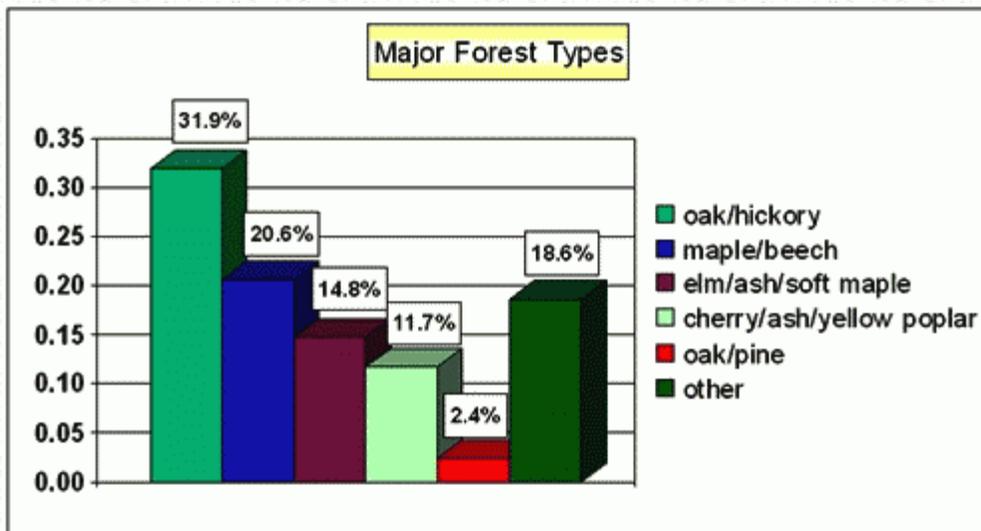


1997 Forest Health Highlights Indiana

The Resource

Indiana ranks third nationally in hardwood lumber production adding over \$4 billion to the state's economy. Of the over 750 business and manufacturers in the forest products industry, 56,600 people are employed with a total payroll over \$1 billion annually.

The forest products industry is the fifth largest manufacturing industry in the state. To support the industry, approximately 500 million board feet were harvested in the most recent year for which statistics are available. For the second quarter of 1997, lumber/wood products exports totaled \$57 million an increase of 22% from the first quarter. Indiana continues to grow approximately 40% more material (14% more in sawlog volume) than is utilized to produce sawtimber, veneer, handles, pulp and cooperage; however this margin has narrowed in recent years as a result of increased global and domestic demands for Indiana hardwood products. Since 1907, forest land increased approximately 430,000 acres, and the volume of timber increased 54% during the last 20 years. Hardwoods account for 96% of the forest that is identified into 13 forest types. Good sites (ability to grow trees 70 feet tall at age 50) represent 76% of the forest which is privately owned (88%).



◇ Total acres 23,171,000
◇ Forested acres 4,439,000
◇ Percent forested - all land 19%
◇ Percent timberland - all land and 17%
◇ Percent timberland - all forest land 99%
◇ Reserved acres - 58,000 or .3% of forest land

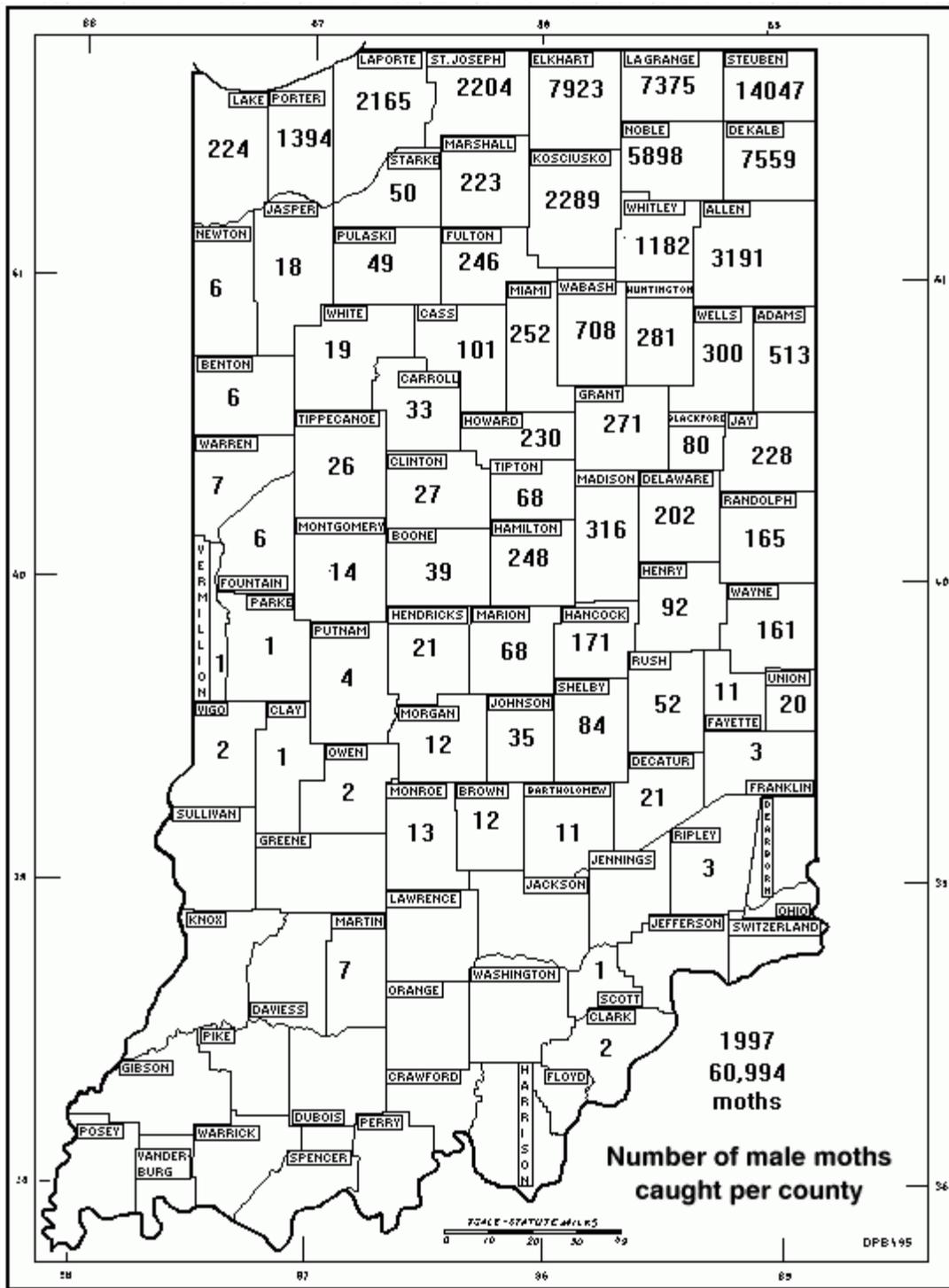
Special Issues

White Pine Root Decline (*Verticilladiella procer*) is the most damaging forest health problem of the 1990's. Trees in windbreaks, yards, Christmas tree plantations and forest plantings have died in increasing numbers. Several Christmas tree plantations have experienced mortality from 5 to 50% of the trees in the planting during the last 3-5 years. Dying/dead windbreak trees from 6 to 40 feet tall resulted in the most phone calls from

homeowners requesting management information to save the remaining trees. The sawdust from sawyer beetles has promoted many people to call for assistance in 1997. Although not investigated, this would indicate that bark beetles and sawyers increased their populations and may have a greater role in the loss of white pine in recent years. No direct control measures are available once symptoms appear. Management of the disease is through sanitation (removal/destruction of infected trees) and planting on sites with good internal drainage. A general observation indicates the disease to be more common on 'wetter' sites (poor drainage).

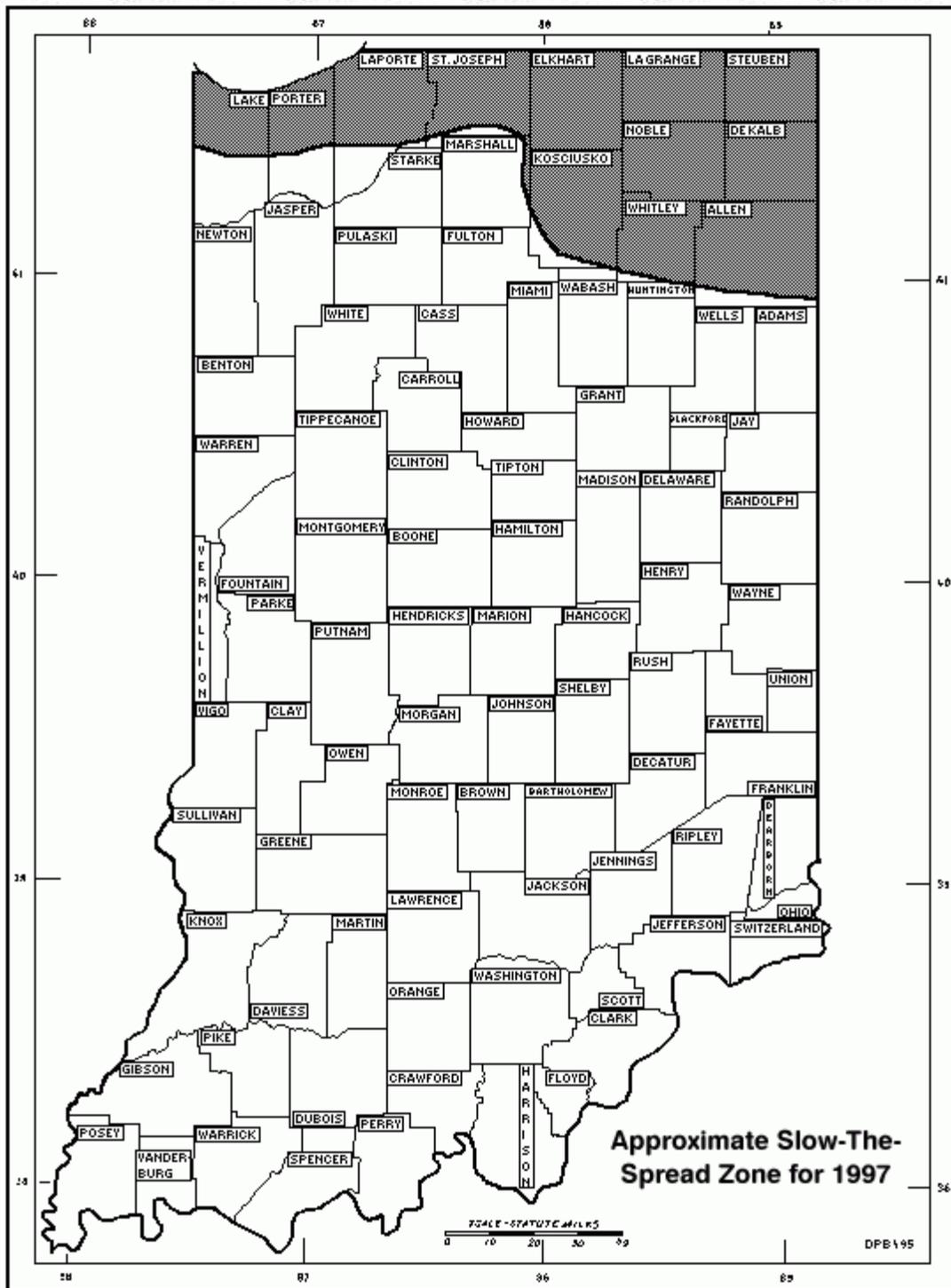
The question among forest health specialists is - "Where, oh Where, did they come from?". The 1997 **Cooperative Statewide Gypsy Moth Survey** detected 61,194 moths from 68 of the 92 counties. This was a tenfold increase from 1996 when 5798 moths were detected in 36 counties, and more than a doubling of the cumulative moth catch from 1972 to 1996 (26,698).

The increase in moth catch is the result of a "BLOW-IN" event that occurred on July 19-20th and extended two thirds the length of the state from north to south and two thirds the width of the state from east to west. From examination of moth color, size and condition, the debate is whether the "BLOW-IN" is a from larvae or male moth and where they came from. Irregardless of the origin, the "BLOW-IN" has confused the interpretation of the trap catch data and evaluation of sites for treatment. The 1998 survey will provide more information to understand the "BLOW-IN" event.



The Slow-The-Spread zone is a 1-2 county layer below the Michigan border where eradication treatments are applied to slow gypsy moth development. In 1997, four sites in Allen, Noble, St. Joseph and Steuben counties totaling 850 acres were treated with B.t. (Foray 48B). Three applications were made in all counties except Steuben which only had two applications. All sites were mass trapped with four additional sites in Steuben county mass trapped.

One area of concern for GM spread is southwest Hamilton county between Carmel and Noblesville(suburbs of Indianapolis metropolitan area). This area has a constant influx of household moves and introduction of nursery stock. For several years, GM has been detected in scattered locations in the Carmel and Noblesville area; however multiple life stages have not been found. Even though a population of GM has not been identified, the survey has shown that GM is being introduced to areas far in advance of the population coming out of Michigan.



Dogwood Anthracnose - *Discula destructiva* - was introduced on nursery stock in recent years and is now becoming a health problem to understory dogwood found in the of Indiana's forests. In one area, approximately 1-2 acre in size, in Parke county over 75% of the dogwood were dead or dying from this disease. Also, the reported death of understory dogwood in several south central counties from 1993 to 1995 was probably the result of this disease, but was not identified as such because of the difficulty in finding leaf spot symptoms and isolating the fungus.

Other Issues

Fall Webworm - *Hyphantria cunea* - defoliation was heavy in areas of southern Indiana and northwestern Indiana. Black cherry, black walnut, hickory, sycamore, sassafras and redbud were commonly webbed. The sight of the web raised the concern of black walnut growers that

the health of their trees was in danger. Fall webworm has two generations per year with the second generation doing most of the defoliation late in the growing season. Because the defoliation is late in the season, the effect to the tree's health is reduced because it has done most of its growing for the season. Populations usually remain high for 2-3 years and then disappear which should occur in 1998 and 1999.

Fall webworm is often called **Bagworm** by landowners and the public. The confusion between the two insects because of the common names was more so in 1997. Bagworm, *Thyridopteryx ephemeraeformis*, developed one month later than normal because of the cool wet spring. Usually, defoliation starts in June through July, but was not present until August this year. Also, bagworm is expected on arborvitae, eastern red cedar, pines and spruce. In August, sycamore, boxelder and soft maple were completely defoliated in several south central counties. In each situation, bagworm was avoiding all other species.

For Christmas tree growers, **Zimmerman Moth**, *Dioryctria zimmermani*, continues to be a major insect health problem. In recent years, the population of zimmerman moth has enlarged within plantations and spread farther south in the state. Commonly found in the northern part of the state, zimmerman moth is becoming more common in southern Indiana plantations.

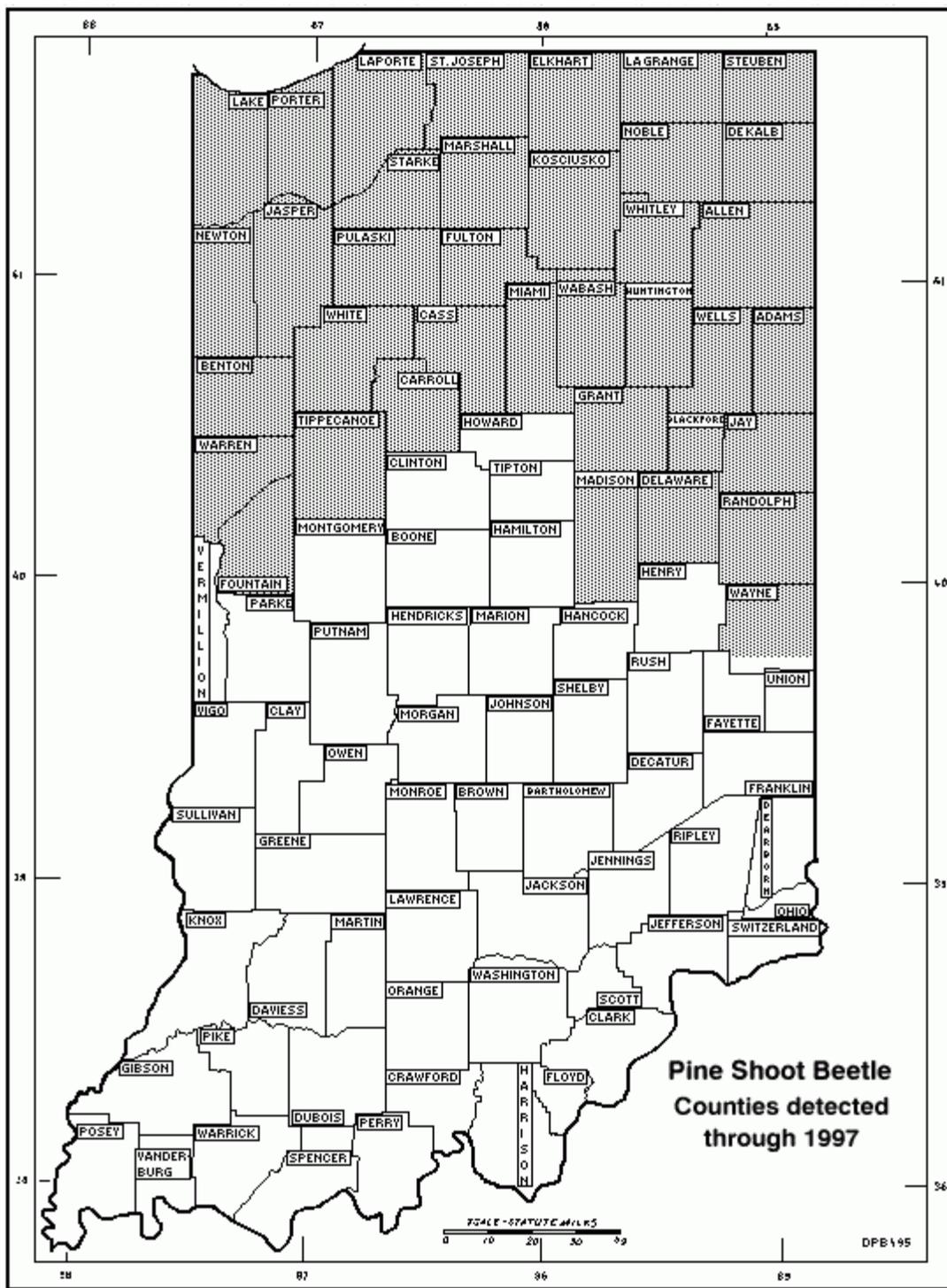
Also affecting Christmas tree health was the disease **Diplodia Tip Blight**. The cool wet spring weather is favorable to the spread and development of this disease. Many growers of scotch pine complained of twig death in their harvestable trees. Concerned about the quality of their trees and planning for the 1998 harvest, growers are requesting and planning fungicide programs to prevent similar damage in 1998.

In the 1990's, it is becoming common place to have **Anthraco nose** defoliate sycamore across wide areas of the state each spring. And when anthracnose defoliation is heavy on sycamore, noticeable defoliation and damage can be expected on oak (primarily white oaks), ash and maples. 1997 was no different as heavy defoliation occurred across the state.

Regional Issues

The distribution of **Pine Shoot Beetle**, *Tomicus pineperda*, has moved slowly with four counties added during the past two years. This is still a regulatory pest and not considered a serious threat to the health of the pine forests of the state.

Butternut canker affects trees throughout the state. During the past two years, nine butternut were located that may have resistance/tolerance to this disease. Scionwood was collected from these trees and grafted onto black walnut. Eventually, the grafted trees will be challenged with the disease to determine resistance/tolerance.



Forest Health Monitoring Survey

In 1996, Forest Health Monitoring (FHM) established 144 plots across the state. Of these, 38 plots had a forest condition. The FHM plot consists of 4 subplots with each subplot a fixed radius of 24 feet. FHM plots are located according to a national survey grid and are approximately 16 miles apart.

The information collected in the FHM survey is part of a national design. Thus, results of the survey are used to make comparisons and analysis on a national or forest type basis. Using the data to make analysis within state boundaries is not statistically sound as this time. However, the baseline data can give a "snapshot" of the trees and forests in Indiana at the start of the annual FHM survey.

The FHM survey began the next statewide Forest Inventory and Analysis (FIA) of Indiana's forest resources (last survey 1986) by combining FIA into FHM. The FIA survey is in progress at this time and is expected to complete field work by May, 1998. The FHM survey completed the remeasurement of approximately one fourth of the plots in 1997 as part of the annual remeasurement. Analysis of change data will be reported in 1998. Future work will continue to incorporate the FIA into the annual survey work of FHM.

Number of trees 5.0+ DBH	
Maple	111
Ash	92
Oak	81
Hickory	53
Elm	49
Yellow Poplar	44
Other Genus/species	200

On each subplot, information is taken on all trees 5.0+'' DBH. A microplot is used to collect information on seedlings (<1.0'') and saplings (1.0-4.9''). The tree information collected consists of crown and damage measures. Crown measures are live crown ratio, crown density, foliage transparency, dieback, crown position, crown exposure and crown diameter.

Using these measures and making comparisons between years, the FHM survey should identify a problem with a tree species or forest type. Once identified, a problem can be evaluated on a more localized basis to understand the problem and define management measures

Six forest types were represented in the survey with Oak/Hickory the predominate type followed by Maple/Beech/Birch. The survey examined 630 trees 5.0+'' DBH in 1996. Maple, ash, oaks(, hickory, elm and yellow poplar were the most common examined. For saplings, maple, elm, beech and yellow poplar were the most common with ash, oak and hickory a small component.

The **crown measures** of foliage transparency, crown density, dieback and live crown ratio can be used to access the tree's "health". Trees with **low** foliage transparency and dieback values and **high** crown density and live crown ratio have increased potential for carbon fixation, nutrient storage, survival and reproduction.

Dieback by Genus/Species for trees > 5.0'' DBH (% of all trees examined)	
Oak	2.7%
Elm	2.0%
Ash	1.7%
Maple	1.4%
Yellow Poplar	1.1%
Hickory	0.6%
Aspen	0.6%
Other Hardwoods	4.8%

For **foliage transparency**, which is used to indicate defoliation, the survey found 97% of the hardwoods and 92% of the softwoods had normal transparency (<30%). Only maple, oak, elm and ash had any trees with moderate to severe transparency (30-50% & >50%).

Dieback is the amount of current years twigs that have died in the outer tree crown. No dieback was found on 84% of the hardwoods and 96% of the softwoods. Light dieback (6-20%) was observed on 13.7% of the hardwoods. Moderate to severe dieback (21-50% & >50%) was recorded on 1.6% of the hardwoods. Only one softwood tree had dieback. By genus/species, Oak, elm, maple, ash and yellow poplar had the most dieback recorded.

Crown density is the amount of foliage, twigs, branches, and seeds in the crown. The survey found 98.7% of all trees had average to good density (21-50% & >50%). Only hardwoods - elm, yellow poplar and black walnut - recorded trees with poor density (<20%). By genus/species, ash, aspen, and beech had more trees with average density than a good density. Maples had the highest percent of trees with good density for the hardwoods.

For hardwoods, 64% of the trees had **Live Crown Ratios** greater than 40%; whereas the

softwoods had 87% of the trees greater than 40%. Examining individual genus/species, there may be concern with ash, yellow poplar, black walnut and elm that had 40%, 58%, 57% and 66%, respectively, of the trees sampled with LCR >40%. This may indicate a problem in the "health" of this genus/species.

Crown Density within genus/species (% of genus/species sampled)		
Genus/Species	Average (21%-50%)	Good (> 50%)
Sweetgum n=6	16.7	83.3
Maple n=111	22.5	77.5
Yellow poplar n=44	22.7	75.0
Walnut n=16	25.0	68.8
Basswood n=3	33.3	66.7
Hickory n=53	37.7	62.3
Elm n=49	38.8	57.1
Oak n=81	48.2	51.8
Beech n=13	53.8	46.2
Ash n=92	57.6	42.4
Aspen n=8	62.5	37.5
cottonwood n=3	100.0	00.0
Other Hardwoods n=128	46.1	50.8

Another measure used to assess the "health" is damage. Damage indicators are cankers, open wounds, decay conks, broken bole, brooms, dead terminals, discolored foliage and more. The survey found no damage on 70% of the hardwoods and 91% of the softwoods. By genus/species, of all trees sampled, maple, ash, oak, hickory, elm, yellow poplar and beech had damage recorded more than other species. Within a genus/species, beech, maple and ash had the highest percentage of trees with damage. In the hardwoods, 8% of the trees sample had more than one damage. (Three damages can be tallied per tree).

The most common damages recorded were decay indicators,

loss of apical dominance, open wounds, broken branches and cankers. Decay indicators represented 70% of the damages recorded.

From the initial data, the "health" of ash, yellow poplar, elm and perhaps maple and oak in Indiana needs to be monitored for future change. The live crown ratio, crown density, crown transparency and crown dieback data for these genus/species indicate they may have a greater "health" concern than other genus/species. Evaluating 1997 remeasurement data and comparing Indiana data to regional data within genus/species may provide an understanding of the "health" of forest resources in Indiana.

Crown & damage measures indicating the need to monitor the "health" of the tree							
Genus/species	transparency: % of trees > 30% transparency	density (%)	dieback (% of trees)	density (%)		live crown > 40% (% of trees)	% of trees with 'X' damage(s)
				Average	Good		
						0	3
ash	6.5	1.7	5.6	42.4	40.0	66.3	1.0
yellow poplar	0.0	1.1	22.7	75.0	58.0	75.0	2.3
maple	0.9	1.4	22.5	77.5	82.0	65.8	0.9
oak	2.5	2.7	48.2	51.8	71.0	77.8	0.0

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the baseline data can give a "snapshot" of the trees and forests in Indiana at the start of the annual FHM survey.

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February 1997