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Indiana's Forest Resources in 2001

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CONTENTS

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The North Central Research Station's Forest Inventory and Analysis (NCFIA) program began fieldwork for the fifth forest inventory of Indiana's forest resources in 1999. This inventory initiated the new annual inventory system in which one-fifth of the field plots (considered one panel) in the State are measured each year. A complete inventory consists of measuring and compiling the data for all plots (or five panels). Once all panels have been measured, each will be remeasured approximately every 5 years. For example, in Indiana, the field plots measured in 1999 will be remeasured in 2004.

In 2001, NCFIA continued the annual inventory effort with the third panel of the fifth Indiana forest inventory. Previous inventories of Indiana are dated 1950, 1967, 1986, and 1998. This fifth inventory of Indiana's forest resources will be completed in 2003. However, because each year's sample is a systematic sample of the State's forest and because timely information is needed about Indiana's forest resources, estimates have been prepared from data gathered during the first 3 years of the inventory. Data presented in this report represent 60 percent of the field plots (or three panels) for a complete inventory and are a combination of the first year's panel from 1999, the second year's panel from 2000, and the third year's panel from 2001. Earlier reports for the 1999 panel (Miles 2001) and the combined 1999 and 2000 panels (Schmidt *et al.* 2002) have also been published. The results presented are estimates based on sampling techniques; estimates were compiled assuming the 1999, 2000, and 2001 data represent one sample. As additional annual inventories are completed, the precision of the estimates will increase and additional data will be released.

Data from new inventories are often compared with data from the previous inventory to determine trends in forest resources. However, for the comparisons to be valid, the procedures used in the two inventories must be similar. As a result of our ongoing efforts to improve the efficiency and reliability of the inventory, several changes in procedures and definitions have been made since the last Indiana inventory in 1998 (Schmidt *et al.* 2000). While these changes will have little impact on statewide estimates of forest area, timber volume, and tree biomass, they may have significant impacts on plot classification variables such as forest type and stand-size class. Some of these changes make it inappropriate to directly compare portions of the 2001 data with those published for the 1998 inventory.

RESULTS

Area

There are 23 million acres of land in Indiana. Forest land totals 4.4 million acres, or about 19 percent, of the State's total land area (table 1). Forest land has three components: 1) Timberland[1]—forest land that is not restricted from harvesting by statute, administrative regulation, or designation and is capable of growing trees at

[1] *Timberland may not be equivalent to the area actually available for commercial timber harvesting or other access. The actual availability of land for various uses depends upon owner decisions that consider economic, environment, and social factors.*

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a rate of 20 cubic feet per acre per year; 2) Reserved forest land—forest land that is restricted from harvesting by statute, administrative regulation, or designation (e.g., national wilderness areas); and 3) Other forest land—forest land that is not capable of growing trees at a rate of 20 cubic feet per acre per year.

Timberland area totals 4.3 million acres, accounting for 97 percent of the forest land area in Indiana (table 2). Timberland area in Indiana has remained fairly stable since 1986 (fig. 1). The relative stability of timberland area over the past 15 years, during an era of suburban expansion, is partially due to the expansion of timberland into land that was once mostly used for agricultural purposes. For instance, some of the added timberland had been partially covered with trees but initially did not have sufficient tree cover to qualify as timberland. As these lands gradually added more trees and existing trees continued to grow, they attained a level of stocking sufficient to qualify as timberland (Schmidt *et al*. 2002). Also, the establishment of trees along riparian areas, and initiatives such as the Conservation Reserve Program, contributed to the increase in Indiana's timberland area.

In Indiana, individuals and corporations (private owners) hold nearly 3.7 million acres of timberland, or 85 percent of the timberland area in Indiana. Individuals and other private owners hold timberland for a variety of reasons. The remaining 15 percent of the timberland area in Indiana is publicly owned (table 2). The State of Indiana, the Hoosier National Forest, and the U.S. Department of Defense hold most of this portion of the timberland base. Public ownership of timberland provides a number of societal benefits, including recreation opportunities, wildlife habitat, watershed protection, timber, and non-timber products.

Hardwood forests predominate in Indiana. About 97 percent of all timberland area supports mostly hardwoods (table 2). Public timberland area plays an important role in providing species diversity because virtually all acres of softwoods were planted on public land (table 2).

Indiana's timberland is comprised of a wide variety of tree species. To facilitate describing forest composition, the various tree species found in Indiana are put into forest type groups that reflect the combination of tree species that

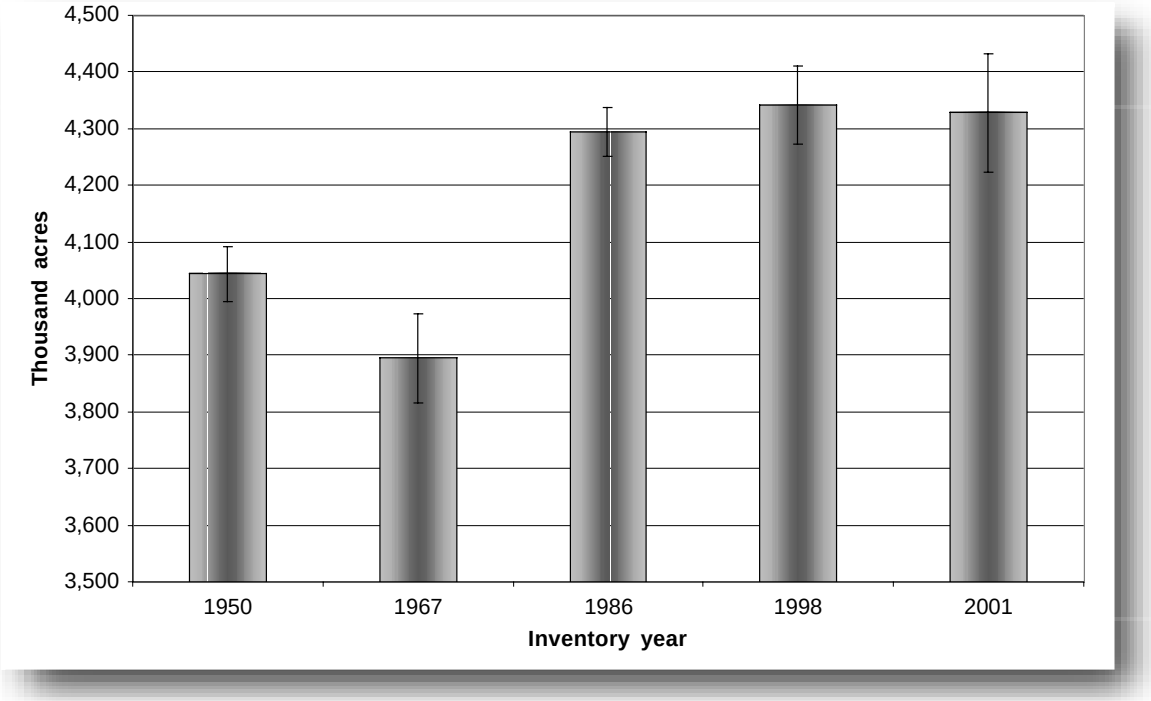

Figure 1.—*Area of timberland, Indiana, 1950-2001. (Note: The sample error associated with an inventory is represented by the vertical line at the top of its bar.)*

occur on a particular site. The classification is based on the species forming a plurality of live tree stocking on the site. Forest type group names are from the national Forest Inventory and Analysis (FIA) program's list of forest types. The national forest type group list was developed to ensure consistency in reporting across regions of the country and may not always effectively describe a particular local situation. For example, the pinyon/juniper forest type group is used to describe the forest type that contains eastern redcedar. An estimated 39.6 thousand acres of timberland in Indiana are classified as the pinyon/juniper forest type group (table 1). In reality there is no pinyon or juniper in Indiana; the pinyon/juniper is actually eastern redcedar. (See Miles *et al.* 2001 for a complete list of national FIA forest types with detailed types.) The fourth panel (2002 data) of inventory report will provide tables that list the national forest type groups as well as the detailed forest types.

The oak/hickory and the maple/beech/birch forest types combined occupy 81 percent of the timberland area in Indiana (table 3, fig. 2). Bottomland hardwoods—elm/ash/cottonwood and oak/gum/cypress—occupy 14 percent of all timberland area. Coniferous timberlands play only a minor role in Indiana's forest; only 2 percent of the total timberland area has conifers as the dominant species.

Stand-size class is a measure of the average diameter of the dominant trees in a stand and reflects the size structure of stands. There are three stand-size classes: sawtimber, poletimber, and sapling/seedling. The area classified as sawtimber (stands with a plurality of stocking in trees more than 11.0 inches in diameter at breast height (d.b.h.) for deciduous species and 9.0 inches d.b.h. for conifers) accounts for 72 percent of the timberland area in Indiana (table 3, fig. 3). The area of timberland in the sawtimber stand-size class increased between 1998 and 2001, but only by an estimated 14 thousand acres. The area classified as poletimber (stands where a plurality of the stocking is in trees from 5 to 9 inches d.b.h. for conifers and 5 to 11 inches d.b.h. for deciduous species) decreased by nearly 70 thousand acres, declining from 23 percent of timberland area in 1998 to 19 percent in 2001. The substantive area of timberland supporting stands of sawtimber-size trees suggests a maturing forest. However, it is likely that many of the stands dominated by larger trees have smaller trees growing in the understory.

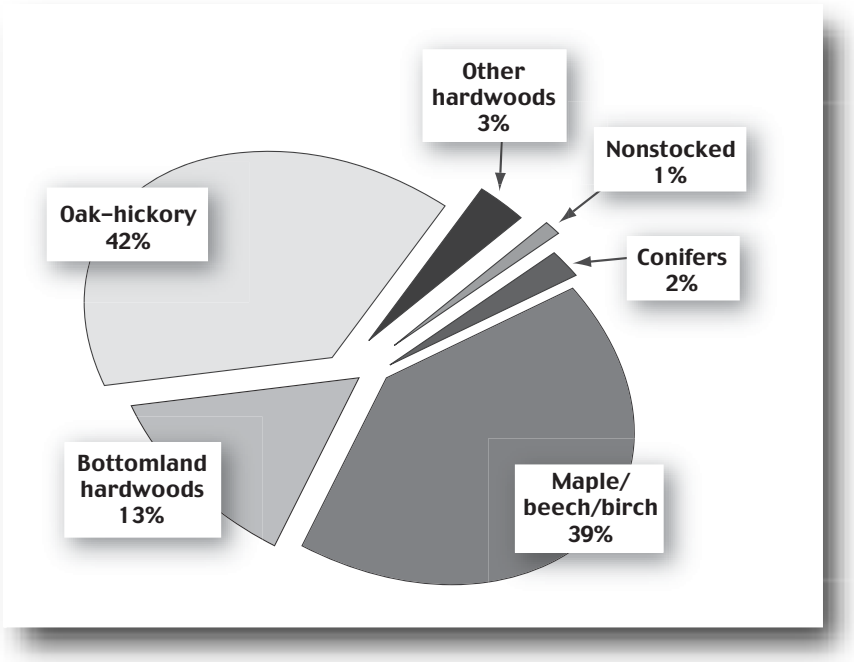

Figure 2.—*Area of timberland by forest type groups, Indiana, 2001.*

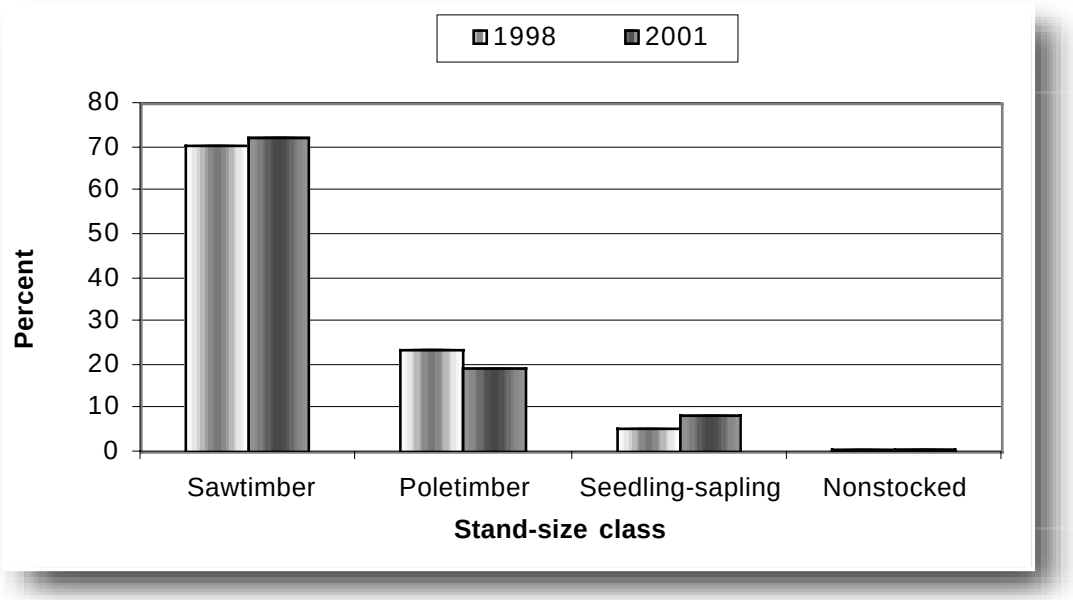

Figure 3.—*Percent of area of timberland by stand-size class, Indiana, 1998 and 2001.*

Volume

Total net volume of all live trees on forest land in Indiana is 8.1 billion cubic feet, which equates to 1,830 cubic feet per acre of forest land (table 4). Net volume is the amount of sound wood computed from a 1-foot stump to a 4-inch top diameter outside bark for live trees at least 5 inches d.b.h. Eight of every ten cubic feet of live volume are on privately owned forest land. Ninety-seven percent (7.9 billion cubic feet) of net volume of all live trees is contained in hardwoods, and 28 percent is in oak trees.

Growing-stock volume on timberland is a measure that has traditionally been used to ascertain wood volume useful for commercial purposes. Growing-stock volume is the amount of solid wood on timberland in commercial trees 5.0 inches d.b.h. and over, from 1 foot above ground (stump) to a minimum 4-inch top diameter with deductions made for poor form or defect. Growing-stock volume excludes rough, rotten, and dead trees and noncommercial tree species. Indiana's growing-stock volume totals 7.1 billion cubic feet, representing 89 percent of the total live volume (table 5).

Eleven percent of volume of all live trees on timberland is in live cull trees—865.5 million cubic feet. Cull volume is often used for commercial purposes. For instance, rough trees are sometimes used for making pallets or for chipping. Salvable dead trees contain 96.6 million cubic feet of wood volume. Dead trees are also used for commercial purposes—they are an important source of firewood. Salvable dead trees are also important to wildlife species, such as cavity nesting birds.

The vast majority of growing-stock volume is in trees in the oak/hickory group, and the maple/beech/birch group. About half (3.3 billion cubic feet) of growing-stock volume is in trees in the oak/hickory forest type group (table 6). Thirty-five percent of growing-stock volume is in the maple/beech/birch group. Growing-stock volume present in the conifer forest type groups accounts for only 2 percent (161.9 million cubic feet) of Indiana's growing-stock volume. However, growing-stock volume for all conifer trees amounts to 3 percent (240.5 million cubic feet) of total growing-stock volume because conifers are sometimes found in hardwood stands (table 6).

Seventy-eight percent of all growing-stock volume is in trees that are 11 inches and larger (table 7). Twenty-three percent of the total growing-stock volume is in trees that are 21 inches d.b.h. and larger; most of this volume is oak.

Since the 1950s, growing-stock volume in Indiana has increased with each succeeding inventory (fig. 4). The increase in growing-stock volume reflects a forest that is maturing, as well as a forest where growth outpaces removals and mortality.

Sawtimber volume is a subset of growing-stock volume. It is the volume of the saw log portion of live sawtimber measured in board feet. Although the Doyle Rule is widely accepted and used by forest industry in Indiana, sawtimber volume for reporting purpose is generally measured using the International 1/4-inch rule. Sawtimber volume in Indiana totals 26.8 billion board feet (table 8). Over 96 percent of sawtimber volume is in hardwood trees. Of total sawtimber volume, 28 percent is in trees with diameters of 21 inches or greater. On an individual species basis, four species account for nearly half of the sawtimber volume in Indiana: yellow-poplar with 3.5 billion board feet; other red oaks with 3.1 billion board feet; select white oak with 3.0 billion board feet; and hickory with 2.9 billion board feet.

Biomass

Live aboveground tree biomass in Indiana is estimated at more than 218 million dry tons, or 51 dry tons per acre of timberland. On average, dry tons per acre of tree biomass in Indiana exceeds that of neighboring states Michigan (40 dry tons per acre) and Illinois (48 dry tons per acre). Forest biomass includes all live aboveground tree biomass in growing-stock trees, non-growing-stock trees, and all live 1- to 5-inch trees (table 9). Eighty-one percent of the total biomass is in growing-stock trees, 13 percent is in non-growing-stock trees, and the remaining 6 percent is in trees less than 5 inches d.b.h. Ninety-eight percent (214 million dry tons) of all live aboveground tree biomass is in hardwood species. Biomass estimates are increasing in importance for analyses of questions about carbon sequestration, wood fiber availability for fuel, and potential wildfire fuel loads in forest stands.

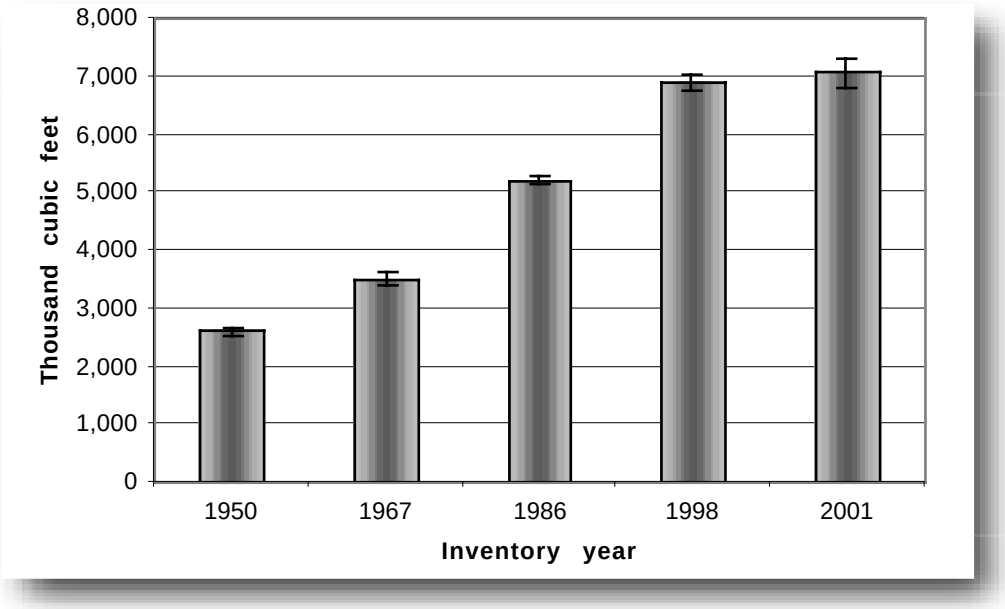

Figure 4.—*Growing-stock volume on timberland, Indiana, 1950-2001. (Note: sampling errors associated with each inventory are represented by the vertical lines at the top of each bar.)*

Forest Health

The information presented about pathogens and insects affecting Indiana's forests was obtained from the National Forest Health Monitoring Program (FHM) at: http://www.na.fs.fed.us/spfo/fhm/index.htm, and the Central States Forest Health Watch newsletter for November 2002 available at: http://www.na.fs.fed.us/spfo/pubs/newsletters/csfhw/index.html.

During 2002 moderate to heavy defoliation by locust leaf miner was observed on black locust trees in the southern half of Indiana. Bagworm defoliation, which usually occurs in the southern half of Indiana, was observed in the northern half of the State. Because of recent mild winters, bagworm populations are surviving in northern Indiana and causing noticeable heavy defoliation to individual trees. Bagworm was reported in the northern quarter of the State for the first time in many years.

In south central Indiana, "flagging" of ash branches throughout the tree crown occurred in August and September of 2002. The flagging symptom is similar to cicada injury but without the oviposition wound and branch breakage. Drought conditions are believed to be the cause.

Drought conditions were evident in the forests of southern Indiana. Yellow-poplar had dropped most of its foliage in response to the drought. By August, the yellowing inner foliage of yellow-poplar made it easy to outline distribution of this species in the forest. Sycamore also showed early fall color (yellowing) in August and September of 2002 because of the drought.

Indiana's gypsy moth management program is holding gypsy moth in place in northern Indiana. Another reason that gypsy moth has not advanced in the State may be the natural parasites and predators. Although not expected to occur with the current low population level of gypsy moth in Indiana, the fungus, *Entomophaga maimaiga*, and the virus, NPV, are present in some counties where the moth is prevalent. Both have been confirmed from dead caterpillars in Steuben and Dekalb Counties. A small wasp that preys upon gypsy moth egg masses has also been found in some counties where the moth is prevalent. Thus, the natural enemies of gypsy moth may be impacting the spread and development of gypsy moth in Indiana.

Two exotic forest pests, the emerald ash borer and the Asian longhorned beetle, are potential threats to Indiana forests. The emerald ash borer has infested trees in Michigan near Detroit and in extreme northwest Ohio. The emerald ash borer attacks and eventually kills ash trees. The Asian longhorned beetle has infested trees in the Chicago area. The Asian longhorned beetle feeds on a wide variety of hardwood trees, including maple, elm, birch, willow, and poplar. Both pests are a threat to Indiana's forest because of the close proximity of infestation areas to Indiana. To date, neither pest has been observed in Indiana.

Summary

Indiana's forest area appears to be holding steady. Growing-stock volume is increasing as the forest matures. Indiana's forest resources appear to be reasonably healthy, but there is concern as the resource continues to age and grow more susceptible to invasive insect species. As additional data become available from ensuing annual inventories, a more precise picture of the direction of Indiana's forests will emerge. Additional data related to the two most recent inventories of Indiana (1998 and 2001) are available at: www.ncrs.fs.fed.us/4801/fiadb/index.htm.

APPENDIX

Inventory Methods

Since the 1998 inventory of Indiana, several changes have been made in NCFIA inventory methods to improve the quality of the inventory as well as to meet increasing demands for timely forest resource information. The most significant difference between inventories is the change from periodic inventories to annual inventories. Historically, NCFIA periodically inventoried each State on a cycle that averaged about 12 years for recent inventories. However, the need for timely and consistent data across large geographical regions, combined with national legislative mandates, resulted in NCFIA's implementation of an annual inventory system. Indiana was one of the first States in the North Central region, and one of the first States in the Nation, to be inventoried with this new system, beginning with the 1999 inventory.

With an annual inventory system, about one-fifth of all field plots are measured in any one year. After 5 years, an entire inventory cycle will be completed. After the first 5 years, NCFIA will report and analyze results as a moving 5-year average. For example, NCFIA will be able to generate a report based on inventory results for 1999 through 2004 or for 2001 through 2006. While there are great advantages for an annual inventory, one difficulty is reporting on results in the first four years. With the 2001 annual measurements, 60 percent of all field plots have been measured. Sampling error estimates for the 2001 inventory results are area of forest land 2.35 percent; area of timberland 2.42 percent; number of growing-stock trees on timberland 4.30 percent; volume of growing stock on timberland 3.66 percent; and volume of sawtimber on timberland 3.19 percent. These sampling error estimates are higher than those for the last periodic inventory completed in 1998 (i.e., 1.59 percent for timberland area and 2.18 percent for growing-stock volume) because of the smaller sample sizes. Thus, caution should be used when drawing conclusions based on this limited data set. As we complete ensuing measurements, we will have additional confidence in our results due to the increased number of field plots measured. As each measurement year is completed, the precision of estimates will improve.

Other significant changes between inventories include the implementation of new remote sensing technology, the implementation of a new field plot design, and the gathering of additional remotely sensed and field data. The advent of remote sensing technology since the previous inventory in 1998 has allowed NCFIA to use computer-assisted classifications of Multi-Resolution Land Characterization (MRLC) data and other available remote sensing products to stratify the total area of the State and to improve estimates. Inventories in Indiana before 1998 used manual interpretation of aerial photos to stratify the sample in 1950, 1967, and 1986. The 1998 stratification was based on the Gap Analysis Program (GAP) classification of satellite imagery.

New algorithms were used in 1999-2002 to assign forest type and stand-size class to each condition observed on a plot. These algorithms are being used nationwide by FIA to provide consistency among States and will be used to reassign the forest type and stand-size class of every plot measured in the 1998 inventory when it is updated. This will be done so that changes in forest type and stand-size class will more accurately reflect actual changes in the forest and not changes in how values are computed. The list of recognized forest types, grouping of these forest types for reporting purposes, equations used to assign stocking values to individual trees, definition of nonstocked (stands with a stocking value of less than 10 percent for all live trees), and names given to the forest types changed with the new

algorithms. As a result, comparisons between the published 1998 inventory results and those published for the 1999-2001 inventory may not be valid. For additional details about algorithms used in both inventories, please contact NCFIA.

Sampling Phases

The 2001 Indiana survey used a two-phase sample for stratification that included remeasuring inventory plots from the 1998 inventory and measuring new field plots. Two-phase sampling, also called double sampling, consists of a phase 1 sample to estimate area by strata and a phase 2 sample to estimate the average value of parameters of interest within these strata. The estimated population total for a parameter is the sum across all strata of the product of each stratum's estimated area and the parameter's estimated mean per unit area.

The only land that could not be sampled was private land where field personnel could not obtain permission from the owner to measure the field plot and plots that could not be accessed because of a hazard or danger to field personnel. The methods used in the preparation of this report make the necessary adjustments to account for sites where access was denied or hazardous.

Phase 1

The 2001 inventory used a computer-assisted classification of satellite imagery. FIA used the imagery to form two initial strata—forest and nonforest. Pixels within 60 m (2 pixel widths) of a forest/nonforest edge formed two additional strata—forest/nonforest and nonforest/forest. Forest pixels within 60 m on the forest side of a forest/nonforest boundary were classified into forest/nonforest strata. Pixels within 60 m of the boundary on the nonforest side were classified into nonforest/forest strata. An overlay of all national forest land was used to identify all lands owned by the Hoosier National Forest. These national forest lands were treated separately but were also stratified into one of the above four strata. Stratification and estimation were conducted at the State level for national forest lands and at the FIA unit level for other lands. In the national forest stratum, forest and forest-edge strata were combined.

Phase 2

Phase 2 of the inventory consisted of the measurement of the annual sample of field plots in Indiana. Current FIA precision standards for annual inventories require a sampling intensity of one plot for approximately every 6,000 acres. FIA has established a grid that divides the entire area of the United States into non-overlapping hexagons, each of which contains approximately 5,937 acres (McRoberts 1999). A grid of field plots was established by selecting one plot from each hexagon based on the following rules: (1) if a Forest Health Monitoring (FHM) plot (Mangold 1998) fell within a hexagon, it was selected as the grid plot; (2) if no FHM plot fell within a hexagon, the existing NCFIA plot from the 1998 inventory nearest the hexagon center was selected as the grid plot; and (3) if neither FHM nor existing NCFIA plots fell within the hexagon, a new NCFIA plot was established in the hexagon (McRoberts 1999). This grid of plots is designated the Federal base sample and is considered an equal probability sample; its measurement in Indiana is funded by the Federal government.

The total Federal base sample of hexagonal grid plots was systematically divided into five interpenetrating, non-overlapping subsamples or panels. Each year the plots in a single panel are measured, and panels are selected on a 5-year, rotating basis (McRoberts 1999). For estimation purposes, the measurement of each panel of plots may be considered an independent systematic sample of all land in a State. Field crews measure vegetation on plots forested at the time of the last inventory and on plots currently classified as forest by trained photointerpreters using aerial photos or digital ortho-quads.

Phase 3

NCFIA has two categories of field plot measurements—phase 2 field plots (standard FIA plots) and phase 3 plots (forest health plots)—to optimize our ability to collect data when available for measurement. Both types of plot are uniformly distributed both geographically and temporally. Phase 3 plots are measured with the full suite of FHM vegetative and health variables (Mangold 1998) collected as well as the full suite of measures associated with phase 2 plots. Phase 3 plots must be measured between June 1 and August 30 to accommodate the additional measurement of non-woody understory vegetation, ground cover, soils, and other variables. We anticipate that in Indiana the complete 5-year annual inventory will involve about 60 phase 3 plots. On the remaining plots, referred to as phase 2 plots, only variables that can be measured throughout the entire year are collected. In Indiana, the complete 5-year annual inventory is expected to involve about 860 phase 2 forested plots. The 1999-2001 annual inventory results represent field measures on 460 timberland, 10 other forest land, and 197 non-forest land plots.

The new national FIA 4-point cluster plot design (fig. 5) was first used for data collection during the 1998 inventory of Indiana. This design was also used in the 1999, 2000, and 2001 inventories and will be used in subsequent years. The national plot design requires mapping forest conditions on each plot. Due to the small sample size (20 percent) each year, precision associated with change factors such as mortality will be relatively low. Consequently, we will not report change estimates in Indiana until at least four annual panels have been measured, and even then we anticipate that estimates of change will be limited in detail. When the complete annual inventory is completed in 2004, the full range of change data will be available.

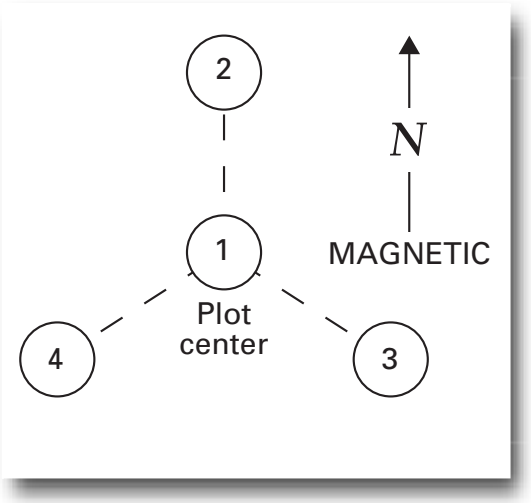

Figure 5.—*Current NCFIA field plot design.*

The overall plot layout for the new design consists of four subplots. The centers of subplots 2, 3, and 4 are located 120 feet from the center of subplot 1. The azimuths to subplots 2, 3, and 4 are 0, 120, and 240 degrees, respectively. The center of the new plot is located at the same point as the center of the previous plot if a previous plot existed within the sample unit. Trees with a diameter at breast height (d.b.h., 4.5 feet above ground level) 5 inches and larger are measured on a 24-foot-radius (1/24 acre) circular subplot. All trees less than 5 inches d.b.h. are measured on a 6.8-foot-radius (1/300 acre) circular microplot located 12 feet east of the center of each of the four subplots. Forest conditions that occur on any of the four subplots are recorded. Factors that differentiate forest conditions are changes in forest type, stand-size class, land use, ownership, and density. Each condition that occurs anywhere on any of the subplots is identified, described, and mapped if the area of the condition meets or exceeds 1 acre in size.

Field plot measurements are combined with phase 1 estimates in the compilation process

and table production. The number of published tables generated from less than five panels of data is limited. However, at www.ncrs.fs.fed.us/4801/fiadb/index.htm, other tabular data can be generated. For additional information, contact:

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LITERATURE CITED

Mangold, R.D. 1998.
Forest health monitoring field methods guide (National 1998). Research Triangle Park, NC: U.S. Department of Agriculture, Forest Service, National Forest Health Monitoring Program. 429 p. (Revision 0, April 1998)

McRoberts, R.E. 1999.
Joint annual forest inventory and monitoring system, the North Central perspective. Journal of Forestry. 97(12): 27-31.

Miles, P.D. 2001.
Indiana's forest resources in 1999. Res. Note NC-377. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 6 p.

Miles, P.D.; Brand, G.J.; Alerich, C.L.; Bednar, L.F.; Woudenberg, S.W.; Glover, J.F.; Ezzell, E.N. 2001.
The Forest Inventory and Analysis database: database description and users manual version 1.0. Gen. Tech. Rep. NC-218. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 130 p.

Schmidt, T.S.; Mielke, M.E.; Marshall, P.T. 2002.
Indiana forest resources in 2000. Resour. Bull. NC-206. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 26 p.

Schmidt, T.S.; Hansen, M.H.; Solomakos, J.A. 2000.
Indiana's forests in 1998. Resour. Bull. NC-196. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 139 p.

TABLE TITLES

Table 1.—*Area of forest land by forest type group and owner category, Inidana, 1999-2001*

Table 2.—*Area of timberland by major forest type group, stand origin, and owner category, Indiana, 1999-2001*

Table 3.—*Area of timberland by forest type group and stand-size class, Indiana, 1999-2001*

Table 4.—*Net volume of all live trees on forest land by species group and owner category, Indiana, 1999-2001*

Table 5.—*Net volume of all live trees and salvable dead trees on timberland by class of timber and softwood/hardwood categories, Indiana, 1999-2001*

Table 6.—*Net volume of growing stock on timberland by forest group and softwood/hardwood species categories, Indiana, 1999-2001*

Table 7.—*Net volume of growing stock on timberland by species group and diameter class, Indiana, 1999-2001*

Table 8.—*Net volume of sawtimber on timberland by species group and diameter class, Indiana, 1999-2001*

Table 9.—*All live aboveground tree biomass on timberland by owner category, softwood/hardwood species category, and tree biomass component, Indiana, 1999-2001*

TABLES

Table 1. -- Area of forest land by forest type group and owner category, Indiana, 1999 - 2001

(In thousand acres)

Forest type group	Owner category			
	All owners	Public	Private	Unidentified owner
Softwood type groups				
White / red / jack pine group	40.7	10.0	30.7	- -
Loblolly / shortleaf pine group	22.8	16.0	6.7	- -
Pinyon / juniper group	39.6	9.5	30.1	- -
All softwood types	103.1	35.6	67.5	- -
Hardwood type groups				
Oak / pine group	119.0	9.3	109.8	- -
Oak / hickory group	1,872.7	405.1	1,467.6	- -
Oak / gum / cypress group	62.1	11.7	50.4	- -
Elm / ash / cottonwood group	522.3	56.6	465.7	- -
Maple / beech / birch group	1,726.6	182.0	1,544.5	- -
Aspen / birch group	16.5	13.2	3.3	- -
All hardwood types	4,319.3	677.9	3,641.4	- -
Nonstocked	20.3	- -	20.3	- -
All forest types	4,442.7	713.4	3,729.2	- -

All table cells without observations in the inventory sample are indicated by --. Table value of 0.0 indicates the acres round to less than 0.1 thousand acres. Columns and rows may not add to their total due to rounding.

Table 2. -- Area of timberland by major forest type group, stand origin, and owner category, Indiana, 1999 - 2001

(In thousand acres)

Major forest type group and stand origin	Owner category			
	All owners	Public	Private	Unidentified owner
Softwood type groups				
Natural	30.1	- -	30.1	- -
Planted	63.5	26.0	37.5	- -
All softwood types	93.6	26.0	67.5	- -
Hardwood type groups				
Natural	4,114.8	581.8	3,533.1	- -
Planted	99.9	21.7	78.3	- -
All hardwood types	4,214.8	603.5	3,611.3	- -
Nonstocked	20.3	- -	20.3	- -
All groups	4,328.7	629.5	3,699.2	- -

All table cells without observations in the inventory sample are indicated by --. Table value of 0.0 indicates the acres round to less than 0.1 thousand acres. Columns and rows may not add to their totals due to rounding.

Table 3. -- Area of timberland by forest type group and stand-size class, Indiana, 1999 - 2001

(In thousand acres)

Forest type group	All stands	Stand-size class			
		Sawtimber	Poletimber	Sapling-seedling	Non-stocked
Softwood type groups					
White / red / jack pine group	40.7	31.5	9.2	- -	- -
Loblolly / shortleaf pine group	22.8	20.5	2.2	- -	- -
Pinyon / juniper group	30.1	16.1	0.8	13.1	- -
All softwood types	93.6	68.2	12.3	13.1	- -
Hardwood type groups					
Oak / pine group	119.0	76.7	13.4	28.9	- -
Oak / hickory group	1,825.5	1,476.6	284.1	64.8	- -
Oak / gum / cypress group	62.1	50.9	- -	11.2	- -
Elm / ash / cottonwood group	522.3	353.7	109.7	58.9	- -
Maple / beech / birch group	1,679.3	1,087.9	401.6	189.8	- -
Aspen / birch group	6.5	6.5	- -	- -	- -
All hardwood types	4,214.8	3,052.3	808.8	353.7	- -
Nonstocked	20.3	- -	- -	- -	20.3
All forest types	4,328.7	3,120.5	821.1	366.8	20.3

All table cells without observations in the inventory sample are indicated by --. Table value of 0.0 indicates the acres round to less than 0.1 thousand acres. Columns and rows may not add to their totals due to rounding.

Table 4. -- Net volume of all live trees on forest land by species group and owner category, Indiana, 1999 - 2001

(In thousand cubic feet)

Species group	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Loblolly and shortleaf pines	23,320	21,942	1,378	- -
Other yellow pines	52,904	21,168	31,736	- -
Eastern white and red pines	85,813	21,791	64,022	- -
Jack pine	2,864	- -	2,864	- -
Cypress	- -	- -	- -	- -
Other eastern softwoods	90,892	14,424	76,468	- -
Total softwoods	255,793	79,325	176,467	- -
Hardwoods				
Select white oaks	822,605	185,973	636,632	- -
Select red oaks	436,628	147,977	288,651	- -
Other white oaks	185,426	68,184	117,242	- -
Other red oaks	806,839	166,201	640,638	- -
Hickory	810,896	123,928	686,968	- -
Hard maple	776,272	128,637	647,635	- -
Soft maple	362,483	32,090	330,393	- -
Beech	271,109	48,224	222,886	- -
Sweetgum	81,598	27,851	53,747	- -
Tupelo and blackgum	65,339	12,309	53,029	- -
Ash	585,087	42,990	542,096	- -
Cottonwood and aspen	257,018	33,261	223,757	- -
Basswood	76,961	1,755	75,206	- -
Yellow-poplar	823,075	124,985	698,091	- -
Black walnut	237,263	17,636	219,627	- -
Other eastern soft hardwoods	1,091,254	105,388	985,867	- -
Other eastern hard hardwoods	128,235	11,441	116,794	- -
Eastern noncommercial hardwoods	56,731	674	56,057	- -
Total hardwoods	7,874,819	1,279,506	6,595,314	- -
All species groups	8,130,612	1,358,831	6,771,781	- -

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand cubic feet. Columns and rows may not add to their totals due to rounding.

Table 5. -- Net volume of all live trees and salvable dead trees on timberland by class of timber and softwood/hardwood categories, Indiana, 1999 - 2001

(In thousand cubic feet)

Class of timber	All species	Softwood species	Hardwood species
Live trees			
Growing-stock trees			
Sawtimber			
Saw log portion	4,959,770	153,039	4,806,732
Upper stem portion	622,512	18,456	604,056
Total	5,582,282	171,494	5,410,788
Poletimber	1,488,136	69,034	1,419,102
All growing-stock trees	7,070,418	240,528	6,829,890
Cull trees			
Rough trees [1]			
Sawtimber size	528,932	3,893	525,040
Poletimber size	201,166	4,484	196,682
Total	730,098	8,377	721,721
Rotten trees [1]			
Sawtimber size	120,374	- -	120,374
Poletimber size	14,989	195	14,794
Total	135,364	195	135,168
All live cull trees	865,462	8,572	856,890
All live trees	7,935,880	249,101	7,686,780
Salvable dead trees			
Sawtimber size	45,650	7,108	38,542
Poletimber size	50,925	5,323	45,601
All salvable dead trees	96,575	12,432	84,143
All classes	8,032,455	261,532	7,770,923

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand cubic feet. Columns and rows may not add to their totals due to rounding.

[1] Includes noncommercial species.

Table 6. -- Net volume of growing stock on timberland by forest group and softwood/hardwood species categories, Indiana, 1999 - 2001

(In thousand cubic feet)

Forest type group	All species	Softwood species	Hardwood species
Softwood type groups			
White / red / jack pine group	88,695	76,585	12,110
Loblolly / shortleaf pine group	52,840	46,310	6,530
Pinyon / juniper group	20,405	13,442	6,963
All softwood types	161,940	136,337	25,603
Hardwood type groups			
Oak / pine group	149,702	50,980	98,721
Oak / hickory group	3,321,627	20,963	3,300,664
Oak / gum / cypress group	129,582	- -	129,582
Elm / ash / cottonwood group	836,608	8,957	827,652
Maple / beech / birch group	2,446,739	23,291	2,423,447
Aspen / birch group	23,514	- -	23,514
All hardwood types	6,907,771	104,191	6,803,580
Nonstocked	707	- -	707
All forest types	7,070,418	240,528	6,829,890

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand cubic feet. Columns and rows may not add to their totals due to rounding.

Table 7. -- Net volume of growing stock on timberland by species group and diameter class, Indiana, 1999 - 2001

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods											
Loblolly and shortleaf pines	22,495	275	2,264	2,775	6,465	4,228	4,122	2,366	--	--	--
Other yellow pines	50,602	3,450	4,428	11,254	11,193	6,582	8,343	5,352	--	--	--
Eastern white and red pines	85,813	2,520	14,770	18,516	15,713	14,228	13,220	2,335	4,511	--	--
Jack pine	2,864	151	795	1,148	770	--	--	--	--	--	--
Cypress	--	--	--	--	--	--	--	--	--	--	--
Other eastern softwoods	78,755	15,925	24,457	15,429	6,835	8,366	7,743	--	--	--	--
Total softwoods	240,528	22,322	46,713	49,122	40,976	33,404	33,428	10,052	4,511	--	--
Hardwoods											
Select white oaks	742,498	13,922	31,872	41,942	48,194	87,326	105,344	93,324	79,820	174,806	65,949
Select red oaks	405,261	7,144	12,535	16,015	25,273	39,772	43,053	40,657	59,999	103,913	56,900
Other white oaks	171,761	2,027	3,881	13,100	24,290	36,274	29,810	19,583	27,766	15,029	--
Other red oaks	731,315	14,085	29,099	43,740	49,450	89,832	104,504	81,563	87,304	183,840	47,898
Hickory	764,324	25,166	58,458	86,006	117,264	111,538	120,796	129,765	53,195	42,667	19,469
Hard maple	644,180	58,069	66,232	83,213	88,012	72,164	99,813	79,101	12,080	73,256	12,241
Soft maple	298,905	25,640	39,663	38,257	36,086	31,171	27,354	17,412	31,575	33,326	18,421
Beech	183,041	5,242	9,606	8,144	15,354	10,478	18,880	33,426	3,447	69,146	9,318
Sweetgum	79,242	6,256	8,604	11,156	20,572	9,318	8,490	11,321	3,525	--	--
Tupelo and blackgum	56,408	6,092	5,015	4,238	5,411	3,858	11,905	5,913	2,801	11,175	--
Ash	474,928	23,130	36,621	57,211	60,162	76,789	64,369	75,678	39,743	41,225	--
Cottonwood and aspen	243,780	2,845	4,076	7,470	11,816	15,371	27,852	17,248	29,237	84,932	42,932
Basswood	62,949	3,495	7,587	9,193	5,786	7,350	8,215	3,133	3,223	14,969	--
Yellow-poplar	794,711	18,973	36,759	61,502	63,154	99,635	77,856	76,682	71,579	278,567	10,004
Black walnut	192,279	8,101	20,123	21,367	36,829	32,699	42,074	24,568	6,518	--	--
Other eastern soft hardwoods	906,086	83,683	97,975	108,905	91,037	96,440	102,564	46,650	66,687	168,850	43,296
Other eastern hard hardwoods	78,220	9,211	15,312	11,149	9,201	13,450	13,398	2,781	3,719	--	--
Total hardwoods	6,829,890	313,078	483,417	622,608	707,891	833,466	906,278	758,806	582,219	1,295,702	326,427
All species	7,070,418	335,399	530,129	671,730	748,867	866,871	939,706	768,858	586,730	1,295,702	326,427

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand cubic feet. Columns and rows may not add to their totals due to rounding.

Table 8. -- Net volume of sawtimber on timberland by species group and diameter class, Indiana, 1999 - 2001

(In thousand board feet)[1]

Species group	All classes	Diameter class (inches at breast height)							
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods									
Loblolly and shortleaf pines	101,557	13,601	32,487	21,605	21,466	12,399	--	--	--
Other yellow pines	216,139	54,154	55,835	33,928	43,596	28,626	--	--	--
Eastern white and red pines	325,287	84,958	74,016	66,993	64,996	11,731	22,593	--	--
Jack pine	9,452	5,622	3,830	--	--	--	--	--	--
Other eastern softwoods	196,600	85,123	34,845	40,502	36,129	--	--	--	--
Total softwoods	849,034	243,458	201,012	163,028	166,188	52,756	22,593	--	--
Hardwoods									
Select white oaks	2,989,244	--	238,098	424,646	503,379	437,701	367,859	764,786	252,775
Select red oaks	1,764,222	--	124,851	197,914	214,532	201,613	295,426	489,201	240,685
Other white oaks	763,996	--	124,066	184,854	149,174	98,129	135,363	72,411	--
Other red oaks	3,068,560	--	243,278	443,272	514,521	398,356	422,126	855,000	192,006
Hickory	2,929,533	--	577,704	550,832	594,354	638,986	261,271	210,635	95,751
Hard maple	2,079,252	--	424,001	349,181	481,953	379,456	56,887	340,292	47,483
Soft maple	830,774	--	156,672	136,458	120,264	76,488	137,881	144,442	58,569
Beech	778,230	--	77,713	52,716	94,378	165,633	16,860	328,296	42,634
Sweetgum	241,296	--	93,871	42,723	38,470	50,546	15,687	--	--
Tupelo and blackgum	182,782	--	24,640	17,516	54,006	26,618	12,518	47,484	--
Ash	1,674,165	--	273,135	355,674	303,288	359,846	189,722	192,501	--
Cottonwood and aspen	1,154,279	--	55,340	75,394	140,043	87,420	147,646	436,085	212,351
Basswood	211,109	--	29,300	36,977	41,001	15,552	15,792	72,488	--
Yellow-poplar	3,531,789	--	314,419	508,239	404,350	399,904	380,661	1,474,151	50,066
Black walnut	688,322	--	178,904	158,829	203,090	117,491	30,008	--	--
Other eastern soft hardwoods	2,835,240	--	423,249	447,574	478,457	214,721	308,922	783,681	178,638
Other eastern hard hardwoods	194,113	--	42,215	61,633	61,091	12,609	16,565	--	--
Total hardwoods	25,916,908	--	3,401,455	4,044,430	4,396,349	3,681,069	2,811,193	6,211,453	1,370,959
All species	26,765,942	243,458	3,602,466	4,207,458	4,562,537	3,733,825	2,833,786	6,211,453	1,370,959

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates that the volume rounds to less than 1 thousand board feet. Columns and rows may not add to their totals due to rounding.

[1]International 1/4-inch rule.

Table 9. -- All live aboveground tree biomass on timberland by owner category, softwood/hardwood species category, and tree biomass component, Indiana, 1999 - 2001

(In dry tons)

Owner category and softwood/hardwood category	All components	Tree biomass component						
		All live 1-5 inch trees	Growing-stock trees			Non-growing-stock trees		
			Total	Boles	Stumps, tops, and limbs	Total	Boles	Stumps, tops, and limbs
Public								
Softwoods	1,333,818	18,663	1,281,543	1,067,295	214,248	33,612	28,616	4,996
Hardwoods	31,806,544	2,028,284	28,050,414	20,679,665	7,370,749	1,727,846	1,264,474	463,372
Total	33,140,362	2,046,947	29,331,957	21,746,959	7,584,997	1,761,458	1,293,090	468,368
Private								
Softwoods	3,910,246	550,276	3,189,482	2,477,737	711,745	170,488	119,907	50,581
Hardwoods	181,823,647	10,368,800	145,522,610	107,542,634	37,979,976	25,932,237	19,227,435	6,704,801
Total	185,733,892	10,919,076	148,712,092	110,020,371	38,691,721	26,102,725	19,347,342	6,755,382
All ownerships								
Softwoods	5,244,064	568,939	4,471,025	3,545,031	925,993	204,100	148,523	55,577
Hardwoods	213,630,190	12,397,084	173,573,024	128,222,299	45,350,725	27,660,083	20,491,909	7,168,174
Total	218,874,254	12,966,023	178,044,048	131,767,330	46,276,718	27,864,183	20,640,432	7,223,750

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates the aboveground tree biomass rounds to less than 1 dry ton. Columns and rows may not add to their totals due to rounding.

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Leatherberry, Earl C.; Mielke, Manfred; Gallion, Joey.
2003. **Indiana's forest resources in 2001.** Resour. Bull. NC-220. St. Paul, MN: U.S. Department of Agricultue, Forest Service, North Central Research Station. 20 p.

Results of the combined 1999, 2000, and 2001 annual forest inventories of Indiana show that 4.4 million acres or 19 percent of the total land area is classified as forest land. The estimate of total all live tree volume on forest land is 8.1 billion cubic feet or approximately 1,830 cubic feet per acre. More than 4.3 million acres of forest land in Indiana are classified as timberland. The estimate of growing-stock volume on timberland is 7.1 billion cubic feet or approximately 1,633 cubic feet per acre. All live aboveground tree biomass on timberland is estimated at 219 million dry tons or approximately 50.6 tons per acre. Important pests in Indiana forests include the gypsy moth and locust leaf miner.

KEY WORDS: Annual inventory, forest area, forest type, volume, biomass, Indiana

Mission Statement

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