable habitat. Any effort to salvage these pines would be recommended, however softwood markets in Indiana are limited primarily to white pine and eastern redcedar.

WHITE PINE ROOT DECLINE

Procera Root Rot (White Pine Root Decline) has been noticeably killing white pine across the state for more than 10 years. During 2005, mortality from this disease continued its role as the most common request for assistance. It continues to kill windbreak, yard and plantation trees. This disease is the most common forest pest that landowners request assistance, and as such has the status of the number one disease in Indiana.

Trees from 4 to 30 feet tall and 3 to 6 inches in diameter are commonly killed. Trees can turn brown in color at any time of the year, but do so more commonly in the spring and fall. Infected trees appear light green and sparse or thin at first. Then the trees turn brown in a short period of time. Most landowners do not recognize the early symptoms of the disease. They usually see the dead brown tree and sawdust from woodborers that attack the dead tree. Management of the disease is accomplished through sanitation measures such as the removal and burning of fallen leaves. There is no cure or preventative treatment for the disease.

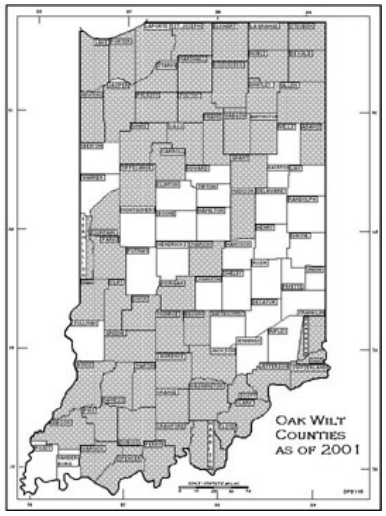
DECLINE/DEATH OF HICKORY, YELLOW POPLAR & ASH

Indiana landowners and foresters have reported dieback and mortality in Pignut Hickory, Yellow-poplar & Ash. It is probable that the 1999 and 2002 droughts are partially responsible for these reports.

To better understand these observations, the locations of certain declining hardwood groves will be identified through a survey of professional foresters. During 2004-5, surveys of these woods will be made and analysis will be used determine the association of decline symptoms with environmental factors. It is hoped that interpretations from this study will aid foresters and landowners in making sound management decision for future drought events.

OAK WILT

Oak wilt was confirmed from black and red oak in one location in Grant County in 2001. This is the latest county with a confirmed identification, increasing the number of counties with Oak Wilt to 62. No new counties have been added since 2001. Oak wilt is predicted to continue as a minor and localized concern in Indiana. Pockets of trees infected with the disease should be cut and properly treated. Injury to stems, especially in the red oak group, should be avoided to help prevent oak wilt from expanding.



Extent of oak wilt in Indiana in 2002

BUTTERNUT CANKER

Butternut is being decimated throughout Indiana by *Sirococcus clavigignenti-juglandacearum*, a fungus most likely introduced from outside of North America. Butternut Canker was first observed in Wisconsin, in 1967, and has since spread over nearly the entire range of this tree. Cankers develop throughout a tree, and when the resulting callus material encircles the stem, the tree will be girdled and die. The disease is spread by rain-splashed spores, possibly by insects and birds, and perhaps by seeds. Currently no butternut selections are available that have known canker resistance. A few healthy butternut trees have been found growing among diseased and dying trees and may be resistant to the disease. Reports of resistant butternut continue each year; however work limitations have slowed the screening of the reported trees. Landowners are still encouraged to locate and report healthy butternut to their District Forester, the State Forest Health Specialist or other Division of Forestry employees.


USDA, Forest Service, S&PF

ASH YELLOWS

Ash Yellows (also known as Ash Decline) continues to be found across the state primarily on white and green ash. The disease is caused by a wall-less microbe called a mycoplasmalike organism (MLO), and is possibly transmitted by leafhoppers. Symptoms of the disease, especially crown dieback and growth loss, are more prevalent in the northern part of the state. It is generally more common to observe the disease on wetter sites, but witches'-brooms (a diagnostic symptom) also can be found on trees growing on dryer sites. Trees in an advanced state of decline have the

greatest change with 7% dying annually. Cumulative mortality over this period was greatest in trees with advanced decline, about 49%. Healthy trees and early declining trees had mortality of 2% and 5%, respectively.

Landowners and forest managers should approach Ash Yellows as a chronic condition requiring long-term rather than immediate attention. Removal of affected ash trees can be considered over a long-term (e.g. 10 year) planning horizon, which coincides with cutting cycles for uneven-aged management on better-quality Indiana woodlands.

DUTCH ELM DISEASE RECURS NOTICABLY IN INDIANA

Since its introduction into the US, Dutch Elm Disease (DED) has had a devastating effect on native elm populations. With the increasing age classes of Indiana's forests, similarly aging elms are beginning to show a marked increase of mortality through DED. Nearly 25% of U.S Forest Service Forest Health Monitoring (FHM) program plot mortality volume was due to elm mortality chiefly due to DED, on FHM plots 1998 -2002.

As Indiana forests continue to age, the incidence of DED will probably increase. Forest managers should mark with prejudice elms greater than 16 inches diameter whenever encountered, particularly in stands already expressing DED symptoms to prevent economic loss and reduce the disease base.

BAGWORM INCREASES WITH MILD WINTERS

The common bagworm (*Thyridopteryx ephemeraeformis)*has increased occurrence, which is probably linked to recent mild winter seasons. The larvae seem to prefer arborvitae and red cedar but many other conifers and deciduous trees are attacked. These include: pine, spruce, cypress, juniper, willow, black locust, sycamore, apple, maple, elm, poplar, oak, and birch. Bagworms tend to be less common in Indiana north of Indianapolis. However, increasing populations have greatly impacted tree species such as arborvitae north of the capital. Bagworms are difficult to control because they are often unnoticed until mature. They need to be sprayed for before the end of June, and require careful observation to note their activity.

IMPACT OF EASTERN TENT CATERPILLAR AND JUMPING OAK GALL LESSENS CONSIDERABLY

Black cherry trees in southern and central Indiana noticeably less affected by **Eastern Tent Caterpillar** (ETC) during May 2003, compared to 2002. Defoliation affected far fewer trees, and on those trees generally to a lesser

degree than the complete defoliation that had occurred during the last two years

By 2003, parasites had built high populations to control ETC. Consequently, the level of defoliation is expected return to very low levels for future years. A large fly was the parasite that similarly controlled Forest Tent Caterpillar during a 1970's outbreak similarly appeared to help control ETC.

Similarly, **Jumping Oak Gall** (caused by one or more species of a Cynipid wasp (*Neuroterus spp*.) has largely disappeared from view. Jumping oak gall forms its gall in late May and early June on the underside of the foliage, causing the leaves to yellow than turn brown. 1999 was the first occurrence of this gall in Indiana's forests.

During aerial surveys of the northern part of Harrison Crawford State Forest in June 2003, scattered discoloration of oak stands observed was thought to be caused by Jumping Oak Gall. Time did not permit subsequent ground-truthing of this phenomenon. The extant of browning on oak stands was much less than that observed in nearby stands affected in 2002, indicating a much-reduced presence.

NEW EXOTIC INSECTS AND DISEASES OF CONCERN

SUDDEN OAK DEATH – *Phytophthora ramorum*

By the summer of 2001, ten California counties had been affected by Sudden Oak Death, resulting in the loss of tens of thousands of oak trees in the northern coastal part of the state. As a water-based mold, this disease has potentially to spread rapidly under humid conditions. Moreover, the list of alternate hosts to this newly described disease is continuing to expand.

Greenhouse studies have shown that red oak species native to Indiana are as susceptible to SOD as those red oak species it currently afflicts on the West Coast. This susceptibility combined with warm humid weather prevalent in the southeast US causes concern that SOD might expand east in southern Indiana forests.

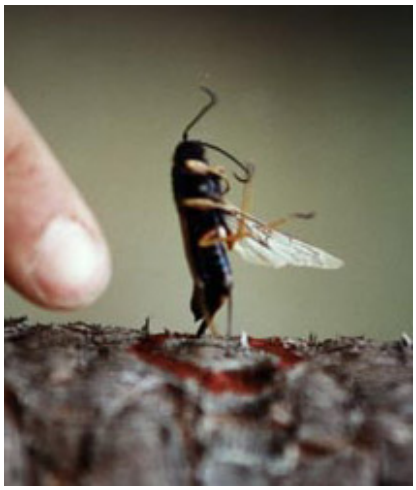
Monitoring of California nursery stock and survey of oaks near to possible site of introduction will probable tools to limit SOD introductions, with methods refined as knowledge develops.

EMERALD ASH BORER – Agrilus planipennis

Detection Survey – Emerald Ash Borer has been recently reported in the Detroit metropolitan area as the cause of potentially millions of ash trees. Because of the proximity of Detroit to the ash-rich forests of northern Indiana, a road survey was initiated in 2003.
Surveyors were trained to identify ash trees and particularly those in decline. During the course of 5,179 survey miles driven in 5 northeastern Indiana counties, 20,801 ash trees were observed. Those trees appearing to be in decline were examined closely, with thankfully none exhibiting symptoms of EAB. A similar study of northeastern Indiana sawmills yielded similarly negative results.

SIREX WOODWASP

Sirex noctilio, the European wood wasp, was found in a Bloomington industrial location during the summer of 2002. This was the first detection of this species in the US. The wasp originated with a shipment of materials that came from Spain. It is found there, as well as Australia, New Zealand, and South Africa where it is a significant pest of pine forests.
Unlike similar species native to the US, *Sirex noctilio* mass attacks trees resulting in rapid loss of vigor and death. Because it is a non-native insect, it is thought to possess great potential for damage.



Sirex female laying eggs (USDA Forest Service)

IDNR Entomology and Forestry personnel are currently in their first year of surveys near the original introduction. Red, Virginia, and shortleaf pine trees were frilled and treated with an herbicide (dicamba) to create conditions of stress that could attract any *Sirex* nearby. Trap logs were placed around the interception sites and in areas where trap trees could not be used. At the end of the growing season, these trap trees and trap logs were collected, cut, and placed in cages to monitor emergence in 2003. To date, *Sirex* has not been detected.

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