

Indiana's Forests

1999-2003 Part B



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North Central Research Station, St. Paul, MN

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Inventory Methods

Forest Inventory Methods

Strategic Model

The Forest Inventory and Analysis program of the North Central Research Station (NCFIA) is part of the national enhanced FIA program that focuses on a set of six strategic objectives (McRoberts 2005):

- Objective 1: a standard set of variables with nationally consistent meanings and measurements
- Objective 2: field inventories of all forested lands
- Objective 3: nationally consistent estimation
- Objective 4: adherence to national precision standards
- Objective 5: consistent reporting and data distribution
- Objective 6: credibility with users and stakeholders

To ensure the six strategic objectives are achieved, ten strategic approaches have been prescribed:

- Approach 1: a national set of prescribed core variables with a national field manual that prescribes measurement procedures and protocols for each variable
- Approach 2: a national plot configuration
- Approach 3: a national sampling design
- Approach 4: estimation using standardized formulae for sample-based estimators
- Approach 5: a national database of FIA data with core standards and user-friendly public access
- Approach 6: a national information management system
- Approach 7: a nationally consistent set of tables of estimates of prescribed core variables
- Approach 8: publication of statewide tables of estimates of prescribed core variables at 5-year intervals
- Approach 9: documentation of the technical aspects of the FIA program including procedures, protocols, and techniques
- Approach 10: peer review and publication of the technical documentation for general access

The result of the strategic objectives and approaches is an inventory program with identifiable new features and a nationally consistent plot configuration, a nationally consistent sampling design for all lands, annual measurement of a proportion of plots in each State, nationally consistent estimation techniques and algorithms, and integration of the ground sampling components of the FIA inventory and the detection monitoring activity of the USDA Forest Service's Forest Health Monitoring (FHM) program.

Plot Configuration

The national FIA plot design consists of four 24-ft-radius subplots configured as a central subplot and three peripheral subplots. Centers of the peripheral subplots are located at distances of 120 ft and at azimuths of 0°, 120°, and 240° from the center of the central subplot. Each tree with diameter at breast height (d.b.h.) 5 inches or greater is measured on these subplots. Each subplot contains a 6.8-ft-radius microplot with center located 12 ft east of the subplot center on which each tree with d.b.h. between 1 in. and 5 in. is measured. Factors that differentiate forest conditions include forest type, stand-size class, stand origin, land use, ownership, and density. Forest conditions that occur on any of the four subplots are identified and recorded, and if the area of the condition is 1 acre or greater, the condition is mapped on the subplot.

Sample Design

Based on historic sampling errors, a sampling intensity of approximately one plot per 6,000 acres is necessary to satisfy national FIA precision guidelines. Therefore, FIA divided the area of the United States into nonoverlapping, 5,937-acre hexagons and established a plot in each hexagon as follows: (1) if an existing FHM plot was located in a hexagon, it was selected; (2) if no FHM plot existed in the hexagon, the existing FIA plot from the previous periodic inventory nearest the hexagon center was selected; and (3) if neither an FHM nor existing FIA plot was located in the hexagon, a new FIA plot was established at a random location in the hexagon (Brand *et al.* 2000, McRoberts 1999). This array of field plots is designated the Federal base sample and is considered an equal probability sample; its measurement is funded by the Federal government.

The Federal base sample was systematically divided into five interpenetrating, nonoverlapping panels or subsamples, each of which provides complete, systematic coverage of the State. 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 is considered an independent, equal probability sample of all lands in a State.

Three-Phase Inventory

NCFIA conducts inventories in three phases. Phase 1 uses remotely sensed data to obtain initial plot land cover observations and to stratify land area in the population of interest to increase the precision of estimates. In phase 2, field crews visit the physical locations of permanent field plots to measure traditional inventory variables such as tree species, diameter, and height. In phase 3, field crews visit a subset of phase 2 plots to obtain measurements for an additional suite of variables associated with forest and ecosystem health. The three phases of the enhanced FIA program are discussed in greater detail in the following sections.

Phase 1

Remotely sensed data in the form of aerial photographs, digital orthoquads (DOQs: digitally scanned aerial photographs), and satellite imagery are used for initial plot measurement and stratification. Phase 1 plot measurement consists of observations of conditions at the plot locations using aerial photographs or DOQs. Analysts determine a digitized geographic location for each field plot, and a human interpreter assigns the plot a land cover/use. Plot locations with forest land uses that are accessible to field crews are selected for further measurement via field crew visits in phase 2. Lands satisfying FIA's definition of forest land use include commercial timberland, some pastured land with trees, forest plantations, unproductive forested land, and reserved, noncommercial forested land. In addition, forest land use requires minimum stocking levels, a 1-acre minimum area, and a minimum bole-to-bole width of 120 ft with continuous canopy. Forest land use excludes wooded strips, idle farmland with trees, and narrow windbreaks.

The combination of natural variability among plots and budgetary constraints prohibits measurement of a sufficient number of plots to satisfy national precision standards for most inventory variables unless the estimation process is enhanced using ancillary data. Thus, the land area is stratified by using remotely sensed data to facilitate stratified estimation. Because FIA uses a quasi-systematic sampling design, stratified random sampling is not an option. Nevertheless, even with systematic sampling, stratified estimation may still increase precision.

The NCFIA approach to stratified estimation is to use classified satellite imagery as the basis for the stratification. Hansen and Wendt (2000) proposed using classified satellite imagery to define strata, and McRoberts *et al.* (2002) investigated the utility of the National Land Cover Data (NLCD) for this purpose. The NLCD is a digital land cover map of the conterminous USA assigning 30-m x 30-m pixels to 21 land cover classes. The land cover classification was produced by the U.S. Geological Survey and was based on nominal 1992 Landsat 5 Thematic Mapper (TM) satellite imagery and a variety of ancillary data (Vogelmann *et al.* 2001). NCFIA follows the recommendation of McRoberts *et al.* (2002), creating four strata using a three-step process: (1) aggregate NLCD classes with trees into a forest stratum, and the remaining classes into a nonforest stratum; (2) reclassify isolated groups of three or fewer pixels into their surrounding forest or nonforest class to comply with the FIA criterion that forest land must be at least one acre; and (3) create a forest edge stratum by removing from the forest stratum a 2-pixel-wide band on the forest side of the forest/nonforest boundary and create a non-forest edge stratum by removing from the non-forest stratum a 2-pixel-wide band on the non-forest side of the forest/nonforest boundary.

In addition to the classification of every pixel into one of the four strata, every pixel is also assigned to an ownership strata based on the Protected Areas Database (PAD) described by DellaSala *et al.* 2001. In Indiana, the PAD was used to classify pixels into three ownership classes: (1) USDA, Forest Service (198,000 acres), (2) Other public owners (541,000 acres), and (3) Private owner (22,419,000 acres). Also, every pixel was assigned to a county based on the location of the pixel center.

Stratified estimation requires that two tasks be accomplished: first, each plot must be assigned to a single stratum, and second, the proportion of the estimation unit in each stratum must be calculated. The first task is accomplished by assigning each plot to the stratum assigned for the pixel containing the center of the center subplot. The second task is accomplished by calculating the proportion of pixels in each stratum. The population total estimate for a variable is calculated as the sum across all strata of the product of each stratum's estimated proportion and the variable's estimated mean per unit area for the stratum.

Phase 2

In phase 2, field crews record a variety of data for plot locations determined in phase 1 to include accessible forest land use. Before visiting plot locations, field crews consult county land records to determine the ownership of plots and then seek permission from private landowners to measure plots on their lands. The field crews determine the location of the geographic center of the center subplot using geographic positioning system (GPS) receivers. They record subplot-level observations that include land cover, forest type, stand origin, stand age, stand-size class, site productivity class, forest disturbance history, slope, aspect, physiographic class, and ground land use conditions. For each tree, field crews record a variety of observations and measurements including species, live/dead status, lean, diameter, height, crown ratio (percent of tree height represented by crown), crown class (e.g., dominant, co-dominant, suppressed), damage, and decay status. Office staff use statistical models based on field crew measurements to calculate values for additional variables including individual tree volume and per unit area estimates of number of trees, volume, and biomass by subplot, by species groups, and by live/dead status.

Phase 3

The third phase of the enhanced FIA program focuses on forest health. Phase 3 is administered cooperatively by the FIA program, other Forest Service programs, other Federal agencies, State natural resource agencies, and universities, and it is partially integrated with the

Forest Health Monitoring (FHM) program. The FHM program consists of four interrelated and complementary activities: detection monitoring, evaluation monitoring, intensive site ecosystem monitoring, and research on monitoring techniques. Detection monitoring consists of systematic aerial and ground surveys designed to collect baseline information on the current condition of forest ecosystems and to detect changes from those baselines over time. Evaluation monitoring studies examine the extent, severity, and probable causes of changes in forest health identified through the detection monitoring surveys. The intensive site ecosystem monitoring program conducts research into regionally specific ecological processes at a network of sites located in representative forested ecosystems. Finally, research on monitoring techniques focuses on developing and refining indicator measurements to improve the efficiency and reliability of data collection and analysis at all levels of the program.

The ground survey portion of the FHM detection monitoring program was integrated into the FIA program as phase 3 in 1999. The phase 3 sample consists of a 1:16 subset of the phase 2 plots with one phase 3 plot for approximately every 95,000 acres. Phase 3 measurements are obtained by field crews during the growing season and include an extended suite of ecological data: lichen diversity and abundance, soil quality (erosion, compaction, and chemistry), vegetation diversity and structure, and down woody material. The incidence and severity of ozone injury for selected bioindicator species also are monitored as part of an associated sampling scheme. Because each phase 3 plot is also a phase 2 plot, the entire suite of phase 2 measurements is collected on each phase 3 plot at the same time as the phase 3 measurements.

The phase 3 suite of variables was selected to address specific criteria outlined by the Montreal Process working group for the conservation and sustainable management of temperate and boreal forests and is based on the concept of indicator variables. Observations of an indicator variable represent an index of ecosystem functions that can be monitored over time to assess trends. Indicator variables are used in conjunction with each other, phase 2 data, data from FHM evaluation monitoring studies, and ancillary data to address ecological issues such as vegetation diversity, fuel loading, regional air quality gradients, and carbon storage. The phase 2 and phase 3 data of the enhanced FIA program serve as the Nation's environmental report card and are a primary source of reporting data for the Montreal Process Criteria.

Estimation

The estimates presented in this report are based on averages observed on 3,881 plots located across Indiana. These plots are located within 43 estimation strata (table B-1) defined by combinations of the four phase 1 classes (nonforest, nonforest edge, forest edge, and forest), a land ownership classification created from the Protected Areas Database, and county groups. The procedures described in Bechtold and Patterson (2005) for stratified estimation with observed stratum areas were used in conjunction with the strata presented in table B-1 to produce all estimates. Table B-1 (See below and page 10) provides the total area and number of plots within each of these strata.

Table B-1—Area and number of plots in each stratum for the stratification used by NCFIA for estimation in Indiana, 1999-2003. Unshaded rows are the strata used in estimation. Shaded rows are summaries.

Unit-County ¹	Ownership layer ²	Classified NLCD layer ³	Area (acres) ⁴	Number of plots						
				Selected ⁵	Non-forest office plots ⁶	Field check plots ⁷	Field check plots measured ⁸	Forest plots measured ⁹	Forest plots measured for change ¹⁰	Plots not measured ¹¹
1	USFS	All	13,000	3	0	3	3	3	2	0
1	Oth. Public	Nonforest & nonforest edge	31,000	5	4	1	1	1	1	0
1	Oth. Public	Forest edge	21,000	6	2	4	4	3	0	0
1	Oth. Public	Forest	86,000	16	0	16	16	16	5	0
1	All public		151,000	30	6	24	24	23	8	0
1N	Private	Nonforest	964,000	160	150	10	10	4	4	0
1N	Private	Nonforest edge	376,000	58	23	35	33	23	15	2
1N	Private	Forest edge	296,000	48	9	39	39	36	24	0
1N	Private	Forest	221,000	37	3	34	33	33	23	1
1N	All private		1,857,000	303	185	118	115	96	66	3
1S	Private	Nonforest	1,133,000	194	181	13	13	3	0	0
1S	Private	Nonforest edge	253,000	38	19	19	17	15	10	2
1S	Private	Forest edge	177,000	27	7	20	19	18	10	1
1S	Private	Forest	120,000	21	3	18	18	18	7	0
1S	All private		1,683,000	280	210	70	67	54	27	3
1	All owners		3,691,000	613	401	212	206	173	101	6
2	USFS	All	185,000	43	0	43	42	42	33	1
2	Oth. Public	All	175,000	33	2	31	31	31	17	0
2	All public		360,000	76	2	74	73	73	50	1
2N	Private	Nonforest	553,000	93	82	11	11	6	6	0
2N	Private	Nonforest edge	278,000	48	22	26	25	21	10	1
2N	Private	Forest edge	254,000	42	6	36	35	34	20	1
2N	Private	Forest	340,000	57	0	57	51	51	27	6
2N	All private		1,425,000	240	110	130	122	112	63	8
2S	Private	Nonforest	1,068,000	184	170	14	14	5	2	0
2S	Private	Nonforest edge	465,000	70	30	40	40	32	17	0
2S	Private	Forest edge	405,000	69	9	60	56	56	21	4
2S	Private	Forest	460,000	74	1	73	69	67	29	4
2S	All private		2,398,000	397	210	187	179	160	69	8
2	All owners		4,183,000	713	322	391	374	345	182	17
3	Oth. Public	All	75,000	12	0	12	7	6	6	5
3	Private	Nonforest	658,000	117	105	12	12	6	2	0
3	Private	Nonforest edge	359,000	65	27	38	38	31	17	0
3	Private	Forest edge	314,000	45	2	43	39	38	18	4
3	Private	Forest	245,000	36	2	34	34	34	14	0
3	All private		1,576,000	263	136	127	123	109	51	4
3	All owners		1,651,000	275	136	139	130	115	57	9

(table continued on next page)

Unit-County ¹	Ownership layer ²	Classified NLCD layer ³	Area (acres) ⁴	Number of plots						
				Selected ⁵	Non-forest office plots ⁶	Field check plots ⁷	Field check plots measured ⁸	Forest plots measured ⁹	Forest plots measured for change ¹⁰	Plots not measured ¹¹
4	Oth. Public	Nonforest	31,000	4	4	0	0	0	0	0
4	Oth. Public	Nonforest edge	32,000	7	3	4	4	4	4	0
4	Oth. Public	Forest edge	37,000	8	1	7	7	4	2	0
4	Oth. Public	Forest	53,000	8	0	8	8	8	6	0
4	All public		153,000	27	8	19	19	16	12	0
4C	Private	Nonforest	5,045,000	847	797	50	50	16	10	0
4C	Private	Nonforest edge	570,000	93	44	49	46	35	26	3
4C	Private	Forest edge	321,000	50	3	47	47	45	24	0
4C	Private	Forest	88,000	15	1	14	13	13	6	1
4C	All private		6,024,000	1,005	845	160	156	109	66	4
4N	Private	Nonforest	3,672,000	605	568	37	37	8	6	0
4N	Private	Nonforest edge	782,000	132	76	56	54	42	26	2
4N	Private	Forest edge	463,000	83	15	68	66	55	31	2
4N	Private	Forest	129,000	22	1	21	18	15	6	3
4N	All private		5,046,000	842	660	182	175	120	69	7
4S	Private	Nonforest	1,951,000	337	317	20	20	4	3	0
4S	Private	Nonforest edge	270,000	43	22	21	21	17	11	0
4S	Private	Forest edge	148,000	22	1	21	19	18	11	2
4S	Private	Forest	41,000	4	0	4	4	3	2	0
4S	All private		2,410,000	406	340	66	64	42	27	2
4	All owners		13,633,000	2,280	1,853	427	414	287	174	13
State	All owners		23,158,000	3,881	2,712	1,169	1,124	920	514	45

1N	1S	2N	2S	3	4C		4N		1N
Clay	Daviss	Brown	Clark	Dearborn	Adams	Huntington	Allen	Marshall	Bartholomew
Green	Gibson	Jackson	Crawford	Fayette	Benton	Jay	De Kalb	Newton	Decatur
Parke	Knox	Lawrence	Dubois	Franklin	Blackford	Madison	Elkhart	Noble	Hancock
Putnam	Martin	Monroe	Floyd	Jefferson	Boone	Miami	Fulton	Porter	Hendricks
Sullivan	Pike	Morgan	Harrison	Jennings	Carroll	Montgomery	Jasper	Pulaski	Henry
Vermillion	Posey	Owen	Orange	Ohio	Cass	Randolph	Kosciusko	St. Joesph	Johnson
Vigo	Vanderburgh		Perry	Ripley	Delaware	Tiptecanoe	La Porte	Starke	Marion
			Scott	Switzerland	Fountain	Tipton	Lagrange	Steuben	Rush
			Spencer	Union	Grant	Wabash	Lake	Whitley	Shelby
			Warrick		Hamilton	Warren			Wayne
			Washington		Howard	Wells			
						White			

¹¹Plots not measured – Plots selected for field measurement, but not measured due to denied access, hazardous condition, or other complications.

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Integration with Previous Inventories

In 2003, NCFIA completed measurement of the fifth panel of inventory plots in Indiana. The 2003 panel, along with those surveyed in 1999, 2000, 2001, and 2002, completed data collection for the fifth inventory of Indiana's forests. Previous inventories of Indiana's forest resources were completed in 1950, 1967, 1986, and 1998 (Hutchison 1956, Schmidt *et al.* 2000, Smith and Golitz 1988, Spencer 1969, Spencer *et al.* 1990). Data from new inventories are often compared with data from earlier inventories 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). Although these changes will have little impact on statewide estimates of forest area, timber volume, and tree biomass, they may significantly impact plot classification variables such as forest type and stand-size class. For estimating growth, removals, and mortality, the 1998 inventory (Schmidt *et al.* 2000) was processed using estimation/summary routines for the 1999-2003 inventory. Although these changes allow limited comparison of inventory estimates among separate inventories in this report, it is inappropriate to directly compare all portions of the 1999-2003 data with those published for earlier inventories.

For further information about the sample protocols and estimation procedures for the first two phases of the FIA program, please see Bechtold and Patterson (2005). For further information on phase 3 indicator sampling protocols, please see USDA FS (2003) and Woodall and Williams (2005).



Estimates

Quality of the Estimates

The quality of this report's estimates is addressed by quantifying associated errors. Two general types of error, random variability (precision) and estimation bias (accuracy), should be of general concern to all users of any estimates. Random variability refers to the general imprecision of the estimate, which would occur if the entire sampling and estimation process were to be repeated many times. Estimation bias, on the other hand, refers to the difference between the estimate and the "true value" in the absence of this random variability and refers to the over-estimation or under-estimation inherent in the entire estimation process.

Errors in the estimates presented in this report (both estimation bias and random variability) are affected by various sources. The four primary sources of error common to all sample-based estimates are sampling, measurement, prediction, and nonresponse error. A section is devoted to each of these sources of error. Included in each of these sections are a definition of the source of error in the context of the FIA inventory and a discussion of methods used to quantify and/or reduce that source of error. Measures of sampling, measurement, and prediction errors associated with various attributes are presented. Issues of possible bias related to non-response are addressed.

Sampling Error

The process of sampling (selecting a random subset of a population and calculating estimates from this subset) causes estimates to contain error they would not have if every member of the population had been observed and included in the estimate. The 1999-2003 FIA inventory of Indiana is based on a sample of 3,836 plots located randomly across the State (a total area of 23,156,604 acres), a sampling rate of approximately one plot for every 6,000 acres.

The statistical estimation procedures outlined in the previous section and described in detail in Bechtold and Patterson (2005) provide the estimates of the population totals and means presented in this report. Along with every estimate is an associated sampling error that is typically expressed as a percentage of the estimated value but that can also be expressed in the same units as the estimate or as a confidence interval (the estimated value plus or minus the sampling error). This sampling error is the primary measure of the reliability of an estimate. A sampling error can be interpreted to mean that the chances are two out of three that had a 100-percent inventory been taken using these methods, the results would have been within the limits indicated.

The sampling errors for State-level estimates of the major attributes presented in this report are presented in table B-2. Table 65 presents sampling errors for these estimates at the Forest Survey Unit and county group level.

Table B-2—State-level estimates of major forest resource attributes and their sampling errors

Item	State total	Sampling error
Growing stock	(Million cubic feet)	(Percent)
Volume	7,520.8	2.72
Average annual net growth	268.1	12.15
Average annual removals	129.9	20.87
Average annual mortality	66.8	14.42
Sawtimber	(Million board feet)	(Percent)
Volume	28,605.1	3.17
Average annual net growth	1,173.4	12.33
Average annual removals	570.1	22.35
Average annual mortality	208.5	20.34
Area	(Thousand acres)	(Percent)
Forest land	4,553.8	1.72
Timberland	4,412.8	1.82

Estimates for classifications smaller than the State totals presented in table B-2 will have larger sampling errors. For example, table 65 shows the sampling error for timberland area in any county is higher than that for total timberland area in the State. To compute an approximate sampling error for an estimate that is smaller than a State total, use the following formula:

$$E = \frac{(SE) \sqrt{\text{State total estimate}}}{\sqrt{\text{Smaller estimate}}} \quad (1)$$

where:

E = approximate sampling error for smaller estimate

SE = sampling error for State total estimate

For example, to compute the error on the area of forest land in the oak/hickory forest type group for the State, proceed as follows:

The total area of the oak-hickory forest type group in the State from table 3 is 2,698,800 acres.

The total area of all forest land in the state from table 3 is 4,553,800 acres.

The State total error for forest land area from table B-2 is 1.72 percent.

Using formula (1):

$$\text{Sampling Error} = E = \frac{(1.72) \sqrt{(4,553,800)}}{\sqrt{(2,698,800)}} = 2.36 \text{ percent.}$$

The estimators used by FIA are unbiased under the assumptions that the sample plots are a random sample of the total population and the observed value for any plot is the true value for that plot. Deviations from these basic assumptions are not reflected in the computation of sampling errors. The following sections on measurement, prediction and nonresponse error address possible departures from these basic assumptions.

Measurement Error

Errors associated with the methods and instruments used to observe and record the sample attributes are called measurement errors. On FIA plots, attributes such as the diameter and height of a tree are measured with different instruments, and other attributes such as species and crown class are observed without the aid of an instrument. On a typical FIA plot, 30 to 70 trees are observed with 15 to 20 attributes recorded on each tree. In addition, many attributes that describe the plot and conditions on the plot are observed. Errors in any of these observations affect the quality of the estimates. If a measurement is biased (such as tree diameter consistently taken at an incorrect place on the tree), then the estimates that use this observation (such as volume) will reflect this bias. Even if measurements are unbiased, high levels of random error in the measurements will add to the total random error of the estimation process.

To ensure that all FIA observations are made to the highest standards possible, a regular program of quality control and quality assurance is an integral part of all FIA data collection efforts. This program begins with the documentation of protocols and procedures used in the inventory followed by extensive crew training. To assess the quality of the data collected by these trained crews, a random sample of at least 4 percent of all plots are measured independently by a different qualified crew. These independent measurements are referred to as blind checks. The purpose of these blind checks is to assess the quality of field measurements. The second measurement on these blind check plots is done by a crew termed the QA crew. In all cases, QA crews have as much or more experience and training in FIA field measurements than standard FIA crews.

The quality of field measurements is assessed nationally through a set of measurement quality objectives (MQO's) that are set for every data item we collect. Each MQO consists of two parts: a tolerance or acceptable level of measurement error, and an objective in terms of the percent of measurements within tolerance. The blind check measurements are used to observe how often individual field crews are meeting these objectives and to assess the overall compliance among all crews. Table B-3 shows the compliance rates for various measurements used to compute the estimates included in this report and in other NCFIA reports. The columns labeled Indiana come from blind check measurements of plots used in this

report, and the columns labeled All NC States come from all measurements made by FIA crews within the entire 11-State area where the North Central Research Station implemented the FIA program over 1999-2003. Training and supervision of crews is a regional effort, and crews often work in more than one State. Regional data quality observations reflect the overall measurement quality of all data collected by FIA in the NC region.

Table B-3—Percent compliance to measurement quality objective (MQO) tolerances of Variables for NCFIA blind check plots measured over 1999-2003

Variable	Measurement quality objective		Indiana		All NC States	
	Tolerance	Objective (percent)	% of data within tolerance	Number of observations	% of data within tolerance	Number of observations
Tree-level variables						
Diameter at breast height	±0.1 /20 in.	95.0	95.0	576	92.9	22,341
Diameter at root collar	±0.1 /20 in.	95.0	0.0	0	60.7	28
Azimuth	±10 °	90.0	98.8	576	98.4	22,369
Horizontal distance	±0.2 /1.0 ft	90.0	98.6	576	97.1	22,369
Species	No tolerance	95.0	98.8	576	96.2	22,369
Tree genus	No tolerance	99.0	99.7	576	99.1	22,360
Tree status	No tolerance	95.0	98.4	576	99.1	22,369
Rotten/missing cull	±10	90.0	98.9	373	98.6	15,312
Total length	±10	90.0	90.2	377	82.4	14,424
Actual length	±10	90.0	78.0	41	80.1	1,638
Compacted crown ratio	±10	90.0	91.7	469	87.8	20,074
Uncompacted crown ratio	±10	90.0	86.2	58	78.2	724
Crown class	No tolerance	85.0	88.3	469	83.1	20,074
Decay class	±1 class	90.0	97.3	73	95.1	2,048
Cause of death	No tolerance	80.0	69.9	73	93.6	2,048
Condition	No tolerance	99.0	96.4	576	97.4	22,369
Crown position	No tolerance		91.3	46	80.9	593
Crown light exposure	±1 class	85.0	96.6	58	90.6	724
Sapling crown vigor class	No tolerance	85.0	75.0	12	61.4	132
Crown density	±10	90.0	82.6	46	67.6	593
Crown dieback	±10	90.0	100.0	46	96.5	593
Transparency	±10	90.0	93.5	46	84.0	593
NC tree class	No tolerance	90.0	94.0	536	92.3	22,054
NC damage agent 1	No tolerance	90.0	95.9	469	91.9	20,074
NC damage agent 2	No tolerance	90.0	94.0	67	87.0	3,235
Utilization	No tolerance	99.0	100.0	23	88.0	309
NC tree grade	No tolerance	90.0	82.8	116	68.5	3,566
D.b.h. of live and sound dead trees	±0.1 /20 in.	95.0	94.9	488	92.6	20,505
D.b.h. of dead rotten trees	±1 /20 in.	95.0	100.0	15	98.4	942
Total length trees 40 ft plus	±10	90.0	90.7	345	83.8	11,863
Total length trees less than 40 ft	±10	90.0	84.4	32	75.8	2,561
Total length trees less than 5 in. d.b.h.	±10	90.0	80.0	10	70.7	147
Seedling-level variables						
Species	No tolerance	85.0	92.9	211	91.2	4,680
Genus	No tolerance	90.0	96.7	211	97.2	4,680
Seedling count	±20	90.0	75.4	211	66.5	4,680
Seedling count coded	No tolerance	90.0	75.8	211	73.2	4,680

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(table B-3 continued)

Variable	Measurement quality objective		Indiana		All NC States	
	Tolerance	Objective (percent)	% of data within tolerance	Number of observations	% of data within tolerance	Number of observations
Condition-level variables						
Condition status	No tolerance	99.0	98.4	62	99.0	1,882
Reserve status	No tolerance	99.0	100.0	62	99.5	1,882
Owner group	No tolerance	99.0	100.0	38	98.3	1,487
Forest type (type)	No tolerance	95.0	84.2	38	80.3	1,487
Forest type (group)	No tolerance	99.0	92.1	38	89.4	1,487
Stand size	No tolerance	99.0	94.7	38	88.0	1,487
Regeneration status	No tolerance	99.0	100.0	38	99.1	1,487
Tree density	No tolerance	99.0	100.0	38	93.8	1,487
Owner class	No tolerance	99.0	100.0	38	95.4	1,487
Owner status	No tolerance	99.0	100.0	38	98.9	1,487
Regeneration species	No tolerance	99.0	100.0	38	98.9	1,487
Stand age	±10	95.0	57.9	38	64.4	1,487
Disturbance 1	No tolerance	99.0	100.0	38	92.9	1,475
Disturbance year 1	±1 yr	99.0	0.0	0	86.2	58
Disturbance 2	No tolerance	99.0	100.0	1	95.4	153
Disturbance year 2	±1 yr	99.0	0.0	0	50.0	4
Disturbance 3	No tolerance	99.0	0.0	0	90.0	10
Disturbance year 3		99.0	0.0	0	0.0	0
Treatment 1	No tolerance	99.0	97.4	38	95.0	1,475
Treatment year 1	±1 yr	99.0	100.0	5	91.0	89
Treatment 2	No tolerance	99.0	100.0	6	85.8	162
Treatment year 2	±1 yr	99.0	0.0	0	100.0	13
Treatment 3	No tolerance	99.0	0.0	0	97.1	35
Treatment year 3	±1 yr	99.0	0.0	0	100.0	5
Physiographic class	No tolerance	80.0	86.8	38	75.4	1,487
Present nonforest use	No tolerance	90.0	97.4	39	99.8	629
NC land use	No tolerance	99.0	95.2	62	93.0	1,882
Subplot-level variables						
Subplot center condition	No tolerance	99.0	97.4	192	97.1	5,183
Microplot center condition	No tolerance	99.0	97.4	192	96.8	5,183
Slope	±10	90.0	96.9	192	97.5	5,183
Aspect	±10 °	90.0	93.4	182	88.3	4,789
Snow/water depth	±0.5 ft		84.9	192	66.2	5,183
Plot-level variables						
Distance to road	No tolerance	90.0	72.9	48	80.8	1,311
Water on plot	No tolerance	90.0	95.8	48	87.7	1,311
Road type code	No tolerance	90.0	90.9	33	76.0	1,028
Recreational use restrictions	No tolerance	90.0	93.9	33	90.4	1,028
Recreational use 1	No tolerance	90.0	100.0	33	94.3	1,028
Recreational use 2	No tolerance	90.0	0.0	0	100.0	16
Recreational use 3	No tolerance	90.0	0.0	0	90.9	11
Road access	No tolerance	90.0	97.9	48	93.5	1,311
Elevation	±50 ft		93.2	44	81.5	1,177
Latitude	±0.0001 dg	99.0	88.9	45	91.2	1,187
Longitude	±0.0001 dg	99.0	95.6	45	90.6	1,187
Latitude	±140 ft		100.0	45	98.1	1,187
Longitude	±140 ft		100.0	45	97.6	1,187

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(table B-3 continued)

Variable	Measurement quality objective		Indiana		All NC States	
	Tolerance	Objective (percent)	% of data within tolerance	Number of observations	% of data within tolerance	Number of observations
Boundary-level variables						
Boundary change	No tolerance	99.0	61.1	18	95.3	275
Contrasting condition	No tolerance	99.0	100.0	18	92.4	275
Left azimuth	±10 degrees	90.0	100.0	18	85.1	275
Corner mapped	No tolerance	90.0	100.0	18	97.5	275
Corner azimuth	±10 degrees	90.0	0.0	0	60.0	10
Corner distance	±1 ft	90.0	0.0	0	50.0	10
Right azimuth	±10 degrees	90.0	94.4	18	84.7	275
Site index tree-level variables						
Condition list	No tolerance	99.0	93.7	63	90.6	2,652
Diameter	±0.1 /20 in.	95.0	92.1	63	90.6	2,044
Species	No tolerance	95.0	100.0	63	95.7	2,652
Genus	No tolerance	99.0	100.0	63	99.7	2,652
Azimuth	±10 degrees	90.0	100.0	63	98.1	2,044
Distance	±5 feet	90.0	98.4	63	99.6	2,044
Total length	±10 percent	90.0	95.2	63	90.5	2,044
Diameter age	±5 years	95.0	82.5	63	78.1	2,044
Site index method	No tolerance	99.0	100.0	63	99.9	2,652
Field site index	No tolerance	99.0	100.0	63	93.3	2,652

In addition to the percent compliance to measurement quality objectives, the blind check observations were used to test for relative bias in the field crew measurements. Relative bias is defined here as a tendency for the standard field crew measurements to be higher or lower than those measurements taken by the QA crews. The estimated relative bias and limits of 95 percent confidence intervals (based on parametric bootstrap estimates) for the relative bias are presented in table B-4.

The blind check measurements do not provide direct observations of true bias in field measurements (average difference between field measurements and true values) because they are paired observations of two field measurements. The QA crew in these blind checks typically has more training and experience with FIA field measurements than the first crew, but both crews use the same methods and instruments to obtain the measurements. These methods have been selected to be the best available and were selected for use nationwide by FIA; they are commonly used by other similar natural resource inventories. A basic assumption is that the methods, when correctly applied, provide unbiased observations of the attribute they are designed to measure. Under this assumption, relative bias observations in table B-4 provide observations of bias due to the difference in experience and training between the field and QA crews. In most cases there is no significant bias.

Table B-4—Observed relative bias values (Average [Field crew – QA crew]) for measurement variables, NCFIA blind check plots measured over 1999-2003

Variable	Unit of measure	Indiana				All NC States			
		Relative bias	95% CI lower limit	95% CI upper limit	Number of observations	Relative bias	95% CI lower limit	95% CI upper limit	Number of observations
Tree-level variables									
Diameter at breast height	inches	-0.03	-0.11	0.03	576	-0.02	-0.03	-0.01	22,341
Diameter at root collar	inches					0.11	-0.12	0.46	28
Azimuth	degrees	0.36	-0.10	0.75	576	0.31	0.19	0.41	22,369
Horizontal distance	feet	0.05	-0.01	0.12	576	0.00	-0.01	0.01	22,369
Species	code	0.95	-0.39	3.20	576	0.01	-0.48	0.40	22,369
Tree genus	code	0.93	-0.42	3.19	576	0.01	-0.47	0.37	22,360
Tree status	code	0.01	0.00	0.03	576	0.00	0.00	0.00	22,369
Rotten/missing cull	percent	-0.10	-0.48	0.19	373	0.01	-0.07	0.08	15,312
Total length	feet	-0.10	-0.97	0.79	377	0.24	-0.06	0.47	14,424
Actual length	feet	2.80	-2.38	8.52	41	-1.89	-3.74	-0.62	1,638
Compacted crown ratio	percent	-1.43	-2.14	-0.73	469	0.48	0.34	0.61	20,074
Uncompacted crown ratio	percent	-0.50	-3.04	2.00	58	-6.62	-8.07	-5.06	724
Crown class	code	-0.06	-0.13	-0.02	469	0.02	0.01	0.03	20,074
Decay class	code	0.12	0.01	0.25	73	0.06	0.03	0.09	2,048
Cause of death	code	3.29	-3.36	10.34	73	1.56	0.91	2.10	2,048
Condition	code	0.02	0.01	0.03	576	0.00	0.00	0.01	22,369
Crown position	code	0.04	-0.04	0.13	46	-0.25	-0.31	-0.18	593
Crown light exposure	code	-0.12	-0.38	0.10	58	-0.25	-0.31	-0.19	724
Sapling crown vigor class	code	-0.08	-0.33	0.17	12	-0.27	-0.37	-0.15	132
Crown density	percent	4.24	1.41	6.58	46	-7.06	-8.66	-5.38	593
Crown dieback	percent	-0.11	-0.87	0.54	46	-0.65	-1.41	-0.12	593
Transparency	percent	1.20	-0.33	2.72	46	-3.53	-4.69	-2.35	593
NC tree class	code	0.09	-0.13	0.35	536	0.11	0.07	0.16	22,054
NC damage agent 1	code	2.00	-2.32	7.64	469	5.17	3.83	6.54	20,074
NC damage agent 2	code	-15.8	-47.4	5.8	67	5.4	0.9	9.9	3,235
Utilization	code	0.00	0.00	0.00	23	-0.02	-0.06	0.02	309
NC tree grade	code	-6.98	-14.6	-0.5	116	-0.98	-4.49	2.48	3,566
D.b.h. of live and sound dead trees	inches	0.00	-0.01	0.03	488	-0.02	-0.03	-0.02	20,505
D.b.h. of dead rotten trees	inches	-0.01	-0.03	0.01	15	-0.04	-0.07	-0.01	942
Total length trees 40 ft plus	feet	-0.23	-1.00	0.57	345	0.88	0.73	1.02	11,863
Total length trees less than 40 ft	feet	1.29	-4.08	5.12	32	-2.70	-3.94	-1.61	2,561
Total length trees less than 5 in. d.b.h.	feet	4.25	-0.19	8.15	10	2.30	-0.15	4.55	147
Seedling-level variables									
Species	code	0.00	-0.04	0.03	211	0.00	-0.01	0.01	4,680
Genus	code	0.00	-0.03	0.02	211	0.00	0.00	0.01	4,680
Seedling count	percent	-9.4	-27.4	0.5	211	-11.3	-14.4	-8.6	4,680
Seedling count coded	percent	0.1	-0.1	0.2	211	0.0	0.0	0.1	4,680
Condition-level variables									
Condition status	code	-0.06	-0.19	0.00	62	0.00	-0.02	0.01	1,882
Reserve status	code	0.00	0.00	0.00	62	0.00	0.00	0.01	1,882
Owner group	code	0.00	0.00	0.00	38	-0.05	-0.21	0.11	1,487
Forest type (type)	code	23.29	0.28	54.14	38	13.83	7.40	19.41	1,487
Forest type (group)	code	23.68	0.00	55.26	38	13.79	7.23	19.50	1,487
Stand size	code	0.05	0.00	0.13	38	-0.01	-0.03	0.02	1,487
Regeneration status	code	0.00	0.00	0.00	38	0.00	0.00	0.00	1,487
Tree density	code	0.00	0.00	0.00	38	0.00	-0.01	0.01	1,487
Owner class	code	0.00	0.00	0.00	38	-0.06	-0.24	0.12	1,487
Owner status	code	0.00	0.00	0.00	38	0.00	-0.01	0.02	1,487
Regeneration species	code	0.00	0.00	0.00	38	0.03	-0.52	0.53	1,487

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(table B-4 continued)

Variable	Unit of measure	Indiana				All NC States			
		Relative bias	95% CI lower limit	95% CI upper limit	Number of observations	Relative bias	95% CI lower limit	95% CI upper limit	Number of observations
Tree density	code	0.00	0.00	0.00	38	0.00	-0.01	0.01	1,487
Owner class	code	0.00	0.00	0.00	38	-0.06	-0.24	0.12	1,487
Owner status	code	0.00	0.00	0.00	38	0.00	-0.01	0.02	1,487
Regeneration species	code	0.00	0.00	0.00	38	0.03	-0.52	0.53	1,487
Stand age	years	-0.13	-3.47	2.62	38	-0.99	-1.73	-0.25	1,487
Disturbance 1	code	0.00	0.00	0.00	38	-1.64	-2.48	-0.95	1,475
Disturbance year 1	year				1	1.22	.57	1.77	58
Disturbance 2	code				1	-1.01	-2.48	0.25	153
Disturbance year 2	year								4
Disturbance 3	code								10
Disturbance year 3	year								
Treatment 1	code	-0.26	-0.79	0.00	38	0.15	-0.03	0.32	1,475
Treatment year 1	year	-0.40	-0.80	0.00	5	0.13	-0.04	0.33	89
Treatment 2	code	0.00	0.00	0.00	6	4.07	2.01	6.14	162
Treatment year 2	year					0.08	-0.23	0.35	13
Treatment 3	code					-1.14	-3.43	0.00	35
Treatment year 3	year								5
Physiographic class	code	-0.24	-0.68	0.09	38	0.02	-0.22	0.26	1,487
Present nonforest use	code	1.03	0.00	3.08	39	0.06	0.00	0.25	629
NC land use	code	-1.06	-3.31	0.16	62	0.04	-0.29	0.34	1,882
Subplot-level variables									
Subplot center condition	code	0.01	-0.02	0.03	192	0.00	0.00	0.01	5,183
Microplot center condition	code	0.01	-0.02	0.03	192	0.01	0.00	0.01	5,183
Slope	percent	0.86	0.10	1.74	192	0.70	-0.60	1.86	5,183
Aspect	degrees	3.60	-3.68	10.84	182	0.11	-1.46	1.85	4,789
Snow/water depth	feet	-0.03	-0.53	0.28	192	-0.47	-0.90	-0.11	5,183
Plot-level variables									
Distance to road	code	0.33	0.08	0.65	48	0.00	-0.04	0.05	1,311
Water on plot	code	-0.04	-0.29	0.19	48	0.13	0.01	0.24	1,311
Road type code	code	0.21	0.00	0.52	33	0.07	0.01	0.13	1,028
Recreational use restrictions	code	0.06	0.00	0.15	33	0.14	-0.11	0.39	1,028
Recreational use 1	code	0.00	0.00	0.00	33	-0.09	-0.15	-0.04	1,028
Recreational use 2	code					0.00	0.00	0.00	16
Recreational use 3	code					-0.09	-0.36	0.00	11
Road access	code	0.02	0.00	0.06	48	-0.04	-0.07	-0.02	1,311
Elevation	feet	3.8	-7.0	14.2	44	-35.9	-71.2	-7.3	1,177
Latitude	degrees	0.00	0.00	0.00	45	-0.01	-0.02	0.00	1,187
Longitude	degrees	0.00	0.00	0.00	45	0.71	0.00	2.84	1,187
Latitude	feet	-1	-8	7	45	-2717	-6421	-106	1,187
Longitude	feet	-2	-10	5	45	11545	189	33863	1,187
Boundary-level variables									
Boundary change	code	0.67	0.28	1.14	18	0.08	0.03	0.13	275
Contrasting condition	code	0.00	0.00	0.00	18	0.00	-0.03	0.03	275
Left azimuth	degrees	0.56	-1.44	2.22	18	-4.67	-9.80	-0.02	275
Corner mapped	code	0.00	0.00	0.00	18	-0.01	-0.03	0.01	275
Corner azimuth	degrees				0	1.60	-4.85	9.15	17
Corner distance	feet				0	-1.60	-8.60	2.80	17
Right azimuth	degrees	3.39	1.47	5.58	18	2.00	-2.79	7.52	275

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(table B-4 continued)

Variable	Unit of measure	Indiana				All NC States			
		Relative bias	95% CI lower limit	95% CI upper limit	Number of observations	Relative bias	95% CI lower limit	95% CI upper limit	Number of observations
Site index tree-level variables									
Condition list	code	-0.70	-1.71	0.00	63	0.21	-0.10	0.44	2,652
Diameter	inches	0.00	-0.02	0.02	63	-0.01	-0.03	0.01	2,044
Species	code	0.00	0.00	0.00	63	-0.04	-0.24	0.17	2,652
Genus	code	0.00	0.00	0.00	63	-0.03	-0.22	0.17	2,652
Azimuth	degrees	0.68	0.39	1.08	63	-0.11	-0.58	0.40	2,044
Distance	feet	0.28	-0.02	0.94	63	0.05	0.02	0.10	2,044
Total length	feet	-0.66	-1.91	0.51	63	0.26	-0.09	0.60	2,044
Diameter age	years	2.37	0.84	3.72	63	0.20	-0.08	0.49	2,044
Site index method	code	0.00	0.00	0.00	63	0.00	0.00	0.00	2,652
Field site index	feet	0.00	0.00	0.00	63	0.48	0.26	0.69	2,652

Prediction Error

Errors associated with using mathematical models (such as volume models) to provide observations of the attributes of interest based on sample attributes are referred to as prediction errors. Area, number of trees, volume, biomass, growth, removals, and mortality are the primary attributes of interest presented in this report. Area and number of trees estimates are based on direct observation and do not involve the use of prediction models; however, FIA estimates of volume, biomass, growth, removals, and mortality use model-based predictions in the estimation process. Models are used to predict volume and biomass estimates of individual tree volumes. Change estimates such as growth, mortality, and removals are based on these model-based predictions of volume from both the current plot measurements and the measurements taken in the previous inventory.

Estimates of prediction errors associated with the volume models used in this report are presented by Hahn and Hansen (1991), along with the model forms, the methods used in model development, and the model parameter estimates. The estimated prediction errors are based on observations of 10,453 trees measured in the 1989 Missouri statewide inventory. For gross cubic foot volume in live trees, an overall overprediction of 2.5 percent was found across all species, with an underprediction of 4.3 percent in trees less than 10.0 inches d.b.h., and an overprediction of 7.1 percent in trees 20.0 inches d.b.h. and larger. Similar prediction errors were observed in the board foot estimates.

Users of FIA estimates should be aware of the possible prediction errors in FIA estimates. In comparing FIA estimates to other data sources, users need to be aware of the prediction models used in both estimates. If both estimates are based on the same prediction models with matching fitted parameter values, then the prediction bias of one estimate should cancel out that of the other estimate. If the estimates are based on different prediction models, then the user should be aware of the prediction error of both models.

Nonresponse Error

Nonresponse error refers to the error caused by not being able to observe some of the elements in the sample. In FIA, nonresponse occurs when crews are unable to measure a plot (or a portion of a plot) at a selected location. Nonresponse falls into the following three classes:

Denied access—Entire plots or portions of plots where the field crew is unable to obtain permission from the landowner and is therefore unable to measure the trees on the plot.

Hazardous/inaccessible—Entire plots or portions of plots where the conditions present prevent a crew from safely getting to the plot or measuring the trees on the plot.

Other—Plots where the field crew is unable to obtain a valid measurement for a variety of reasons other than those stated above.

Nonresponse has two effects on the sample. First, it reduces the sample size. The reduced sample size is reflected in the sampling errors discussed in that section. Second, nonresponse can bias the estimates if the portion of the population not being sampled differs from the portion being sampled.

In FIA, unlike many survey samples, nonresponse rates are relatively low. In the 1999-2003 Indiana inventory, a total of 3,881 sample plots were selected to be observed. Of the total sample plots selected for observation, 99 percent are in the sample used for the estimation of current resources. There were 31 plots where crews were unable to obtain owner permission to measure the plot, 8 plots where hazardous conditions prevented the crew from measuring all or part of the plot, and 8 plots that were lost from the sample due to other problems.

Even though an overall nonresponse rate of only 1 percent is quite low, it can cause considerable bias if not properly accounted for. The major source of nonresponse is denied access to plots. Denied access plots primarily occur on lands in private ownership. Also, the observations needed for plots on nonforest and water land classes do not usually require crews to physically enter the land and permission is not needed to obtain the observation because it can be obtained from aerial photos or other remotely sensed information sources.

The stratified estimation process used by FIA with strata defined by three ownership classes (National Forest, Other Public, and Private) and four Landsat TM forest cover classes (Nonforest, Nonforest Edge, Forest Edge, and Forest) reduces the possible effects of bias caused by non-response. Under the stratified estimation process used by FIA, nonresponses are removed from the sample, and stratum estimates (means, totals, and sampling errors) are obtained from only those plots with valid observations. The net effect in the estimates of

means and totals is that the average of the observed plots within the stratum (ownership class-forest cover class) becomes the estimate for all nonresponses within that stratum. The nonresponse rate in one stratum does not affect the estimate in other strata. The response rate within each stratum is presented in table B-5 for the Indiana 1999-2003 inventory and for all FIA inventories conducted by the North Central Research Station over the same period.

Table B-5—FIA nonresponse by strata for NCFIA annual inventories measured in 1999-2003

Inventory State	Owner-strata	Total number of plots selected	Sum of plot portions ¹				Response rate (percent)
			Observed	Denied access	Hazardous	Other	
Indiana							
	National Forest						
	Nonforest	0	0				
	Nonforest edge	1	1.0	0.0	0.0	0.0	100
	Forest edge	5	5.0	0.0	0.0	0.0	100
	Forest	40	39.0	0.0	0.0	1.0	98
	Total	46	45.0	0.0	0.0	1.0	98
	Other Public						
	Nonforest	8	8.0	0.0	0.0	0.0	100
	Nonforest edge	10	9.0	0.0	1.0	0.0	90
	Forest edge	22	21.0	0.0	1.0	0.0	95
	Forest	59	56.0	0.0	3.0	0.0	95
	Total	99	94.0	0.0	5.0	0.0	95
	Private						
	Nonforest	2,537	2,537.0	0.0	0.0	0.0	100
	Nonforest edge	547	536.8	8.0	1.2	1.0	98
	Forest edge	386	371.9	10.0	0.1	4.0	96
	Forest	266	251.0	13.0	0.0	2.0	94
	Total	3,736	3,696.8	31.0	1.2	7.0	99
	Total	3,881	3,835.8	31.0	6.2	8.0	99
All NC States							
	National Forest						
	Nonforest	125	125.0	0.0	0.0	0.0	100
	Nonforest edge	156	156.0	0.0	0.0	0.0	100
	Forest edge	314	311.0	0.0	3.0	0.0	99
	Forest	2,547	2,516.5	3.3	24.3	3.0	99
	Total	3,142	3,108.5	3.3	27.3	3.0	99
	Other Public						
	Nonforest	1,037	1,035.0	1.0	1.0	0.0	100
	Nonforest edge	664	658.0	2.0	3.0	1.0	99
	Forest edge	946	932.8	3.0	8.3	2.0	99
	Forest	3,837	3,762.8	9.0	29.3	36.0	98
	Total	6,484	6,388.5	15.0	41.5	39.0	99
	Private						
	Nonforest	47,137	47,032.5	98.0	1.5	5.0	100
	Nonforest edge	10,272	9,916.8	335.1	10.2	10.0	97
	Forest edge	8,011	7,464.2	527.4	11.4	8.0	93
	Forest	10,327	9,664.5	624.1	19.4	19.0	94
	Total	75,747	74,077.9	1,584.6	42.5	42.0	98
	Total	85,373	83,574.9	1,602.8	111.3	84.0	98

In table 1 of this report, we acknowledge denied access and hazardous as two land classes that exist in Indiana within which we are not able to provide estimates of conditions such as forest area or timber volume; however, we do report the total estimated area in each of these classes. In all other tables of the report, we do not acknowledge either of these classes, and in the estimation process we treat the sample where we do have observations as a random sample of the entire State.

The nonresponse plots in this inventory were not permanently removed from the FIA system of plots. In future inventories we will again attempt to measure these plots. At that time we may be able to obtain permission to access these plots, the hazardous conditions may have changed, or other circumstances that caused us to drop plots from a specific inventory cycle will probably be different.

Glossary

Average annual mortality of growing stock: The average cubic foot volume of sound wood in growing-stock trees that died in one year, between 1999 and 2003.

Average annual mortality of sawtimber: The average board foot volume of sound wood in sawtimber trees that died in one year, between 1999 and 2003.

Average annual net growth of growing stock: The annual change in cubic foot volume of sound wood in live sawtimber and poletimber trees, and the total volume of trees entering these classes through ingrowth, less volume losses resulting from natural causes, between 1999 and 2003.

Average annual net growth of sawtimber: The annual change in the board foot volume of live sawtimber trees, and the total volume of trees reaching sawtimber size, less volume losses resulting from natural causes, between 1999 and 2003.

Average annual removals from growing stock: The average net growing-stock volume in growing-stock trees removed annually for roundwood forest products, in addition to the volume of logging residues and the volume of other removals.

Average annual removals from sawtimber: The average net board foot sawtimber volume of live sawtimber trees removed annually for roundwood forest products, in addition to the volume of logging residues and the volume of other removals, between 1999 and 2003.

Basal area: Tree area in square feet of the cross section at breast height of a single tree. When the basal areas of all trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Bioindicator species: A tree, woody shrub, or nonwoody herb species that responds to ambient levels of ozone pollution with distinct visible foliar symptoms that are easy to diagnose.

Biomass: The aboveground volume of all live trees (including bark but excluding foliage) reported in green tons (i.e., green weight). Biomass has four components:

Bole: Biomass of a tree from 1 foot above the ground to a 4-inch top outside bark.

Tops and limbs: Total biomass of a tree from a 1-foot stump minus the bole.

1-to 5-inch trees: Total aboveground biomass of a tree from 1 to 5 inches d.b.h.

Stump: Biomass of a tree 5 inches d.b.h. and larger from the ground to a height of 1 foot.

Bulk density: The mass of soil per unit volume. A measure of the ratio of pore space to solid materials in a given soil. Expressed in units of grams per cubic centimeter of oven-dry soil.

Commercial species: Tree species suitable for industrial wood products.

Compacted live crown ratio: The percent of the total length of the tree that supports a full, live crown. To determine compacted live crown ratio for trees that have uneven length crowns, lower branches are ocularly transferred to fill holes in the upper portions of the crown, until a full, even crown is created.

County and municipal: An ownership class of public lands owned by counties or local public agencies, or lands leased by these governmental units for more than 50 years.

Cropland: Land under cultivation within the last 24 months, including cropland harvested, crop failures, cultivated summer fallow, idle cropland used only for pasture, orchards, active Christmas tree plantations indicated by annual shearing, nurseries, and land in soil improvement crops, but excluding land cultivated in developing improved pasture.

Crown: The part of a tree or woody plant bearing live branches or foliage.

Crown dieback: Recent mortality of branches with fine twigs, which begins at the terminal portion of a branch and proceeds toward the trunk. Dieback is considered only when it occurs in the upper and outer portions of the tree. When whole branches are dead in the upper crown, without obvious signs of damage such as breaks or animal injury, it is assumed the branches died from the terminal portion of the branch. Dead branches in the lower portion of the live crown are assumed to have died from competition and shading.

Cull tree: A live tree, 5.0 inches d.b.h. or larger, that is unmerchantable for saw logs now or prospectively because of rot, roughness, or species.
(See definitions for rotten and rough trees.)

Decay class: Qualitative assessment of stage of decay (5 classes) of coarse woody debris based on visual assessments of color of wood, presence/absence of twigs and branches, texture of rotten portions, and structural integrity.

Diameter class: A classification of trees based on diameter outside bark measured at breast height (4-1/2 feet above ground). D.b.h. is the common abbreviation for “diameter at breast height.” With 2-inch diameter classes, the 6-inch class, for example, includes trees 5.0 through 6.9 inches d.b.h.

Down woody material (DWM): Woody pieces of trees and shrubs that have been uprooted (no longer supporting growth) or severed from their root system, not self-supporting, and lying on the ground.

Duff: A soil layer dominated by organic material derived from the decomposition of plant and animal litter and deposited on either an organic or a mineral surface. This layer is distinguished from the litter layer in that the original organic material has undergone sufficient decomposition that the source of this material (e.g., individual plant parts) can no longer be identified.

Effective cation exchange capacity (ECEC): The sum of cations that a soil can adsorb in its natural pH. Expressed in units of centimoles of positive charge per kilogram of soil.

Federal: An ownership class of public lands owned by the U.S. Government.

Fiber products: Products derived from wood and bark residues, such as pulp, composition board products, and wood chips for export.

Fine materials: Wood residues not suitable for chipping, such as planer shavings and sawdust.

Fine woody debris (FWD): Dead branches, twigs, wood splinters 0.1 to 2.9 inches in diameter.

Forest industry: An ownership class of private lands owned by companies or individuals operating wood-using plants.

Forest land: Land at least 10 percent stocked by forest trees of any size, including land that formerly had such tree cover and that will be naturally or artificially regenerated. Forest land includes transition zones, such as areas between heavily forested and nonforested lands that are at least 10 percent stocked with forest trees and forest areas adjacent to urban and built-up lands. Also included are pinyon-juniper and chaparral areas in the West and afforested areas. The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of trees must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas are classified as forest if less than 120 feet wide.

Forest type: A classification of forest land based on the species presently forming a plurality of the live tree stocking.

Forest type group: A combination of forest types that share closely associated species or site requirements and are generally combined for brevity of reporting.

Major eastern forest type groups:

White-red-jack pine: Forests in which eastern white pine, red pine, or jack pine, singly or in combination, comprise a plurality of the stocking. Common associates include hemlock, aspen, birch, and maple.

Oak-pine: Forests in which hardwoods (usually upland oaks) comprise a plurality of the stocking, but in which pine or eastern redcedar comprises 25-50 percent of the stocking. Common associates include gum, hickory, and yellow-poplar.

Oak-hickory: Forests in which upland oaks or hickory, singly or in combination, comprise a plurality of the stocking except where pines comprise 25-50 percent, in which case the stand is classified as oak-pine. Common associates include yellow-poplar, elm, maple, and black walnut.

Oak-gum-cypress: Bottomland forests in which tupelo, blackgum, sweetgum, oaks, or southern cypress, singly or in combination, comprise a plurality of the stocking except where pines comprise 25-50 percent, in which case the stand is classified as oak-pine. Common associates include cottonwood, willow, ash, elm, hackberry, and maple.

Elm-ash-cottonwood: Forests in which elm, ash, or cottonwood, singly or in combination, comprise a plurality of the stocking. Common associates include willow, sycamore, beech, and maple.

Maple-beech-birch: Forests in which maple, beech, or yellow birch, singly or in combination, comprise a plurality of the stocking. Common associates include hemlock, elm, basswood, and white pine.

Aspen-birch: Forests in which aspen, balsam poplar, paper birch, or gray birch, singly or in combination, comprise a plurality of the stocking. Common associates include maple and balsam fir.

Growing stock: A classification of timber inventory that includes live trees of commercial species meeting specified standards of quality or vigor. Cull trees are excluded. When associated with volume, includes only trees 5.0 inches d.b.h. and larger.

Hardwood: A dicotyledonous tree, usually broad-leaved and deciduous.

Industrial wood: All commercial roundwood products except fuelwood.

Land area: The area of dry land and land temporarily or partly covered by water, such as marshes, swamps, and river flood plains; streams, sloughs, estuaries, and canals less than 200 feet wide; and lakes, reservoirs, and ponds less than 4.5 acres in area.

Litter: Undecomposed or only partially decomposed organic material that can be readily identified (e.g., plant leaves, twigs).

Live cull: A classification that includes live, cull trees. When associated with volume, it is the net volume in live, cull trees that are 5.0 inches d.b.h. and larger.

Log grade: A log classification based on external characteristics as indicators of quality or value. Also see Tree grade. (See USDA, 2003 on tree grading field techniques.)

Logging residues: The unused portions of growing-stock and non-growing-stock trees cut or killed by logging and left in the woods.

Merchantable: Refers to a pulpwood or saw log section that meets pulpwood or saw log specifications, respectively.

National forest: An ownership class of Federal lands, designated by Executive order or statute as national forests or purchase units, and other lands under the administration of the Forest Service including experimental areas.

Net annual growth: The average annual net increase in the volume of trees during the period between inventories. Components include the increment in net volume of trees at the beginning of the specific year surviving to its end, plus the net volume of trees reaching the minimum size class during the year, minus the volume of trees that died during the year, and minus the net volume of trees that became cull trees during the year.

Net volume in cubic feet: The gross volume in cubic feet less deductions for rot, roughness, and poor form. Volume is computed for the central stem from a 1-foot stump to a minimum 4.0-inch top diameter outside bark, or to the point where the central stem breaks into limbs.

Noncommercial species: Tree species of typically small size, poor form, or inferior quality, which normally do not develop into trees suitable for industrial wood products.

Nonforest land: Land that has never supported forests and lands formerly forested where use of timber management is precluded by development for other uses. (Note: Includes area used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1- to 4.5-acre areas of water

classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide, and clearings, etc., must be more than 1 acre in area, to qualify as nonforest land.)

Nonindustrial private: An ownership class of private lands where the owner does not operate wood-using plants.

Nonstocked areas: Timberland less than 10 percent stocked with all live trees.

Other red oaks: A group of species in the genus *Quercus* that includes scarlet oak, northern pin oak, southern red oak, bear oak, shingle oak, laurel oak, blackjack oak, water oak, pin oak, willow oak, and black oak.

Other white oaks: A group of species in the genus *Quercus* that includes overcup oak, chestnut oak, and post oak.

Ownership: The property owned by one ownership unit, including all parcels of land in the United States.

Ownership unit: A classification of ownership encompassing all types of legal entities having an ownership interest in land, regardless of the number of people involved. A unit may be an individual; a combination of persons; a legal entity such as a corporation, partnership, club, or trust; or a public agency. An ownership unit has control of a parcel or group of parcels of land.

Ozone (O₃): A regional, gaseous air pollutant produced primarily through sunlight-driven chemical reactions of nitrogen dioxide and hydrocarbons in the atmosphere and causing foliar injury to deciduous trees, conifers, shrubs, and herbaceous species.

Ozone bioindicator site: An open area used for ozone injury evaluations on ozone-sensitive species. The area must meet certain site selection guidelines on size, condition, and plant counts to be used for ozone injury evaluations in FIA

Physiographic class: A measure of soil and water conditions that affect tree growth on a site. The physiographic classes are

Xeric: Very dry soils where excessive drainage seriously limits both growth and species occurrence. These sites are usually on upland and upper half slopes.

Xeromesic: Moderately dry soils where excessive drainage limits growth and species occurrence to some extent. These sites are usually on the lower half slopes.

Mesic: Deep, well-drained soils. Growth and species occurrence are limited only by climate. These include all cove sites and bottomlands along intermittent streams.

Hydromesic: Moderately wet soils where insufficient drainage or infrequent flooding limits growth and species occurrence to some extent.

Hydric: Very wet sites where excess water seriously limits both growth and species occurrence.

Poletimber trees: Live trees at least 5.0 inches in d.b.h., but smaller than sawtimber trees.

Primary wood-using mill: A mill that converts roundwood products into other wood products. Common examples are sawmills that convert saw logs into lumber and pulpmills that convert pulpwood into wood pulp.

Productivity class: A classification of forest land in terms of potential annual cubic-foot volume growth per acre at culmination of mean annual increment in fully stocked natural stands.

Pulpwood: Roundwood, whole-tree chips, or wood residues used for the production of wood pulp.

Reserved forest land: Forest land withdrawn from timber utilization through statute, administrative regulation, or designation without regard to productive status.

Residues: Bark and woody materials that are generated in primary wood-using mills when roundwood products are converted to other products. Examples are slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and pulp screenings. Includes bark residues and wood residues (both coarse and fine materials) but excludes logging residues.

Rotten tree: A live tree of commercial species that does not contain a saw log now or prospectively primarily because of rot (that is, when rot accounts for more than 50 percent of the total cull volume).

Rough tree: (a) A live tree of commercial species that does not contain a saw log now or prospectively primarily because of roughness (that is, when sound cull due to such factors as poor form, splits, or cracks accounts for more than 50 percent of the total cull volume) or (b) a live tree of noncommercial species.

Roundwood products: Logs, bolts, and other round timber generated from harvesting trees for industrial or consumer use.

Salvable dead tree: A downed or standing dead tree considered currently or potentially merchantable by regional standards.

Saplings: Live trees 1.0 inch through 4.9 inches d.b.h.

Saw log: A log meeting minimum standards of diameter, length, and defect, including logs at least 8 feet long, sound and straight, and with a minimum diameter inside bark of 6 inches for softwoods and 8 inches for hardwoods, or meeting other combinations of size and defect specified by regional standards.

Sawtimber tree: A live tree of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs 8 feet or longer, and meeting regional specifications for freedom from defect. Softwoods must be at least 9.0 inches d.b.h. Hardwoods must be at least 11.0 inches diameter outside bark (d.o.b.).

Sawtimber volume: Net volume of the saw log portion of live sawtimber in board feet, International 1/4-inch rule (unless specified otherwise), from stump to a minimum 7.0 inches top diameter outside bark (d.o.b.) for softwoods and a minimum 9.0 inches top d.o.b. for hardwoods.

Seedlings: Live trees less than 1.0 inch d.b.h. and at least 1 foot in height.

Select red oaks: A group of species in the genus *Quercus* that includes cherrybark oak, northern red oak, and Shumard oak.

Select white oaks: A group of species in the genus *Quercus* that includes white oak, swamp white oak, bur oak, swamp chestnut oak, and chinkapin oak.

Site index: An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Snag: A standing dead tree. In the current inventory, a snag must be 5.0 inches d.b.h./d.r.c. and 4.5 feet tall, and have a lean angle less than 45 degrees from vertical. A snag may be either self-supported by its roots or supported by another tree or snag.

Softwood: A coniferous tree, usually evergreen, having needles or scale-like leaves.

Sound dead: The net volume in salvable dead trees.

Stand: A group of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

Stand-size class: A classification of forest land based on the size class of all live trees in the area. The classes include:

Nonstocked: Forest land stocked with less than 10 percent of full stocking with all live trees. Examples are recently cutover areas or recently reverted agricultural fields.

Seedling-sapling: Forest land stocked with at least 10 percent of full stocking with all live trees with half or more of such stocking in seedlings or saplings or both.

Poletimber: Forest land stocked with at least 10 percent of full stocking with all live trees with half or more of such stocking in poletimber or sawtimber trees or both, and in which the stocking of poletimber exceeds that of sawtimber.

Sawtimber: Forest land stocked with at least 10 percent of full stocking with all live trees with half or more of such stocking in poletimber or sawtimber trees or both, and in which the stocking of sawtimber is at least equal to that of poletimber.

State: An ownership class of public lands owned by States or lands leased by States for more than 50 years.

Stocking: The degree of occupancy of land by trees, measured by basal area or number of trees by size and spacing, or both, compared to a stocking standard; that is, the basal area or number of trees, or both, required to fully utilize the growth potential of the land.

Timberland: Forest land that is producing or is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. (Note: Areas qualifying as timberland are capable of producing in excess of 20 cubic feet per acre per year of industrial wood in natural stands. Currently inaccessible and inoperable areas are included.)

Timber products output: All timber products cut from roundwood and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edging, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulp mills that are used as pulpwood chips or other products.

Tree: A woody plant usually having one or more erect perennial stems, a stem diameter at breast height of at least 3 inches, a more or less definitely formed crown of foliage, and a height of at least 13 feet at maturity.

Tree size class: A classification of trees based on diameter at breast height, including saw-timber trees, poletimber trees, saplings, and seedlings.

Tops: The wood of a tree above the merchantable height (or above the point on the stem 4.0 inches diameter outside bark). It includes the usable material in the uppermost stem.

Urban forest land: Land that would otherwise meet the criteria for timberland but is in an urban-suburban area surrounded by commercial, industrial, or residential development and not likely to be managed for the production of industrial wood products on a continuing basis. Wood removed would be for land clearing, fuelwood, or esthetic purposes. Such forest land may be associated with industrial, commercial, residential subdivision, industrial parks, golf course perimeters, airport buffer strips, and public urban parks that qualify as forest land.

Unreserved forest land: Forest land not withdrawn from harvest by statute or administrative regulation. Includes forest lands that are not capable of producing in excess of 20 cubic feet per acre per year of industrial wood in natural stands.

Veneer log: A roundwood product from which veneer is sliced or sawn and that usually meets certain standards of minimum diameter and length and maximum defect.

Weight: The weight of wood and bark, oven-dry basis (approximately 12 percent moisture content).

References

- Bechtold, W.A.; Patterson, P.L., eds. 2005.** The enhanced Forest Inventory and Analysis program—national sampling design and estimation procedures. Gen. Tech. Rep. SRS-80. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 85 p.
- Brand, G.J.; Nelson, M.D.; Wendt, D.G.; Nimerfro, K.K. 2000.** The hexagon/panel system for selecting FIA plots under an annual inventory. In: McRoberts, R.E.; Reams, G.A.; Van Deusen, P.C., eds. Proceedings of the First annual Forest Inventory and Analysis symposium; 1999 November 2-3; San Antonio, TX. Gen. Tech. Rep. NC-213. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station: 8-13.
- DellaSala, D.A.; Staus, N.L.; Strittholt, J.R.; Hackman, A.; Iacobelli, A. 2001.** An updated protected areas database for the United States and Canada. *Natural Areas Journal*. 21(2): 124-135.
- Hahn, J.T.; Hansen, M.H. 1991.** Cubic and board foot volume models for the Central States. *Northern Journal of Applied Forestry*. 8: 47-57.
- Hansen, M.H.; Wendt, D.G. 2000.** Using classified Landsat Thematic Mapper data for stratification in a statewide forest inventory. In: McRoberts, R.E.; Reams, G.A.; Van Deusen, P.C. eds. Proceedings of the First annual Forest Inventory and Analysis symposium; 1999 November 2-3; San Antonio, TX. Gen. Tech. Rep. NC-213. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station: 20-27.
- Hutchison, O.K. 1956.** Indiana's forest resources and industries. For. Ser. Rep. 10. Washington, DC: U.S. Department of Agriculture, Forest Service. 44 p.
- McRoberts, R.E. 1999.** Joint annual forest inventory and monitoring system: the North Central perspective. *Journal of Forestry*. 97: 21-26.
- McRoberts, R.E.; Wendt, D.G.; Nelson, M.D.; Hansen, M.H. 2002.** Using a land cover classification based on satellite imagery to improve the precision of forest inventory area estimates. *Remote Sensing of Environment*. 80: 1-9.
- McRoberts, R.E. 2003.** Compensating for missing plot observations in forest inventory estimation. *Canadian Journal of Forest Research*. 33: 1990-1997.
- McRoberts, R.E. 2005.** The enhanced forest inventory and analysis program. In: Bechtold, W.A.; Patterson, P.L., eds. The enhanced forest inventory and analysis program—national sampling design and estimation procedures. Gen. Tech. Rep. SRS-80. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 1-10.
- Schmidt, T.L.; 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.
- Smith, W.B.; Golitz, M.F. 1988.** Indiana forest statistics, 1986. *Resour. Bull. NC-108*. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 39 p.
- Spencer, J.S. 1969.** Indiana's timber. *Resour. Bull. NC-7*. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 61 p.
- Spencer, J.S.; Kingsley, N.P.; Mayer, R.V. 1990.** Indiana's timber resource, 1986: an analysis. *Resour. Bull. NC-113*. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 85 p.

U.S. Department of Agriculture, Forest Service. 2003. Forest inventory and analysis national core field guide; Volume I: Field data collection procedures for phase 2 plots. Volume II: Field data collection procedures for phase 3 plots. Version 2.0. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 410 p.

Vogelmann, J.E.; Howard, S.M.; Yang, L.; Larson, C.R.; Wylie, B.K.; Van Driel, N. 2001. Completion of the 1990s National Land Cover Data Set for the conterminous United States from Landsat Thematic Mapper data and ancillary data sources. *Photogrammetric Engineering and Remote Sensing*. 67: 650-662.

Woodall, C.W.; Williams, M.S. 2005. Sampling, estimation, and analysis procedures for the Down Woody Materials indicator. Gen. Tech. Rep. NC-256. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 47 p.

Appendices

Ozone Indicator

Ozone is a natural constituent of our lower (ground level) and upper atmosphere. Elevated ozone concentrations in the lower atmosphere are commonly found around and downwind of major urban and industrial areas. Ozone is a very reactive molecule and concentrations slightly above background can readily damage photosynthetic cells in sensitive plant species. In contrast to these harmful effects, stratospheric ozone protects us from harmful solar UV radiation.

The ozone bioindicator program was developed in the early 1990s and a new national grid emphasizing ozone exposures as well as forested acreage was activated in 2002. The number of species and plants sampled was increased to provide more robust estimates of ozone stress.

The following bioindicator species have been tested in both laboratory and field settings for over a decade and have proven to be reliable field indicators of atmospheric ozone stress:

blackberry (*Rubus allegheniensis*), black cherry (*Prunus serotina*), milkweed (*Asclepias syriaca*), yellow-poplar (*Liriodendron tuliperfera*), white ash (*Fraxinus americana*), sassafras (*Sassafras albidum*), spreading dogbane (*Apocynum andrasefolium*), big leaf aster (*Aster macrophyllus*), sweetgum (*Liquidambar styraciflua*), pin cherry (*Prunus pensylvanica*).

Plants respond differently to ozone exposure because of individual physiological and genetic attributes as well as various environmental gradients. Injury occurs only after the ozone molecules enter the plant through the stomata so conditions resulting in open stomata typically result in higher levels of leaf injury. Numerous factors, such as genetic sensitivity, soil moisture, landscape position, and general plant health can affect ozone uptake (i.e., dose), so the amount of injury sustained may vary dramatically by years, regions, and microsite conditions.

Ozone Exposure in Indiana

Injury index scores in appendix table 1 provide a uniform measure of plant damage across States and regions. First, a species injury index is calculated by averaging all the foliar injury ratings (i.e., amount * severity) for all plants of a given species at a biosite. Next, an overall injury index score for the biosite can be calculated by averaging all the species scores. These biosite scores can then be interpolated with geographic information systems to provide estimates of ozone injury risk on regional and national scales.

Hourly ozone concentrations in the atmosphere before industrial development are believed to have ranged from 0 to 40 parts per billion (ppb). Peak hourly values in Indiana now exceed 120 ppb and seasonal exposures are many times higher. Seasonal exposures are typically measured by summing all hourly ozone concentrations above a threshold concentration.

As an example, a common growing season exposure index (SUM60) is the sum of all hourly ozone concentrations greater than 60 ppb between 7 a.m. and 7 p.m. from June 1 through August 31 for a given year. SUM60 values in Indiana typically range between 15,000 and 30,000 ppb-hours during an average summer. Pre-settlement SUM60 values are believed to have been in the hundreds to a few thousand ppb-hours. Forest communities today face far higher ozone and air pollution stress in general compared to the past.

Ground level ozone is called a secondary pollutant because it is not emitted directly. It forms in the atmosphere during the summer when volatile organic compounds (e.g., petroleum distillates and natural sources) and nitrogen oxides (a byproduct of combustion) combine in the atmosphere under conditions of high temperature (greater than 85 degrees F) and sunny weather. Elevated ozone concentrations are often created when moist, hot southerly airflows stagnate over major urban and industrial areas.

Ozone exposures can vary dramatically over space and time. Areas downwind of industrial areas, often at distances exceeding hundreds of miles, will incur elevated ozone levels while nearby upwind areas may have relatively low ozone exposures. This creates a patchy exposure surface with varying biological impacts depending on the length and severity of the ozone exposures. Typically ozone episodes occur several times a summer, and peak ozone concentrations often exceed 120 ppb. Hot years usually produce significant exposures while cool wet years result in lower ozone exposures.

Appendix Table 1—Plant and injury information for ozone plots in Indiana, 1997-2001

Parameter	1997	1998	1999	2000	2001	5 year average
Number of biosites	10	18	20	27	32	21.2
Number of biosites with injury	6	17	14	24	24	17
Percent biosites with injury	60	94	70	89	75	80
Percent biosites with injury index 0	40	6	30	11	25	22
Percent biosites with injury index 0.1 to 4.9	30	0	35	37	41	29
Percent biosites with injury index 5 to 14.9	20	17	20	30	16	21
Percent biosites with injury index 15 to 24.9	0	0	5	7	6	4
Percent biosites with injury index >=25	10	78	10	15	13	25
Average biosite index score	9.6	49.0	8.7	11.0	10.9	18.0
Average number of species per biosite	3	3.06	3.45	3.89	3.75	3.4
Number of plants evaluated	729	915	1,561	2,365	2,588	1,631
Number of plants with injury	84	231	180	360	192	209
Percent plants with injury	11	26	11	14	7	13

Indiana's Forest Attribute Tables

Area

- Table 1.— Percentage of area by land status
Table 2.— Area of forest land by owner class and forest land status
Table 3.— Area of forest land by forest type group and productivity class
Table 4.— Area of forest land by forest type group, ownership group, and land status
Table 5.— Area of forest land by forest type group and stand-size class
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- Table 24.— Average annual net growth of growing-stock trees on timberland by species group and ownership group, 1998 to 1999-2003
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Table 30.— Average annual removals of growing-stock trees on timberland by species group and ownership group, 1998 to 1999-2003

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Table 31.— Aboveground dry weight of all live trees by owner class and forest land status

Table 32.— Aboveground dry weight of all live trees on forest land by species group and diameter class

County-Level

Table 54.— Area of accessible forest land by Forest Survey Unit, county, and forest land status

Table 55.— Area of accessible forest land by Forest Survey Unit, county, ownership group, and forest land status

Table 56.— Area of forest land by Forest Survey Unit, county/county group, and forest type group

Table 57.— Area of timberland by Forest Survey Unit, county, and stand-size class

Table 58.— Area of timberland by Forest Survey Unit, county, and stocking class

Table 59.— Net volume of growing stock and sawtimber (International 1/4-inch rule) on timberland by Forest Survey Unit, county, and major species group

Table 59a.— Net volume of growing stock and sawtimber (Doyle rule) on timberland by Forest Survey Unit, county, and major species group

Table 60.— Average annual net growth of growing stock and sawtimber (International 1/4-inch rule) on timberland by Forest Survey Unit, county, and major species group

Table 60a.— Average annual net growth of growing stock and sawtimber (Doyle rule) on timberland by Forest Survey Unit, county, and major species group

Table 61.— Average annual removals of growing stock and sawtimber (International 1/4-inch rule) on timberland by Forest Survey Unit, county, and major species group

Table 61a.— Average annual removals of growing stock and sawtimber (Doyle rule) on timberland by Forest Survey Unit, county, and major species group

Table 65.— Sampling errors by Forest Survey Unit and county for area of timberland, volume, average annual net growth, average annual removals, and average annual mortality on timberland

* All tables contain forest attribute estimates for Indiana for measurements taken from 1999 to 2003, except where indicated.

** Gaps in enumeration of tables are placeholders for future reports where tables may be available, but at this time are unavailable due to estimation limitations with new annual inventory design (i.e., growth, removal, and mortality tables).

Table 1. — Percentage of area by land status, Indiana, 1999-2003

Land status	Percentage of area
Accessible forest land	
Unreserved forest land	
Timberland	18.4
Unproductive	0.0
Total unreserved forest land	18.4
Reserved forest land	
Productive	0.6
Unproductive	--
Total reserved forest land	0.6
All accessible forest land	19.0
Nonforest and other land	
Nonforest land	78.8
Water	
Census	0.7
Non-Census	0.5
All nonforest and other land	80.0
Nonsampled land	
Access denied	0.8
Hazardous conditions	0.2
Other	--
All land	100.0
Total area (thousands of acres)	23,157

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

Table 2. — Area of forest land by owner class and forest land status, Indiana, 1999-2003

(In thousand acres)

Owner class	Unreserved forests		Reserved forests		All forest land
	Timberland	Unproductive	Total	Productive	Unproductive
Forest Service					
National forest	192.4	--	192.4	13.2	--
Other Federal					
National Park Service	--	--	--	11.3	--
Fish and Wildlife Service	21.7	--	21.7	5.3	--
Department of Defense or Energy	106.3	--	106.3	--	--
Other Federal	85.4	--	85.4	--	--
State and local government					
State	200.3	--	200.3	87.3	--
Local (county, municipal, etc.)	20.1	--	20.1	4.3	--
Other non-Federal lands	6.3	--	6.3	--	--
Private					
Undifferentiated private	3,780.8	1.5	3,782.3	17.6	--
All owners	4,413.3	1.5	4,414.7	139.1	--

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 forest land by forest type group and productivity class, Indiana, 1999-2003

(In thousand acres)

Forest type group	Site productivity class (cubic feet/acre/year)							All classes
	0-19	20-49	50-84	85-119	120-164	165-224	225+	
White / red / jack pine group	--	--	3.6	8.1	27.5	1.5	5.6	46.4
Loblolly / shortleaf pine group	--	1.7	9.0	13.5	8.9	--	0.9	34.0
Pinyon / juniper group	--	14.6	8.0	14.2	3.1	--	--	40.0
Exotic softwoods group	--	--	--	--	6.0	--	--	6.0
Oak / pine group	--	14.5	45.0	75.4	19.5	--	--	154.4
Oak / hickory group	--	153.5	769.0	1,250.5	448.3	62.2	15.4	2,698.8
Oak / gum / cypress group	--	--	--	27.5	8.1	12.8	--	48.4
Elm / ash / cottonwood group	1.5	13.0	97.0	250.9	105.5	10.4	--	478.3
Maple / beech / birch group	--	47.3	282.2	461.0	199.2	14.7	--	1,004.4
Aspen / birch group	--	--	4.6	--	6.2	--	--	10.8
Nonstocked	--	1.4	5.8	23.5	1.7	--	--	32.4
All forest type groups	1.5	246.1	1,224.2	2,124.6	833.9	101.6	21.9	4,553.8

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. — Area of forest land by forest type group, ownership group, and land status, Indiana, 1999-2003

(In thousand acres)

Forest type group	Forest Service		Other Federal		State and local government		Undifferentiated private			
	Timber-land	Other forest land	Timber-land	Other forest land	Timber-land	Other forest land	Timber-land	Other forest land	All forest land	
White / red / jack pine group	4.4	--	--	--	4.6	6.7	30.7	--	46.4	
Loblolly / shortleaf pine group	13.6	--	--	--	4.8	--	15.6	--	34.0	
Pinyon / juniper group	--	--	--	--	1.3	8.0	30.6	--	40.0	
Exotic softwoods group	--	--	--	--	--	--	6.0	--	6.0	
Oak / pine group	9.2	4.4	--	--	9.4	9.1	122.3	--	154.4	
Oak / hickory group	140.4	8.8	135.4	9.3	139.2	46.6	2,208.2	10.8	2,698.8	
Oak / gum / cypress group	--	--	5.7	--	--	--	42.7	--	48.4	
Elm / ash / cottonwood group	4.4	--	21.0	7.3	26.3	5.3	412.5	1.5	478.3	
Maple / beech / birch group	20.4	--	48.6	--	41.1	11.3	876.3	6.8	1,004.4	
Aspen / birch group	--	--	2.7	--	--	4.6	3.5	--	10.8	
Nonstocked	--	--	--	--	--	--	32.4	--	32.4	
All forest type groups	192.4	13.2	213.4	16.6	226.7	91.6	3,780.8	19.1	4,553.8	

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 5. — Area of forest land by forest type group and stand-size class, Indiana, 1999-2003

(In thousand acres)

Forest type group	Stand-size class					All size classes
	Large diameter	Medium diameter	Small diameter	Chaparral	Nonstocked	
White / red / jack pine group	39.9	6.4	--	--	--	46.4
Loblolly / shortleaf pine group	24.4	5.0	4.6	--	--	34.0
Pinyon / juniper group	12.2	20.0	7.8	--	--	40.0
Exotic softwoods group	--	--	6.0	--	--	6.0
Oak / pine group	75.8	57.5	21.1	--	--	154.4
Oak / hickory group	2,011.5	493.8	193.5	--	--	2,698.8
Oak / gum / cypress group	46.9	1.5	--	--	--	48.4
Elm / ash / cottonwood group	351.7	83.0	43.6	--	--	478.3
Maple / beech / birch group	767.5	181.8	55.1	--	--	1,004.4
Aspen / birch group	9.2	--	1.6	--	--	10.8
Nonstocked	--	--	--	--	32.4	32.4
All forest type groups	3,339.0	849.0	333.4	--	32.4	4,553.8

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 6. — Area of forest land by forest type group and stand-age class, Indiana, 1999-2003

(In thousand acres)

Forest type group	Non-stocked	Stand-age class (years)											All classes
		1-20	21-40	41-60	61-80	81-100	101-120	121-140	141-160	161-180	181-200	201+	
White / red / jack pine group	--	--	19.8	20.4	6.1	--	--	--	--	--	--	--	46.4
Loblolly / shortleaf pine group	--	--	5.0	19.2	5.1	--	--	--	--	--	--	--	34.0
Pinyon / juniper group	--	1.5	27.4	9.7	1.3	--	--	--	--	--	--	--	40.0
Exotic softwoods group	--	6.0	--	--	--	--	--	--	--	--	--	--	6.0
Oak / pine group	--	11.4	57.9	62.5	22.5	--	--	--	--	--	--	--	154.4
Oak / hickory group	--	163.1	524.9	822.9	768.9	324.9	83.2	10.9	--	--	--	--	2,698.8
Oak / gum / cypress group	--	--	6.6	40.3	1.5	--	--	--	--	--	--	--	48.4
Elm / ash / cottonwood group	--	27.9	151.2	177.9	96.1	17.7	7.5	--	--	--	--	--	478.3
Maple / beech / birch group	--	69.5	224.8	324.4	219.6	137.6	18.2	8.8	--	--	--	--	1,004.4
Aspen / birch group	--	1.6	7.3	--	1.9	--	--	--	--	--	--	--	10.8
Nonstocked	32.4	--	--	--	--	--	--	--	--	--	--	--	32.4
All forest type groups	32.4	281.0	1,024.9	1,477.4	1,123.1	480.2	108.9	19.7	--	--	--	--	4,553.8

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 7. — Area of forest land by forest type group and stand origin, Indiana, 1999-2003

(In thousand acres)

Forest type group	Stand origin		All forest land
	Natural stands	Artificial regeneration	
White / red / jack pine group	--	46.4	46.4
Loblolly / shortleaf pine group	3.4	30.6	34.0
Pinyon / juniper group	40.0	--	40.0
Exotic softwoods group	--	6.0	6.0
Oak / pine group	129.1	25.3	154.4
Oak / hickory group	2,655.6	43.1	2,698.8
Oak / gum / cypress group	48.4	--	48.4
Elm / ash / cottonwood group	452.6	25.7	478.3
Maple / beech / birch group	993.8	10.6	1,004.4
Aspen / birch group	10.8	--	10.8
Nonstocked	32.4	--	32.4
All forest type groups	4,366.2	187.6	4,553.8

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 8. — Area of forest land by forest type group and disturbance class, Indiana, 1999-2003

(In thousand acres)

Forest type group	Disturbance class							All forest land
	None	Insects	Disease	Weather	Fire	Domestic animals	Wild animals	
White / red / jack pine group	42.0	--	4.4	--	--	--	--	46.4
Loblolly / shortleaf pine group	24.9	--	--	1.3	--	3.1	4.6	34.0
Pinyon / juniper group	40.0	--	--	--	--	--	--	40.0
Exotic softwoods group	6.0	--	--	--	--	--	--	6.0
Oak / pine group	142.8	--	--	--	2.8	8.7	--	154.4
Oak / hickory group	2,452.1	--	6.8	35.7	11.4	95.7	10.8	2,698.8
Oak / gum / cypress group	34.6	--	--	--	--	--	5.7	48.4
Elm / ash / cottonwood group	345.7	--	--	79.7	--	13.8	8.1	478.3
Maple / beech / birch group	894.7	--	--	6.7	0.4	54.6	7.5	1,004.4
Aspen / birch group	10.8	--	--	--	--	--	--	10.8
Nonstocked	28.8	--	--	1.7	--	--	1.8	32.4
All forest type groups	4,022.3	--	11.2	125.1	14.6	176.0	36.8	4,553.8

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 9. — Area of timberland by forest type group and stand-size class, Indiana, 1999-2003

(In thousand acres)

Forest type group	Stand-size class					All size classes
	Large diameter	Medium diameter	Small diameter	Chaparral	Nonstocked	
White / red / jack pine group	33.3	6.4	--	--	--	39.7
Loblolly / shortleaf pine group	24.4	5.0	4.6	--	--	34.0
Pinyon / juniper group	12.2	12.0	7.8	--	--	32.0
Exotic softwoods group	--	--	6.0	--	--	6.0
Oak / pine group	71.4	48.4	21.1	--	--	140.8
Oak / hickory group	1,944.6	485.2	193.5	--	--	2,623.3
Oak / gum / cypress group	46.9	1.5	--	--	--	48.4
Elm / ash / cottonwood group	341.4	80.3	42.5	--	--	464.2
Maple / beech / birch group	760.7	179.2	46.5	--	--	986.3
Aspen / birch group	4.6	--	1.6	--	--	6.1
Nonstocked	--	--	--	--	32.4	32.4
All forest type groups	3,239.4	817.9	323.6	--	32.4	4,413.3

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 10. — Number of live trees on forest land by species group and diameter class, Indiana, 1999-2003

(In thousand acres)

Species group	Diameter class (inches)																All classes
	1.0-2.9	3.0-4.9	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	21.0-24.9	25.0-28.9	29.0-32.9	33.0-36.9	37.0+		
Softwood species groups																	
Eastern softwood species groups																	
Loblolly and shortleaf pines	--	--	326	638	613	544	373	186	106	--	--	--	--	--	--	--	2,784
Other yellow pines	492	4,244	1,428	739	1,098	787	317	171	107	--	--	--	--	--	--	--	9,385
Eastern white and red pines	8,065	1,015	1,572	2,524	2,234	1,335	562	275	95	72	169	40	--	--	--	--	17,977
Jack pine	414	--	36	149	72	36	--	--	--	--	--	--	--	--	--	--	707
Cypress	258	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	258
Other eastern softwoods	52,161	22,965	10,557	6,575	2,586	885	902	284	27	--	32	--	--	--	--	--	96,773
All softwoods	61,410	28,224	13,919	10,624	6,603	3,387	2,154	916	335	72	201	40	--	--	--	--	127,885
Hardwood species groups																	
Eastern hardwood species groups																	
Select white oaks	24,249	6,223	6,522	6,211	5,545	4,386	3,896	3,910	2,615	1,795	2,184	702	245	126	108	--	68,718
Select red oaks	9,911	4,161	3,134	2,100	1,626	1,795	1,689	1,430	1,300	836	768	439	186	109	37	--	29,501
Other white oaks	2,370	500	627	885	1,329	1,497	1,727	873	501	379	80	40	--	--	--	--	10,806
Other red oaks	24,001	8,116	6,519	5,333	4,556	3,298	3,801	2,798	2,097	1,575	2,044	711	271	79	40	--	65,241
Hickory	30,514	13,270	12,052	11,759	9,061	7,127	5,111	3,213	2,392	934	535	108	78	--	--	--	96,155
Yellow birch	--	492	--	--	--	--	--	--	--	--	--	--	--	--	--	--	492
Hard maple	217,026	56,386	24,672	12,965	9,871	6,667	4,091	3,241	1,924	607	756	458	82	118	--	--	338,865
Soft maple	87,244	19,759	12,534	9,458	5,680	3,526	1,913	1,380	887	775	689	153	--	34	34	--	144,066
Beech	59,182	10,414	3,028	2,177	1,238	1,302	940	933	766	371	451	338	160	38	75	--	81,414
Sweetgum	20,018	6,987	2,374	1,485	1,122	1,274	659	377	326	206	91	--	--	--	--	--	34,918
Tupelo and blackgum	20,343	5,776	4,268	1,875	873	430	222	330	121	37	74	--	--	--	--	--	34,350
Ash	70,007	23,623	15,644	9,487	8,048	4,625	3,619	2,382	1,984	789	738	441	123	--	38	--	141,548
Cottonwood and aspen	4,106	3,721	1,534	797	925	806	554	670	568	437	498	343	223	78	--	--	15,261
Basswood	9,960	2,751	2,380	1,989	1,306	807	403	373	260	174	230	197	--	--	--	--	20,830
Yellow-poplar	35,264	14,285	9,018	6,613	6,848	4,600	3,407	2,499	1,832	1,506	1,978	632	168	--	--	--	88,651
Black walnut	7,665	5,384	4,819	4,361	3,070	3,033	2,242	1,163	940	234	72	73	--	--	--	--	33,057
Other eastern soft hardwoods	338,782	128,461	55,290	30,259	17,577	9,295	6,270	3,394	2,239	1,224	1,266	487	162	77	38	--	594,820
Other eastern hard hardwoods	114,996	30,145	8,567	3,922	2,195	1,243	1,138	854	325	336	36	--	--	--	--	--	163,758
Eastern noncommercial hardwoods	143,915	35,821	8,269	2,649	1,242	416	188	148	--	--	39	--	36	--	--	--	192,722
All hardwoods	1,219,554	376,277	181,252	114,325	82,110	56,126	41,851	29,970	21,077	12,215	12,528	5,121	1,734	660	370	--	2,155,171
All species groups	1,280,963	404,502	195,171	124,949	88,713	59,513	44,005	30,886	21,412	12,287	12,729	5,161	1,734	660	370	--	2,283,056

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

Table 11. — Number of growing-stock trees on timberland by species group and diameter class, Indiana, 1999-2003

(In thousand acres)

Species group	Diameter class (inches)														33.0-36.9	37.0+	All classes
	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	21.0-24.9	25.0-28.9	29.0-32.9						
Softwood species groups																	
Eastern softwood species groups																	
Loblolly and shortleaf pines	326	559	533	485	346	106	53	--	--	--	--	--	--	--	--	2,407	
Other yellow pines	1,394	679	944	750	317	171	107	--	--	--	--	--	--	--	--	4,362	
Eastern white and red pines	1,403	2,363	2,113	1,268	482	275	95	72	169	--	--	--	--	--	--	8,241	
Jack pine	36	109	72	36	--	--	--	--	--	--	--	--	--	--	--	254	
Other eastern softwoods	8,757	5,617	2,171	644	739	284	27	--	32	--	--	--	--	--	--	18,271	
All softwoods	11,915	9,327	5,834	3,183	1,884	836	282	72	201	--	--	--	--	--	--	33,534	
Hardwood species groups																	
Eastern hardwood species groups																	
Select white oaks	5,896	5,802	4,600	3,894	3,800	3,639	2,476	1,701	1,848	639	168	88	72	34,623			
Select red oaks	2,680	1,982	1,472	1,651	1,632	1,328	1,259	802	625	401	186	72	--	14,089			
Other white oaks	531	525	937	1,150	1,268	751	346	301	80	40	--	--	--	5,929			
Other red oaks	5,840	5,124	4,181	2,935	3,550	2,616	2,001	1,433	1,645	678	161	79	40	30,283			
Hickory	10,993	11,022	8,624	6,687	4,681	3,135	2,257	860	501	108	78	--	--	48,948			
Hard maple	21,855	11,206	8,796	5,635	3,673	2,909	1,625	529	597	152	42	36	--	57,054			
Soft maple	10,076	7,980	4,673	2,749	1,320	1,024	612	736	542	77	--	--	34	29,824			
Beech	2,429	1,795	933	895	759	729	728	260	342	199	36	--	--	9,106			
Sweetgum	2,334	1,403	1,090	1,194	659	377	294	206	45	--	--	--	--	7,601			
Tupelo and blackgum	3,669	1,629	653	323	187	254	121	37	74	--	--	--	--	6,948			
Ash	12,070	7,454	6,702	3,597	3,196	2,050	1,781	724	588	227	77	--	--	38,466			
Cottonwood and aspen	1,429	765	748	649	498	531	512	375	470	343	223	78	--	6,622			
Basswood	2,088	1,708	958	699	295	339	225	174	152	158	--	--	--	6,798			
Yellow-poplar	8,494	6,246	6,429	4,376	3,375	2,467	1,778	1,405	1,937	600	101	--	--	37,207			
Black walnut	4,040	3,806	2,708	2,535	1,780	1,029	550	159	34	--	--	--	--	16,641			
Other eastern soft hardwoods	40,671	21,362	13,193	6,401	4,347	2,816	1,712	1,078	1,119	410	121	45	38	93,312			
Other eastern hard hardwoods	4,773	2,619	1,309	765	780	438	139	97	--	--	--	--	--	10,920			
All hardwoods	139,871	92,427	68,006	46,133	35,803	26,430	18,417	10,878	10,600	4,032	1,193	398	184	454,372			
All species groups	151,786	101,753	73,840	49,316	37,688	27,266	18,699	10,950	10,801	4,032	1,193	398	184	487,906			

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

Table 12. — Net volume of all live trees by owner class and forest land status, Indiana, 1999-2003

(In million cubic feet)

Owner class	Unreserved forests		Reserved forests		All forest land
	Timberland	Unproductive	Productive	Unproductive	
Forest Service					
National forest	394.2	--	394.2	--	433.7
Other Federal					
National Park Service	--	--	20.8	--	20.8
Fish and Wildlife Service	37.3	--	10.3	--	47.6
Department of Defense or Energy	221.1	--	--	--	221.1
Other Federal	170.9	--	--	--	170.9
State and local government					
State	356.0	--	187.3	--	543.3
Local (county, municipal, etc.)	58.4	--	10.0	--	68.5
Other non-Federal lands	24.1	--	--	--	24.1
Private					
Undifferentiated private	7,131.1	2.3	33.5	--	7,166.9
All owners	8,393.0	2.3	301.4	--	8,696.8

All table cells without observations in the inventory sample are indicated by —. Table value of 0.0 indicates the volume rounds to less than 0.1 million cubic feet. Columns and rows may not add to their totals due to rounding.

Table 13. — Net volume of all live trees on forest land by forest type group and stand-size class, Indiana, 1999-2003

(In million cubic feet)

Forest type group	Stand-size class				All size classes
	Large diameter	Medium diameter	Small diameter	Nonstocked	
White / red / jack pine group	112.8	9.1	--	--	121.9
Loblolly / shortleaf pine group	61.5	5.8	--	--	67.3
Pinyon / juniper group	13.4	13.5	0.2	--	27.1
Exotic softwoods group	--	--	2.1	--	2.1
Oak / pine group	130.0	66.6	11.0	--	207.6
Oak / hickory group	4,520.5	537.2	60.3	--	5,117.9
Oak / gum / cypress group	95.7	0.9	--	--	96.6
Elm / ash / cottonwood group	941.0	89.2	10.7	--	1,040.9
Maple / beech / birch group	1,766.9	200.8	14.2	--	1,982.0
Aspen / birch group	29.7	--	1.3	--	31.0
Nonstocked	--	--	--	2.4	2.4
All forest type groups	7,671.5	923.2	99.7	2.4	8,696.8

All table cells without observations in the inventory sample are indicated by —. Table value of 0.0 indicates the volume rounds to less than 0.1 million cubic feet. Columns and rows may not add to their totals due to rounding.

Table 14. — Net volume of all live trees on forest land by species group and ownership group, Indiana, 1999-2003

(In million cubic feet)

Species group	Ownership group				All owners
	Forest Service	Other Federal	State and local government	Undifferentiated private	
Softwood species groups					
Eastern softwood species groups					
Loblolly and shortleaf pines	29.9	0.8	3.8	5.1	39.6
Other yellow pines	1.8	0.2	11.3	34.9	48.2
Eastern white and red pines	13.7	--	22.7	73.3	109.7
Jack pine	--	--	0.2	1.6	1.9
Other eastern softwoods	7.0	2.0	14.7	85.0	108.7
All softwoods	52.4	3.0	52.8	199.9	308.1
Hardwood species groups					
Eastern hardwood species groups					
Select white oaks	100.9	49.6	81.8	642.3	874.6
Select red oaks	24.7	29.6	58.1	318.4	430.8
Other white oaks	17.9	--	41.1	87.8	146.8
Other red oaks	45.5	64.0	52.0	625.6	787.1
Hickory	39.0	48.4	34.8	667.2	789.3
Hard maple	42.1	30.1	45.9	730.8	848.8
Soft maple	18.1	15.6	26.1	390.4	450.2
Beech	10.9	15.3	15.5	230.7	272.4
Sweetgum	0.3	14.6	14.9	74.4	104.3
Tupelo and blackgum	4.3	2.0	2.8	51.5	60.6
Ash	8.9	28.1	36.2	582.7	656.0
Cottonwood and aspen	0.3	22.4	30.8	221.2	274.6
Basswood	--	7.4	0.6	116.1	124.1
Yellow-poplar	40.1	83.1	53.1	768.6	945.0
Black walnut	5.0	5.7	7.7	217.4	235.7
Other eastern soft hardwoods	22.0	33.8	72.7	1,067.4	1,195.9
Other eastern hard hardwoods	1.0	7.3	8.1	125.5	141.9
Eastern noncommercial hardwoods	0.2	0.4	0.9	49.1	50.6
All hardwoods	381.2	457.4	583.0	6,966.9	8,388.7
All species groups					
	433.7	460.4	635.8	7,166.9	8,696.8

All table cells without observations in the inventory sample are indicated by —. Table value of 0.0 indicates the volume rounds to less than 0.1 million cubic feet. Columns and rows may not add to their totals due to rounding.

Table 15. — Net volume of all live trees on forest land by species group and diameter class, Indiana, 1999-2003

(In million cubic feet)

Species group	Diameter class (inches)														37.0+	All classes
	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	21.0-24.9	25.0-28.9	29.0-32.9	33.0-36.9				
Softwood species groups																
Eastern softwood species groups																
Loblolly and shortleaf pines	1	3	6	9	9	6	5	--	--	--	--	--	--	--	40	
Other yellow pines	4	4	10	12	7	6	5	--	--	--	--	--	--	--	48	
Eastern white and red pines	4	13	21	20	13	9	4	5	15	6	--	--	--	--	110	
Jack pine	0	1	1	0	--	--	--	--	--	--	--	--	--	--	2	
Other eastern softwoods	22	29	20	9	17	8	1	--	3	--	--	--	--	--	109	
All softwoods	30	50	58	51	47	29	15	5	18	6	--	--	--	--	308	
Hardwood species groups																
Eastern hardwood species groups																
Select white oaks	15	31	51	64	87	120	110	98	154	71	32	21	21	21	875	
Select red oaks	8	12	17	30	39	47	58	48	61	51	29	24	7	7	431	
Other white oaks	1	4	11	21	36	25	20	19	6	4	--	--	--	--	147	
Other red oaks	15	28	43	49	87	89	92	88	151	82	39	15	10	10	787	
Hickory	29	64	90	120	128	116	117	58	44	12	12	--	--	--	789	
Hard maple	65	73	104	114	106	119	94	37	61	46	11	21	--	--	849	
Soft maple	31	51	54	55	45	46	37	46	52	18	--	6	10	10	450	
Beech	7	11	12	20	23	31	35	22	37	38	19	5	12	12	272	
Sweetgum	5	8	10	19	15	13	14	13	7	--	--	--	--	--	104	
Tupelo and blackgum	9	9	8	6	5	10	5	2	7	--	--	--	--	--	61	
Ash	35	49	76	71	84	80	89	47	56	48	15	--	6	6	656	
Cottonwood and aspen	4	4	9	13	15	24	27	26	45	47	41	20	--	--	275	
Basswood	6	10	12	13	9	13	12	11	17	22	--	--	--	--	124	
Yellow-poplar	24	41	77	84	96	100	98	103	196	93	33	--	--	--	945	
Black walnut	11	22	27	43	46	35	33	11	4	5	--	--	--	--	236	
Other eastern soft hardwoods	113	136	152	133	139	112	97	76	110	65	34	19	8	8	1,196	
Other eastern hard hardwoods	16	17	18	17	24	23	12	13	2	--	--	--	--	--	142	
Eastern noncommercial hardwoods	15	10	9	5	3	4	--	--	2	--	3	--	--	--	51	
All hardwoods	409	580	779	878	987	1,005	949	717	1,010	601	267	131	74	74	8,389	
All species groups																
	440	631	837	929	1,034	1,033	964	722	1,028	607	267	131	74	74	8,697	

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

Table 16. — Net volume of all live trees on forest land by forest type group and stand origin, Indiana, 1999-2003

(In million cubic feet)

Forest type group	Stand origin		All forest land
	Natural stands	Artificial regeneration	
White / red / jack pine group	--	121.9	121.9
Loblolly / shortleaf pine group	3.7	63.6	67.3
Pinyon / juniper group	27.1	--	27.1
Exotic softwoods group	--	2.1	2.1
Oak / pine group	166.6	41.0	207.6
Oak / hickory group	5,055.6	62.3	5,117.9
Oak / gum / cypress group	96.6	--	96.6
Elm / ash / cottonwood group	986.5	54.3	1,040.9
Maple / beech / birch group	1,980.0	2.0	1,982.0
Aspen / birch group	31.0	--	31.0
Nonstocked	2.4	--	2.4
All forest type groups	8,349.6	347.2	8,696.8

All table cells without observations in the inventory sample are indicated by —. Table value of 0.0 indicates the volume rounds to less than 0.1 million cubic feet. Columns and rows may not add to their totals due to rounding.

Table 17. — Net volume of growing-stock trees on timberland by species group and diameter class, Indiana, 1999-2003

(In million cubic feet)

Species group	Diameter class (inches)														37.0+	All classes
	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	21.0-24.9	25.0-28.9	29.0-32.9	33.0-36.9				
Softwood species groups																
Eastern softwood species groups																
Loblolly and shortleaf pines	1	3	5	8	9	4	3	--	--	--	--	--	--	--	32	
Other yellow pines	3	4	9	12	7	6	5	--	--	--	--	--	--	--	47	
Eastern white and red pines	3	13	20	20	11	9	4	5	15	--	--	--	--	--	99	
Jack pine	0	0	1	0	--	--	--	--	--	--	--	--	--	--	2	
Other eastern softwoods	19	25	17	8	14	8	1	--	3	--	--	--	--	--	95	
All softwoods	26	45	52	48	41	26	13	5	18	--	--	--	--	--	274	
Hardwood species groups																
Eastern hardwood species groups																
Select white oaks	14	30	43	57	85	113	104	93	132	65	22	16	16	16	788	
Select red oaks	7	11	15	28	39	44	56	46	51	48	29	16	--	--	390	
Other white oaks	1	3	8	16	27	21	14	16	6	4	--	--	--	--	116	
Other red oaks	14	27	39	44	82	84	88	81	128	78	25	15	10	10	714	
Hickory	27	60	87	114	119	114	111	54	42	12	12	--	--	--	751	
Hard maple	58	64	94	98	97	109	81	33	49	18	7	7	--	--	715	
Soft maple	26	44	45	44	32	36	27	44	42	9	--	--	10	10	358	
Beech	6	10	9	14	20	25	34	17	29	26	5	--	--	--	195	
Sweetgum	5	7	10	19	15	13	13	13	5	--	--	--	--	--	99	
Tupelo and blackgum	8	8	6	5	4	8	5	2	7	--	--	--	--	--	53	
Ash	28	41	66	59	77	71	82	44	47	27	11	--	--	--	552	
Cottonwood and aspen	4	4	8	11	13	19	24	24	42	47	41	20	--	--	256	
Basswood	5	9	9	11	7	12	11	11	12	19	--	--	--	--	107	
Yellow-poplar	23	39	73	81	95	99	95	99	194	89	20	--	--	--	907	
Black walnut	9	19	24	38	39	32	22	8	2	--	--	--	--	--	193	
Other eastern soft hardwoods	86	101	121	99	105	98	80	70	101	57	25	12	8	8	962	
Other eastern hard hardwoods	9	12	12	12	18	14	7	6	--	--	--	--	--	--	89	
All hardwoods	330	488	669	749	874	911	853	659	888	499	197	84	45	45	7,247	
All species groups	356	533	721	797	916	937	866	663	906	499	197	84	45	45	7,521	

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

Table 18. — Net volume of growing-stock trees on timberland by species group and ownership group, Indiana, 1999-2003

(In million cubic feet)

Species group	Ownership group				All owners
	Forest Service	Other Federal	State and local government	Undifferentiated private	
Softwood species groups					
Eastern softwood species groups					
Loblolly and shortleaf pines	22.5	0.8	3.3	5.1	31.7
Other yellow pines	1.8	0.2	11.0	33.5	46.6
Eastern white and red pines	13.4	--	12.5	73.2	99.1
Jack pine	--	--	--	1.6	1.6
Cypress	--	--	--	--	--
Other eastern softwoods	6.9	1.8	9.2	77.4	95.3
All softwoods	44.7	2.7	36.0	190.8	274.3
Hardwood species groups					
Eastern hardwood species groups					
Select white oaks	88.8	47.1	57.3	595.2	788.4
Select red oaks	22.3	25.9	49.3	292.6	390.1
Other white oaks	15.2	--	18.0	82.7	115.9
Other red oaks	44.2	60.2	26.2	583.5	714.1
Hickory	37.3	48.0	28.3	637.8	751.4
Hard maple	36.5	23.8	31.1	624.0	715.4
Soft maple	8.4	12.6	12.8	324.5	358.4
Beech	5.7	13.4	9.0	167.0	195.0
Sweetgum	0.3	13.2	14.8	70.7	99.0
Tupelo and blackgum	4.1	1.6	0.9	46.7	53.2
Ash	7.3	20.0	19.7	504.7	551.7
Cottonwood and aspen	0.3	11.4	25.5	219.1	256.3
Basswood	--	7.4	--	99.3	106.7
Yellow-poplar	36.4	80.9	37.5	751.9	906.7
Black walnut	3.9	5.5	5.8	178.0	193.2
Other eastern soft hardwoods	21.1	30.4	36.4	874.0	961.8
Other eastern hard hardwoods	0.7	4.4	3.5	80.7	89.4
All hardwoods	332.6	405.8	375.9	6,132.3	7,246.5
All species groups	377.3	408.5	411.9	6,323.1	7,520.8

All table cells without observations in the inventory sample are indicated by —. Table value of 0.0 indicates the volume rounds to less than 0.1 million cubic feet. Columns and rows may not add to their totals due to rounding.

Table 19. — Net volume of sawtimber trees (International 1/4-inch rule) on timberland by species group and diameter class, Indiana, 1999-2003

(In million board feet)¹

Species group	Diameter class (inches)												All classes
	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-24.9	25.0-28.9	29.0-32.9	33.0-36.9	37.0+		
Softwood species groups													
Eastern softwood species groups													
Loblolly and shortleaf pines	25	41	45	19	13	--	--	--	--	--	--	143	
Other yellow pines	45	59	39	31	27	--	--	--	--	--	--	201	
Eastern white and red pines	91	93	54	44	21	23	74	--	--	--	--	400	
Jack pine	3	2	--	--	--	--	--	--	--	--	--	5	
Other eastern softwoods	96	43	67	35	4	--	16	--	--	--	--	260	
All softwoods	260	237	204	129	66	23	89	--	--	--	--	1,008	
Hardwood species groups													
Eastern hardwood species groups													
Select white oaks	--	282	413	539	486	427	586	277	89	59	55	3,212	
Select red oaks	--	137	193	219	277	228	244	224	128	64	--	1,713	
Other white oaks	--	84	139	107	69	77	27	17	--	--	--	520	
Other red oaks	--	218	406	411	429	391	604	352	108	59	37	3,015	
Hickory	--	561	590	558	547	266	207	56	59	--	--	2,846	
Hard maple	--	471	471	526	389	156	229	82	30	26	--	2,380	
Soft maple	--	192	139	157	117	191	181	39	--	--	33	1,049	
Beech	--	72	98	127	167	83	140	121	24	--	--	833	
Sweetgum	--	85	68	58	59	55	21	--	--	--	--	346	
Tupelo and blackgum	--	22	19	38	25	9	30	--	--	--	--	144	
Ash	--	267	355	334	389	208	226	125	48	--	--	1,952	
Cottonwood and aspen	--	52	65	94	123	122	218	240	199	90	--	1,202	
Basswood	--	57	37	59	54	53	59	89	--	--	--	408	
Yellow-poplar	--	405	488	517	498	524	1,031	462	102	--	--	4,028	
Black walnut	--	183	188	154	105	39	11	--	--	--	--	679	
Other eastern soft hardwoods	--	458	484	453	371	325	471	257	116	53	28	3,015	
Other eastern hard hardwoods	--	53	84	63	30	25	--	--	--	--	--	255	
All hardwoods	--	3,599	4,238	4,417	4,134	3,178	4,283	2,341	903	351	152	27,597	
All species groups	260	3,837	4,442	4,546	4,200	3,201	4,372	2,341	903	351	152	28,605	

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

¹International 1/4-inch rule.

Table 19a. — Net volume of sawtimber trees (Doyle rule) on timberland by species group and diameter class, Indiana, 1999-2003

(In million board feet)¹

Species group	Diameter class (inches)															All classes
	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-24.9	25.0-28.9	29.0-32.9	33.0-36.9	37.0+					
Softwood species groups																
Eastern softwood species groups																
Loblolly and shortleaf pines	8	19	27	13	10	--	--	--	--	--	--	--	--	--	--	78
Other yellow pines	16	28	23	21	21	--	--	--	--	--	--	--	--	--	--	109
Eastern white and red pines	32	44	33	30	16	20	67	--	--	--	--	--	--	--	--	241
Jack pine	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	2
Other eastern softwoods	33	20	40	24	3	--	14	--	--	--	--	--	--	--	--	136
All softwoods	90	113	122	89	50	20	81	--	--	--	--	--	--	--	--	566
Hardwood species groups																
Eastern hardwood species groups																
Select white oaks	--	118	211	317	319	307	468	249	101	67	62	2,218				
Select red oaks	--	57	99	129	182	164	195	205	145	73	--	1,248				
Other white oaks	--	35	71	63	45	55	21	15	--	--	--	306				
Other red oaks	--	91	208	242	282	281	485	318	123	67	41	2,137				
Hickory	--	234	302	328	360	191	165	49	67	--	--	1,697				
Hard maple	--	197	241	309	256	112	180	73	34	30	--	1,431				
Soft maple	--	80	71	93	77	137	145	36	--	--	38	676				
Beech	--	30	50	75	110	59	114	112	27	--	--	577				
Sweetgum	--	35	35	34	39	40	17	--	--	--	--	200				
Tupelo and blackgum	--	9	10	23	16	6	25	--	--	--	--	89				
Ash	--	111	182	197	256	150	180	116	54	--	--	1,245				
Cottonwood and aspen	--	22	33	55	81	87	176	217	226	102	--	1,000				
Basswood	--	24	19	35	36	38	47	81	--	--	--	279				
Yellow-poplar	--	169	250	304	327	376	827	414	116	--	--	2,783				
Black walnut	--	76	96	90	69	28	8	--	--	--	--	368				
Other eastern soft hardwoods	--	191	248	267	243	233	379	236	131	60	31	2,020				
Other eastern hard hardwoods	--	22	43	37	20	18	--	--	--	--	--	140				
All hardwoods	--	1,502	2,169	2,598	2,716	2,282	3,433	2,120	1,025	399	172	18,415				
All species groups	90	1,615	2,291	2,687	2,766	2,301	3,514	2,120	1,025	399	172	18,981				

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

¹Doyle rule.

Table 20. — Net volume of sawtimber trees on timberland by species group and ownership group, Indiana, 1999-2003

(In million cubic feet)

Species group	Ownership group				All owners
	Forest Service	Other Federal	State and local government	Undifferentiated private	
Softwood species groups					
Eastern softwood species groups					
Loblolly and shortleaf pines	18.6	0.7	2.1	3.9	25.3
Other yellow pines	0.5	--	9.4	25.5	35.4
Eastern white and red pines	10.6	--	7.6	57.0	75.2
Jack pine	--	--	--	0.9	0.9
Other eastern softwoods	3.7	1.2	5.9	34.7	45.6
All softwoods	33.3	1.9	25.1	121.9	182.3
Hardwood species groups					
Eastern hardwood species groups					
Select white oaks	71.1	41.5	41.5	476.3	630.4
Select red oaks	19.6	22.4	44.5	240.3	326.8
Other white oaks	10.6	--	12.6	64.9	88.1
Other red oaks	36.4	49.6	18.5	470.7	575.2
Hickory	26.6	32.0	18.1	418.4	495.0
Hard maple	16.5	14.9	17.0	385.9	434.3
Soft maple	2.2	4.1	7.1	200.1	213.5
Beech	4.0	11.0	6.9	134.1	155.9
Sweetgum	--	8.4	7.8	48.2	64.4
Tupelo and blackgum	1.7	0.7	--	25.1	27.6
Ash	4.5	12.8	8.1	340.6	366.1
Cottonwood and aspen	--	9.4	24.0	193.1	226.5
Basswood	--	6.5	--	69.5	76.0
Yellow-poplar	26.6	63.2	30.7	584.5	705.0
Black walnut	1.9	3.2	3.7	106.0	114.7
Other eastern soft hardwoods	11.4	13.8	22.0	527.7	574.9
Other eastern hard hardwoods	--	0.8	1.9	43.4	46.1
All hardwoods	233.1	294.2	264.2	4,328.8	5,120.3
All species groups	266.4	296.2	289.3	4,450.7	5,302.6

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

Table 24. — Average annual net growth of growing-stock trees on timberland by species group and ownership group, Indiana, 1998 to 1999-2003

(In million cubic feet)

Species group	Ownership group				All owners
	Forest Service	Other Federal	State and local government	Undifferentiated private	
Softwood species groups					
Eastern softwood species groups					
Loblolly and shortleaf pines	0.7	0.0	-0.7	--	0.0
Other yellow pines	0.1	0.0	0.2	-0.3	0.0
Eastern white and red pines	0.7	--	-1.2	1.5	1.1
Jack pine	--	--	--	0.0	0.0
Other eastern softwoods	0.5	0.2	0.2	1.2	2.0
All softwoods	2.0	0.2	-1.5	2.4	3.1
Hardwood species groups					
Eastern hardwood species groups					
Select white oaks	1.2	1.1	1.4	10.8	14.5
Select red oaks	0.6	0.8	0.7	14.6	16.7
Other white oaks	0.4	--	0.8	0.7	1.8
Other red oaks	-0.2	2.6	1.4	5.0	8.9
Hickory	0.9	1.8	1.0	17.3	21.0
Hard maple	0.3	1.5	0.9	28.0	30.7
Soft maple	0.2	0.3	0.9	8.3	9.7
Beech	-0.4	0.3	1.0	23.3	24.2
Sweetgum	0.0	0.4	1.0	2.3	3.7
Tupelo and blackgum	0.2	0.0	0.0	0.1	0.3
Ash	0.1	1.8	0.9	27.3	30.1
Cottonwood and aspen	0.0	0.4	-0.3	5.2	5.4
Basswood	--	--	--	3.5	3.5
Yellow-poplar	1.1	3.8	2.4	52.7	60.0
Black walnut	0.1	1.1	0.6	5.4	7.1
Other eastern soft hardwoods	2.7	1.8	-0.2	44.9	49.1
Other eastern hard hardwoods	0.0	0.3	0.1	3.4	3.8
All hardwoods	7.1	17.8	12.7	252.8	290.5
All species groups					
	9.1	18.0	11.2	255.2	293.6

All table cells without observations in the inventory sample are indicated by —. Table value of 0.0 indicates the volume rounds to less than 0.1 million cubic feet. Columns and rows may not add to their totals due to rounding.

Table 28. — Average annual mortality of growing-stock trees on timberland by species group and ownership group, Indiana, 1998 to 1999-2003

(In million cubic feet)

Species group	Ownership group				All owners
	Forest Service	Other Federal	State and local government	Undifferentiated private	
Softwood species groups					
Eastern softwood species groups					
Loblolly and shortleaf pines	--	--	0.3	--	0.3
Other yellow pines	--	--	0.1	0.8	1.0
Eastern white and red pines	--	--	1.8	3.6	5.4
Jack pine	--	--	--	0.0	0.0
Other eastern softwoods	--	--	--	0.3	0.3
All softwoods	--	--	2.2	4.7	6.9
Hardwood species groups					
Eastern hardwood species groups					
Select white oaks	0.1	--	--	4.8	4.9
Select red oaks	--	--	--	1.0	1.0
Other white oaks	0.2	--	--	0.3	0.5
Other red oaks	1.7	0.1	0.1	15.8	17.6
Hickory	0.0	0.3	--	12.1	12.5
Hard maple	--	--	--	6.5	6.5
Soft maple	0.0	0.3	--	3.5	3.8
Beech	--	--	--	0.4	0.4
Sweetgum	--	--	--	0.3	0.3
Tupelo and blackgum	0.0	--	--	--	0.0
Ash	--	0.1	--	1.6	1.7
Cottonwood and aspen	--	--	0.5	5.7	6.2
Basswood	--	--	--	0.1	0.1
Yellow-poplar	0.4	--	0.2	3.4	4.0
Black walnut	--	--	--	0.4	0.4
Other eastern soft hardwoods	0.3	1.2	0.2	16.4	18.1
Other eastern hard hardwoods	--	0.1	--	2.1	2.2
All hardwoods	2.6	2.0	1.0	74.6	80.2
All species groups					
	2.6	2.0	3.2	79.3	87.1

All table cells without observations in the inventory sample are indicated by —. Table value of 0.0 indicates the volume rounds to less than 0.1 million cubic feet. Columns and rows may not add to their totals due to rounding.

Table 30. — Average annual removals of growing-stock trees on timberland by species group and ownership group, Indiana, 1998 to 1999-2003

(In million cubic feet)

Species group	Ownership group				All owners
	Forest Service	Other Federal	State and local government	Undifferentiated private	
Softwood species groups					
Eastern softwood species groups					
Eastern white and red pines	--	--	--	3.3	3.3
Other eastern softwoods	--	--	--	0.2	0.2
All softwoods	--	--	--	3.4	3.4
Hardwood species groups					
Eastern hardwood species groups					
Select white oaks	--	--	--	20.1	20.1
Select red oaks	--	--	--	13.2	13.2
Other white oaks	--	--	0.4	3.3	3.6
Other red oaks	0.7	--	3.6	8.6	12.9
Hickory	0.0	--	--	20.4	20.4
Hard maple	0.4	--	--	13.2	13.7
Soft maple	--	--	--	11.3	11.3
Beech	--	--	--	6.9	6.9
Tupelo and blackgum	--	--	--	0.4	0.4
Ash	--	--	--	9.0	9.0
Cottonwood and aspen	--	--	--	0.9	0.9
Yellow-poplar	--	--	--	37.5	37.5
Black walnut	--	--	--	1.6	1.6
Other eastern soft hardwoods	--	--	--	15.1	15.1
Other eastern hard hardwoods	--	--	--	2.0	2.0
All hardwoods	1.1	--	4.0	163.5	168.6
All species groups					
	1.1	--	4.0	166.9	172.1

All table cells without observations in the inventory sample are indicated by —. Table value of 0.0 indicates the volume rounds to less than 0.1 million cubic feet. Columns and rows may not add to their totals due to rounding.

Table 31. — Aboveground dry weight of all live trees by owner class and forest land status, Indiana, 1999-2003

(In thousand dry tons)

Owner class	Unreserved forests			Reserved forests			All forest land
	Timberland	Unproductive	Total	Productive	Unproductive	Total	
Forest Service							
National forest	10,887	--	10,887	1,000	--	1,000	11,888
Other Federal							
National Park Service	--	--	--	606	--	606	606
Fish and Wildlife Service	1,061	--	1,061	303	--	303	1,364
Department of Defense or Energy	5,762	--	5,762	--	--	--	5,762
Other Federal	4,863	--	4,863	--	--	--	4,863
State and local government							
State	9,611	--	9,611	4,954	--	4,954	14,564
Local (county, municipal, etc.)	1,395	--	1,395	253	--	253	1,648
Other non-Federal lands	638	--	638	--	--	--	638
Private							
Undifferentiated private	194,122	59	194,181	895	--	895	195,076
All owners	228,340	59	228,399	8,012	--	8,012	236,410

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 thousand dry tons. Columns and rows may not add to their totals due to rounding.

Table 32. — Aboveground dry weight of all live trees on forest land by species group and diameter class, Indiana, 1999-2003

(In thousand dry tons)

Species group	Diameter class (inches)																All classes
	1.0-2.9	3.0-4.9	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	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+		
Softwood species groups																	
Eastern softwood species groups																	
Loblolly and shortleaf pines	--	--	17	63	111	173	173	119	88	--	--	--	--	--	--	--	746
Other yellow pines	0	69	67	71	186	209	125	97	85	--	--	--	--	--	--	--	907
Eastern white and red pines	17	12	64	228	351	342	220	147	68	75	86	156	--	95	--	--	1,860
Jack pine	1	--	2	12	11	7	--	--	--	--	--	--	--	--	--	--	33
Cypress	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0
Other eastern softwoods	173	426	514	641	432	181	347	149	20	--	--	55	--	--	--	--	2,939
All softwoods	192	507	664	1,015	1,091	912	864	513	261	75	86	211	--	95	--	--	6,485
Hardwood species groups																	
Eastern hardwood species groups																	
Select white oaks	141	167	528	1,028	1,605	1,965	2,586	3,544	3,170	2,791	2,948	1,457	1,220	775	2,131	26,056	
Select red oaks	59	114	261	365	490	859	1,112	1,307	1,574	1,303	1,014	653	655	716	1,679	12,160	
Other white oaks	7	9	50	146	361	652	1,087	732	569	578	157	--	100	--	--	4,448	
Other red oaks	111	234	509	863	1,284	1,454	2,516	2,516	2,554	2,437	2,645	1,667	1,252	951	1,754	22,738	
Hickory	151	370	1,004	2,071	2,840	3,663	3,814	3,417	3,402	1,679	908	325	332	--	321	24,298	
Yellow birch	--	15	--	--	--	--	--	--	--	--	--	--	--	--	--	15	
Hard maple	960	1,613	2,011	2,166	2,981	3,184	2,909	3,205	2,525	978	1,318	295	792	609	944	26,491	
Soft maple	372	513	862	1,350	1,395	1,407	1,116	1,160	916	1,078	750	490	196	238	399	12,243	
Beech	215	203	225	335	333	560	622	829	904	587	222	756	521	536	1,296	8,142	
Sweetgum	48	169	142	192	245	470	350	294	327	278	79	106	--	--	--	2,701	
Tupelo and blackgum	60	130	234	223	197	152	121	223	124	44	--	153	--	--	--	1,688	
Ash	244	546	1,074	1,421	2,114	1,961	2,222	2,080	2,272	1,171	1,022	415	625	591	547	18,305	
Cottonwood and aspen	15	86	86	91	186	258	276	441	489	492	364	425	505	319	1,035	5,067	
Basswood	30	43	115	195	219	222	163	219	207	177	193	114	218	162	--	2,279	
Yellow-poplar	136	304	549	878	1,603	1,699	1,884	1,927	1,858	1,986	2,270	1,389	1,191	500	626	18,801	
Black walnut	32	142	306	580	695	1,106	1,168	848	886	286	105	--	158	--	--	6,313	
Other eastern soft hardwoods	1,072	2,392	2,978	3,426	3,688	3,179	3,269	2,488	2,189	1,649	1,342	992	447	942	1,252	31,305	
Other eastern hard hardwoods	327	506	410	415	427	398	554	538	313	378	53	--	--	--	--	4,320	
Eastern noncommercial hardwoods	406	651	430	301	249	143	95	103	--	--	64	--	--	--	114	2,555	
All hardwoods	4,386	8,205	11,772	16,045	20,913	23,331	25,856	25,900	24,279	17,894	15,455	9,238	8,213	6,340	12,097	229,925	
All species groups	4,577	8,712	12,437	17,060	22,004	24,243	26,720	26,413	24,540	17,968	15,541	9,450	8,213	6,435	12,097	236,410	

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 thousand dry tons. Columns and rows may not add to their totals due to rounding.

Table 54. — Area of accessible forest land by Forest Survey Unit, county, and forest land status, Indiana, 1999-2003

(In thousand acres)

Forest Survey Unit and county								All forest land
Lower Wabash	Unreserved forests			Reserved forests		Total		
	Timberland	Unproductive	Total	Productive	Unproductive			
Clay	62.6	--	62.6	--	--	--	62.6	
Davless, Knox	46.0	--	46.0	--	--	--	46.0	
Gibson	49.4	--	49.4	--	--	--	49.4	
Greene	114.2	--	114.2	--	--	--	114.2	
Martin	144.4	--	144.4	--	--	--	144.4	
Parke	99.7	--	99.7	6.2	--	6.2	106.0	
Pike	74.0	--	74.0	--	--	--	74.0	
Posey, Vanderburgh	29.3	--	29.3	5.4	--	5.4	34.7	
Putnam	76.3	--	76.3	--	--	--	76.3	
Sullivan	57.1	--	57.1	--	--	--	57.1	
Vermillion	26.2	--	26.2	--	--	--	26.2	
Vigo	44.3	--	44.3	--	--	--	44.3	
Total	823.6	--	823.6	11.6	--	11.6	835.2	
Knobs								
Brown	136.4	--	136.4	31.0	--	31.0	167.4	
Clark, Scott	103.8	--	103.8	--	--	--	103.8	
Crawford	130.5	--	130.5	--	--	--	130.5	
Dubois	63.9	--	63.9	--	--	--	63.9	
Floyd, Harrison	178.1	--	178.1	--	--	--	178.1	
Jackson	107.4	--	107.4	5.3	--	5.3	112.7	
Lawrence	116.4	--	116.4	5.3	--	5.3	121.8	
Monroe	133.8	--	133.8	8.8	--	8.8	142.6	
Morgan	91.0	--	91.0	--	--	--	91.0	
Orange	121.3	--	121.3	--	--	--	121.3	
Owen	128.0	--	128.0	--	--	--	128.0	
Perry	156.7	--	156.7	--	--	--	156.7	
Spencer	61.8	--	61.8	--	--	--	61.8	
Warrick	73.6	--	73.6	--	--	--	73.6	
Washington	135.0	--	135.0	--	--	--	135.0	
Total	1,737.7	--	1,737.7	50.4	--	50.4	1,788.2	
Upland Flats								
Dearborn	109.2	--	109.2	--	--	--	109.2	
Fayette, Union	54.0	--	54.0	--	--	--	54.0	
Franklin	82.4	--	82.4	4.1	--	4.1	86.5	
Jefferson	102.9	--	102.9	6.8	--	6.8	109.7	
Jennings	117.4	--	117.4	--	--	--	117.4	
Ohio, Switzerland	90.2	--	90.2	--	--	--	90.2	
Ripley	77.9	--	77.9	19.8	--	19.8	97.7	
Total	633.9	--	633.9	30.8	--	30.8	664.7	

(Table 54 continued on next page)

(Table 54 continued)

Forest Survey Unit and county		Unreserved forests			Reserved forests			All forest land
		Timberland	Unproductive	Total	Productive	Unproductive	Total	
Northern								
AdHuWe		65.0	--	65.0	6.7	--	6.7	71.6
Allen		65.9	--	65.9	--	--	--	65.9
Batholomew		46.9	--	46.9	--	--	--	46.9
BeFoWa		50.6	--	50.6	--	--	--	50.6
BlDeGrMa		69.7	--	69.7	--	--	--	69.7
BoCiHaTi		29.9	1.5	31.4	--	--	--	31.4
CaHoMiWa		111.7	--	111.7	--	--	--	111.7
CaTiWh		84.2	--	84.2	6.3	--	6.3	90.5
De Kalb, Steuben		31.7	--	31.7	4.5	--	4.5	36.2
DeHeRuWa		80.9	--	80.9	--	--	--	80.9
EInoWh		106.3	--	106.3	4.6	--	4.6	110.9
Fulton, Marshall		28.5	--	28.5	--	--	--	28.5
HaHeJoMaSh		97.6	--	97.6	--	--	--	97.6
JaLaNe		57.2	--	57.2	--	--	--	57.2
Jay, Randolph		26.6	--	26.6	--	--	--	26.6
Kosciusko		40.2	--	40.2	--	--	--	40.2
La Grange		38.4	--	38.4	--	--	--	38.4
La Porte		44.7	--	44.7	--	--	--	44.7
Montgomery		35.5	--	35.5	4.6	--	4.6	40.1
Porter		36.1	--	36.1	11.3	--	11.3	47.4
PuStSt		70.1	--	70.1	8.3	--	8.3	78.4
Total		1,217.9	1.5	1,219.4	46.3	--	46.3	1,265.7
All counties								
		4,413.3	1.5	4,414.7	139.1	--	139.1	4,553.8
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.								
		AdHuWe = Adams, Huntington, and Wells Counties			DeHeRuWa = Decatur, Henry, Rush, and Wayne Counties			
		BeFoWa = Benton, Fountain, and Warren Counties			EInoWh = Elkhart, Noble, and Whitley Counties			
		BlDeGrMa = Blackford, Delaware, Grant, and Madison Counties			HaHeJoMaSh = Hancock, Hendricks, Johnson, Marion, and Shelby Counties			
		BoCiHaTi = Boone, Clinton, Hamilton, and Tipton Counties			JaLaNe = Jasper, Lake, and Newton Counties			
		CaHoMiWa = Cass, Howard, Miami, and WabashCounties			PuStSt = Pulaski, St. Joseph, and Starke Counties			
		CaTiWh = Carroll, Tippecanoe, and White Counties						

Table 55. — Area of accessible forest land by Forest Survey Unit, county, ownership group, and forest land status, Indiana, 1999-2003

(In thousand acres)

Forest Survey Unit and county	Forest Service				Other Federal				State and local government				Undifferentiated private			
	Timber-		Other forest		Timber-		Other forest		Timber-		Other forest		Timber-		Other forest	
	land	land	land	land	land	land	land	land	land	land	land	land	land	land	land	land
Lower Wabash																
Clay	--	--	--	--	--	--	--	--	--	--	--	--	62.6	--	--	62.6
Daviess, Knox	--	--	--	--	--	--	--	--	--	--	--	--	46.0	--	--	46.0
Gibson	--	--	--	--	--	--	--	--	--	--	--	--	49.4	--	--	49.4
Greene	--	--	--	--	5.4	--	--	--	9.2	--	--	--	99.6	--	--	114.2
Martin	13.1	--	--	48.4	--	--	--	--	10.6	--	--	--	72.3	--	--	144.4
Parke	--	--	--	--	--	--	--	--	5.0	--	6.2	--	94.7	--	--	106.0
Pike	--	--	--	5.7	--	--	--	--	15.1	--	--	--	53.2	--	--	74.0
Posey, Vanderburgh	--	--	--	--	--	--	--	--	4.4	5.4	--	--	24.9	--	--	34.7
Putnam	--	--	--	--	--	--	--	--	6.1	--	--	--	70.2	--	--	76.3
Sullivan	--	--	--	--	--	--	--	--	3.4	--	--	--	53.6	--	--	57.1
Vermillion	--	--	--	--	--	--	--	--	--	--	--	--	26.2	--	--	26.2
Vigo	--	--	--	--	--	--	--	--	--	--	--	--	44.3	--	--	44.3
Total	13.1	--	--	59.5	--	53.9	--	11.6	697.2	--	--	--	835.2	--	--	835.2
Knobs																
Brown	22.0	4.4	--	5.3	--	12.0	--	26.6	97.1	--	--	--	167.4	--	--	167.4
Clark, Scott	--	--	--	--	--	11.9	--	--	92.0	--	--	--	103.8	--	--	103.8
Crawford	28.7	--	--	11.2	--	10.6	--	--	79.9	--	--	--	130.5	--	--	130.5
Dubois	--	--	--	6.6	--	5.3	--	--	52.0	--	--	--	63.9	--	--	63.9
Floyd, Harrison	--	--	--	--	--	29.4	--	--	148.7	--	--	--	178.1	--	--	178.1
Jackson	12.0	--	--	12.0	5.3	5.3	--	--	78.1	--	--	--	112.7	--	--	112.7
Lawrence	17.6	--	--	5.3	--	--	--	5.3	93.5	--	--	--	121.8	--	--	121.8
Monroe	9.2	8.8	--	11.5	--	21.3	--	--	91.7	--	--	--	142.6	--	--	142.6
Morgan	--	--	--	--	--	--	--	--	91.0	--	--	--	91.0	--	--	91.0
Orange	25.8	--	--	13.1	--	--	--	--	82.4	--	--	--	121.3	--	--	121.3
Owen	--	--	--	13.3	--	7.0	--	--	107.7	--	--	--	128.0	--	--	128.0
Perry	63.9	--	--	--	--	--	--	--	92.9	--	--	--	156.7	--	--	156.7
Spencer	--	--	--	--	--	--	--	--	61.8	--	--	--	61.8	--	--	61.8
Warrick	--	--	--	--	--	13.1	--	--	60.4	--	--	--	73.6	--	--	73.6
Washington	--	--	--	--	--	17.2	--	--	117.8	--	--	--	135.0	--	--	135.0
Total	179.3	13.2	5.3	78.4	5.3	133.1	31.9	1,346.9	--	--	--	--	1,788.2	--	--	1,788.2

(Table 55 continued on next page)

(Table 55 continued)

Forest Survey Unit and county	Forest Service				Other Federal				State and local government				Undifferentiated private			
	Timber-		Other forest		Timber-		Other forest		Timber-		Other forest		Timber-		Other forest	
	land	land	land	land	land	land	land	land	land	land	land	land	land	land	land	land
Upland Flats																
Dearborn	--	--	--	--	--	--	--	--	--	--	--	--	109.2	--	--	109.2
Fayette, Union	--	--	--	--	--	--	--	--	--	--	--	--	54.0	--	--	54.0
Franklin	--	--	--	--	--	--	--	--	--	--	4.1	--	82.4	--	--	86.5
Jefferson	--	--	--	10.7	--	--	--	--	--	--	--	--	92.2	6.8	--	109.7
Jennings	--	--	--	32.0	--	--	--	--	--	--	--	--	85.4	--	--	117.4
Ohio, Switzerland	--	--	--	--	--	--	--	--	--	--	--	--	90.2	--	--	90.2
Ripley	--	--	--	--	--	--	--	--	--	--	19.8	--	77.9	--	--	97.7
Total	--	--	--	42.7	--	--	--	23.9	--	--	591.2	6.8	--	--	--	664.7
Northern																
AdHuWe	--	--	--	6.4	--	--	--	--	1.5	--	6.7	--	57.0	--	--	71.6
Allen	--	--	--	--	--	--	--	--	--	--	--	--	65.9	--	--	65.9
Batholomew	--	--	--	13.3	--	--	--	--	--	--	--	--	33.6	--	--	46.9
BeFoWa	--	--	--	--	--	--	--	--	--	--	--	--	50.6	--	--	50.6
BiDeGrMa	--	--	--	--	--	--	--	--	--	--	--	--	69.7	--	--	69.7
BoCIHaTi	--	--	--	--	--	--	--	--	--	--	--	--	29.9	1.5	--	31.4
CaHoMiWa	--	--	--	6.3	--	--	--	--	--	--	--	--	105.4	--	--	111.7
CaTiWh	--	--	--	--	--	--	--	--	--	--	--	--	84.2	6.3	--	90.5
De Kalb, Steuben	--	--	--	--	--	--	--	--	--	--	--	--	31.7	4.5	--	36.2
DeHeRuWa	--	--	--	--	--	--	--	--	--	--	--	--	80.9	--	--	80.9
EINoWh	--	--	--	--	--	--	--	--	--	--	4.6	--	106.3	--	--	110.9
Fulton, Marshall	--	--	--	--	--	--	--	--	--	--	--	--	28.5	--	--	28.5
HaHeJoMaSh	--	--	--	6.7	--	--	--	--	3.4	--	--	--	87.6	--	--	97.6
JaLaNe	--	--	--	--	--	--	--	--	5.0	--	--	--	52.2	--	--	57.2
Jay, Randolph	--	--	--	--	--	--	--	--	6.3	--	--	--	20.4	--	--	26.6
Kosciusko	--	--	--	--	--	--	--	--	--	--	--	--	40.2	--	--	40.2
La Grange	--	--	--	--	--	--	--	--	11.3	--	--	--	27.1	--	--	38.4
La Porte	--	--	--	--	--	--	--	--	1.5	--	--	--	43.2	--	--	44.7
Montgomery	--	--	--	--	--	--	--	--	--	--	4.6	--	35.5	--	--	40.1
Porter	--	--	--	--	--	--	--	--	--	--	--	--	36.1	--	--	47.4
PuStSt	--	--	--	--	--	--	--	--	10.9	--	8.3	--	59.2	--	--	78.4
Total	--	--	--	32.7	--	11.3	--	24.2	39.8	24.2	1,145.5	12.3	--	--	--	1,265.7
All counties	192.4	13.2	213.4	16.6	226.7	91.6	3,780.8	19.1	4,553.8							

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.

AdHuWe = Adams, Huntington, and Wells Counties
BeFoWa = Benton, Fountain, and Warren Counties
BiDeGrMa = Blackford, Delaware, Grant, and Madison Counties
BoCIHaTi = Boone, Clinton, Hamilton, and Tipton Counties
CaHoMiWa = Cass, Howard, Miami, and Wabash Counties
CaTiWh = Carroll, Tippecanoe, and White Counties
DeHeRuWa = Decatur, Henry, Rush, and Wayne Counties
EINoWh = Elkhart, Noble, and Whitley Counties
HaHeJoMaSh = Hancock, Hendricks, Johnson, Marion, and Shelby Counties
JaLaNe = Jasper, Lake, and Newton Counties
PuStSt = Pulaski, St. Joseph, and Starke Counties

Table 56. — Area of forest land by Forest Survey Unit, county/county group, and forest type group, Indiana, 1999-2003

(In thousand acres)

Forest Survey Unit and county	Forest type group											All groups
	White-red-jack pine	Loblolly-shortleaf pine	Pinyon-juniper	Exotic softwoods	Oak-pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch	Aspen-birch	Non-stocked	
Lower Wabash												
Clay	--	--	--	--	5.0	30.9	--	7.7	19.0	--	--	62.6
Davless, Knox	--	--	--	--	--	24.2	--	9.3	12.6	--	--	46.0
Gibson	--	--	--	--	--	27.7	--	13.1	8.7	--	--	49.4
Greene	6.1	--	--	--	--	90.0	--	3.4	14.6	--	--	114.2
Marlin	--	1.8	--	--	--	90.8	--	12.5	39.3	--	--	144.4
Parke	--	4.6	--	--	--	68.8	--	5.0	24.3	--	3.2	106.0
Pike	5.7	4.2	--	--	9.7	29.0	5.7	12.1	7.6	--	--	74.0
Posey, Vanderburgh	--	--	--	--	--	28.6	--	4.4	1.7	--	--	34.7
Putnam	--	--	--	--	--	45.5	--	--	30.8	--	--	76.3
Sullivan	--	--	--	--	--	45.7	--	3.7	6.2	--	1.5	57.1
Vermillion	--	--	--	--	--	26.2	--	--	--	--	--	26.2
Vigo	--	--	1.5	--	--	6.7	--	19.9	16.2	--	--	44.3
Total	11.8	10.6	1.5	--	14.7	514.0	5.7	91.1	181.0	--	4.8	835.2
Knobs												
Brown	--	--	--	--	4.4	144.3	--	4.4	12.7	1.6	--	167.4
Clark, Scott	--	--	--	--	11.4	67.6	--	6.2	18.6	--	--	103.8
Crawford	--	--	--	--	7.0	114.5	--	--	8.9	--	--	130.5
Dubois	--	--	--	--	5.0	32.7	6.2	6.3	13.7	--	--	63.9
Floyd, Harrison	--	5.0	20.7	--	18.9	90.5	--	--	36.3	--	6.7	178.1
Jackson	--	--	--	--	3.9	53.9	1.5	15.7	37.8	--	--	112.7
Lawrence	--	2.0	--	--	--	89.7	--	14.8	15.3	--	--	121.8
Monroe	--	--	1.7	--	1.2	117.2	--	--	22.5	--	--	142.6
Morgan	3.4	--	--	--	--	40.2	--	16.9	30.6	--	--	91.0
Orange	1.5	7.0	--	--	9.3	58.7	--	4.6	40.2	--	--	121.3
Owen	--	--	--	--	4.3	73.9	--	5.0	44.7	--	--	128.0
Perry	4.4	6.3	--	--	7.1	114.8	6.6	6.2	11.4	--	--	156.7
Spencer	--	--	--	--	--	41.0	--	5.4	12.7	--	2.7	61.8
Warrick	--	--	--	--	--	54.1	3.4	14.4	1.6	--	--	73.6
Washington	--	3.1	--	--	3.3	74.7	--	3.1	50.8	--	--	135.0
Total	9.3	23.4	22.3	--	75.9	1,167.6	17.7	103.1	357.9	1.6	9.3	1,788.2
Upland Flats												
Dearborn	--	--	8.1	--	17.0	60.4	--	1.4	22.3	--	--	109.2
Fayette, Union	--	--	--	--	5.7	28.8	--	5.5	14.0	--	--	54.0
Franklin	--	--	--	--	--	60.8	--	12.6	13.2	--	--	86.5
Jefferson	--	--	--	--	5.1	70.7	--	7.0	26.8	--	--	109.7
Jennings	5.1	--	--	--	1.4	68.7	--	12.1	27.4	2.7	--	117.4
Ohio, Switzerland	--	--	--	--	15.1	34.8	--	14.6	24.1	--	1.7	90.2
Ripley	--	--	8.0	--	11.0	48.2	--	7.3	23.1	--	--	97.7
Total	5.1	--	16.1	--	55.3	372.4	--	60.5	150.9	2.7	1.7	664.7

(Table 56 continued on next page)

(Table 56 continued)

Forest Survey Unit and county	Forest type group											All groups
	White-red-jack pine	Loblolly-shortleaf pine	Pinyon-juniper	Exotic softwoods	Oak-pine	Oak-hickory	Oak-gum-cypress	Elm-ash-cottonwood	Maple-beech-birch	Aspen-birch	Non-stocked	
Northern												
AdHuWe	6.7	--	--	--	--	31.9	--	12.5	20.6	--	--	71.6
Allen	--	--	--	--	--	34.7	--	2.7	28.5	--	--	65.9
Batholomew	--	--	--	--	--	23.9	8.1	8.2	6.7	--	--	46.9
BeFoWa	--	--	--	--	--	29.0	--	9.6	11.9	--	--	50.6
BiDeGrMa	0.5	--	--	--	--	47.0	--	4.8	15.9	--	1.6	69.7
BoClHaTi	--	--	--	--	--	15.2	--	12.4	3.8	--	--	31.4
CaHoMiWa	6.3	--	--	--	--	42.4	--	10.9	52.1	--	--	111.7
CaTiWh	--	--	--	--	--	68.2	--	9.2	13.0	--	--	90.5
De Kalb, Steuben	--	--	--	--	--	25.7	--	8.7	1.8	--	--	36.2
DeHeRuWa	1.8	--	--	--	--	39.1	--	22.3	17.6	--	--	80.9
EINoWh	--	--	--	--	--	50.2	--	21.0	37.9	1.9	--	110.9
Fulton, Marshall	--	--	--	--	1.0	10.4	--	5.7	11.3	--	--	28.5
HaHeJoMaSh	--	--	--	--	7.4	34.9	10.4	22.7	20.4	--	1.8	97.6
JaLaNe	0.3	--	--	--	--	43.7	--	2.5	5.0	--	5.7	57.2
Jay, Randolph	--	--	--	--	--	12.3	--	6.4	7.9	--	--	26.6
Kosciusko	--	--	--	--	--	9.2	--	15.0	16.0	--	--	40.2
La Grange	4.6	--	--	6.0	--	--	--	21.4	6.4	--	--	38.4
La Porte	--	--	--	--	--	25.4	--	--	11.9	--	7.4	44.7
Montgomery	--	--	--	--	--	13.3	--	9.6	12.7	4.6	--	40.1
Porter	--	--	--	--	--	33.6	--	6.7	7.2	--	--	47.4
PuStSt	--	--	--	--	--	54.5	6.5	11.2	6.2	--	--	78.4
Total	20.1	--	--	6.0	8.4	644.7	25.0	223.6	314.6	6.5	16.6	1,265.7
All counties	46.4	34.0	40.0	6.0	154.4	2,698.8	48.4	478.3	1,004.4	10.8	32.4	4,553.8
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.												
AdHuWe = Adams, Huntington, and Wells Counties												
BeFoWa = Benton, Fountain, and Warren Counties												
BiDeGrMa = Blackford, Delaware, Grant, and Madison Counties												
BoClHaTi = Boone, Clinton, Hamilton, and Tipton Counties												
CaHoMiWa = Cass, Howard, Miami, and Wabash Counties												
CaTiWh = Carroll, Tippecanoe, and White Counties												
DeHeRuWa = Decatur, Henry, Rush, and Wayne Counties												
EINoWh = Elkhart, Noble, and Whitley Counties												
HaHeJoMaSh = Hancock, Hendricks, Johnson, Marion, and Shelby Counties												
JaLaNe = Jasper, Lake, and Newton Counties												
PuStSt = Pulaski, St. Joseph, and Starke Counties												

Table 57. — Area of timberland by Forest Survey Unit, county, and stand-size class, Indiana, 1999-2003

(In thousand acres)

Forest Survey Unit and county	Stand-size class					All size classes
	Large diameter	Medium diameter	Small diameter	Chaparral	Nonstocked	
Lower Wabash						
Clay	50.3	12.3	--	--	--	62.6
Daviess, Knox	35.6	--	10.4	--	--	46.0
Gibson	42.4	7.0	--	--	--	49.4
Greene	70.2	22.6	21.4	--	--	114.2
Martin	136.8	6.2	1.5	--	--	144.4
Parke	82.0	6.2	8.3	--	3.2	99.7
Pike	57.1	8.8	8.0	--	--	74.0
Posey, Vanderburgh	25.3	4.0	--	--	--	29.3
Putnam	62.1	9.9	4.3	--	--	76.3
Sullivan	45.9	9.6	--	--	1.5	57.1
Vermillion	15.0	6.1	5.0	--	--	26.2
Vigo	21.0	21.8	1.5	--	--	44.3
Total	643.8	114.6	60.5	--	4.8	823.6
Knobs						
Brown	121.9	9.8	4.7	--	--	136.4
Clark, Scott	92.5	1.6	9.8	--	--	103.8
Crawford	105.7	21.5	3.2	--	--	130.5
Dubois	57.7	5.9	0.3	--	--	63.9
Floyd, Harrison	122.9	42.3	6.2	--	6.7	178.1
Jackson	88.4	9.9	9.1	--	--	107.4
Lawrence	76.9	19.3	20.3	--	--	116.4
Monroe	87.4	43.0	3.3	--	--	133.8
Morgan	67.8	23.3	--	--	--	91.0
Orange	98.3	23.0	--	--	--	121.3
Owen	108.4	4.0	15.5	--	--	128.0
Perry	109.1	32.8	14.9	--	--	156.7
Spencer	43.9	10.2	5.0	--	2.7	61.8
Warrick	63.6	8.3	1.6	--	--	73.6
Washington	116.0	12.5	6.5	--	--	135.0
Total	1,360.5	267.4	100.5	--	9.3	1,737.7

Table 57 continued on next page)

(Table 57 continued on next page)

(Table 57 continued)

Forest Survey Unit and county	Stand-size class				All size classes
	Large diameter	Medium diameter	Small diameter	Chaparral	
Upland Flats					
Dearborn	49.9	54.4	4.9	--	109.2
Fayette, Union	34.4	17.1	2.6	--	54.0
Franklin	61.9	20.5	--	--	82.4
Jefferson	56.0	18.4	28.4	--	102.9
Jennings	65.7	24.1	27.6	--	117.4
Ohio, Switzerland	30.6	55.5	2.5	--	90.2
Ripley	69.3	2.8	5.7	--	77.9
Total	367.9	192.7	71.7	--	633.9
Northern					
AdHuWe	40.1	16.1	8.8	--	65.0
Allen	65.4	0.5	--	--	65.9
Batholomew	39.7	7.2	--	--	46.9
BeFoWa	32.6	14.6	3.4	--	50.6
BiDeGrMa	47.6	20.5	--	--	69.7
BoClHaTi	17.3	9.4	3.1	--	29.9
CaHoMiWa	74.4	35.8	1.5	--	111.7
CaTiWh	64.5	15.7	4.0	--	84.2
De Kalb, Steuben	22.5	6.0	3.2	--	31.7
DeHeRuWa	64.7	7.1	9.2	--	80.9
EINoWh	97.2	7.7	1.5	--	106.3
Fulton, Marshall	24.4	4.0	--	--	28.5
HaHeJoMaSh	62.9	18.2	14.7	--	97.6
JaLaNe	22.3	26.0	3.2	--	57.2
Jay, Randolph	26.6	--	--	--	26.6
Kosciusko	34.5	5.7	--	--	40.2
La Grange	21.0	5.7	11.7	--	38.4
La Porte	27.0	--	10.2	--	44.7
Montgomery	27.6	6.3	1.6	--	35.5
Porter	14.5	17.4	4.3	--	36.1
PuStSt	40.3	19.2	10.5	--	70.1
Total	867.2	243.3	90.9	--	1,217.9
All counties	3,239.4	817.9	323.6	--	4,413.3
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.					
	AdHuWe = Adams, Huntington, and Wells Counties BeFoWa = Benton, Fountain, and Warren Counties BiDeGrMa = Blackford, Delaware, Grant, and Madison Counties BoClHaTi = Boone, Clinton, Hamilton, and Tipton Counties CaHoMiWa = Cass, Howard, Miami, and Wabash Counties CaTiWh = Carroll, Tippecanoe, and White Counties		DeHeRuWa = Decatur, Henry, Rush, and Wayne Counties EINoWh = Elkhart, Noble, and Whitley Counties HaHeJoMaSh = Hancock, Hendricks, Johnson, Marion, and Shelby Counties JaLaNe = Jasper, Lake, and Newton Counties PuStSt = Pulaski, St. Joseph, and Starke Counties		

Table 58. — Area of timberland by Forest Survey Unit, county, and stocking class, Indiana, 1999-2003

(In thousand acres)

Forest Survey Unit and county	Stocking class of growing-stock trees					All classes
	Nonstocked	Poorly stocked	Moderately stocked	Fully stocked	Overstocked	
Lower Wabash						
Clay	--	24.0	28.0	10.6	--	62.6
Daviess, Knox	--	12.6	6.8	26.7	--	46.0
Gibson	2.1	3.4	33.4	7.0	3.5	49.4
Greene	0.7	9.0	50.5	50.2	3.8	114.2
Martin	0.2	33.0	57.1	51.8	2.3	144.4
Parke	12.8	14.0	52.9	20.1	--	99.7
Pike	--	11.2	46.5	16.3	--	74.0
Posey, Vanderburgh	0.9	--	10.8	17.6	--	29.3
Putnam	1.5	11.4	28.0	35.4	--	76.3
Sullivan	1.8	20.1	25.4	9.8	--	57.1
Vermillion	--	--	7.7	18.5	--	26.2
Vigo	3.0	12.3	12.3	13.6	3.1	44.3
Total	22.9	150.9	359.3	277.7	12.7	823.6
Knobs						
Brown	--	21.3	60.9	54.2	--	136.4
Clark, Scott	--	29.9	44.1	28.3	1.6	103.8
Crawford	2.5	11.7	54.8	61.4	--	130.5
Dubois	0.3	16.3	44.8	--	2.5	63.9
Floyd, Harrison	7.9	33.5	83.2	47.2	6.2	178.1
Jackson	0.3	17.8	57.8	29.6	1.9	107.4
Lawrence	0.4	17.1	54.1	43.3	1.5	116.4
Monroe	0.3	12.7	62.9	56.3	1.5	133.8
Morgan	--	10.7	43.8	32.1	4.5	91.0
Orange	--	44.6	36.1	40.6	--	121.3
Owen	--	16.5	72.6	35.5	3.3	128.0
Perry	--	28.6	86.6	41.6	--	156.7
Spencer	2.7	16.8	25.9	11.4	5.0	61.8
Warrick	0.1	9.8	41.3	20.8	1.6	73.6
Washington	1.6	36.3	66.1	28.8	2.3	135.0
Total	16.1	323.7	835.0	531.2	31.8	1,737.7

(Table 58 continued on next page)

(Table 58 continued)

Forest Survey Unit and county	Stocking class of growing-stock trees					All classes
	Nonstocked	Poorly stocked	Moderately stocked	Fully stocked	Overstocked	
Upland Flats						
Dearborn	12.2	26.1	58.5	6.4	6.1	109.2
Fayette, Union	4.3	15.3	29.8	4.7	--	54.0
Franklin	--	23.3	44.6	14.5	--	82.4
Jefferson	--	13.5	76.6	8.5	4.2	102.9
Jennings	0.2	29.4	28.4	44.7	14.7	117.4
Ohio, Switzerland	1.7	52.6	29.7	4.9	1.4	90.2
Ripley	--	8.6	61.1	8.2	--	77.9
Total	18.3	168.8	328.8	91.7	26.4	633.9
Northern						
AdHuWe	1.5	19.3	22.7	21.5	--	65.0
Allen	0.5	6.7	24.8	34.0	--	65.9
Batholomew	--	7.2	20.3	19.4	--	46.9
BeFoWa	--	12.9	23.0	14.2	0.5	50.6
BiDeGrMa	1.6	23.3	41.2	3.2	0.5	69.7
BoClHaTi	3.1	7.2	8.7	10.9	--	29.9
CaHoMiWa	2.0	28.4	58.6	18.7	3.9	111.7
CaTiWh	2.1	27.8	27.3	27.0	--	84.2
De Kalb, Steuben	--	--	13.6	18.0	0.1	31.7
DeHeRuWa	--	24.5	27.2	25.9	3.3	80.9
EiNoWh	--	34.3	36.6	33.9	1.5	106.3
Fulton, Marshall	2.8	6.5	12.9	6.2	--	28.5
HaHeJoMaSh	8.1	9.7	58.5	17.9	3.4	97.6
JaLaNe	11.1	26.3	15.5	4.1	0.3	57.2
Jay, Randolph	0.1	2.7	6.4	17.4	--	26.6
Kosciusko	--	5.7	20.4	14.1	--	40.2
La Grange	--	4.7	18.1	15.7	--	38.4
La Porte	7.4	1.6	22.1	13.5	--	44.7
Montgomery	--	14.9	12.8	6.2	1.6	35.5
Porter	--	8.8	25.3	2.0	--	36.1
PuStSt	--	11.2	29.0	28.4	1.4	70.1
Total	40.3	283.8	525.1	352.4	16.4	1,217.9
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.						
	AdHuWe = Adams, Huntington, and Wells Counties		DeHeRuWa = Decatur, Henry, Rush, and Wayne Counties			
	BeFoWa = Benton, Fountain, and Warren Counties		EiNoWh = Elkhart, Noble, and Whitley Counties			
	BiDeGrMa = Blackford, Delaware, Grant, and Madison Counties		HaHeJoMaSh = Hancock, Hendricks, Johnson, Marion, and Shelby Counties			
	BoClHaTi = Boone, Clinton, Hamilton, and Tipton Counties		JaLaNe = Jasper, Lake, and Newton Counties			
	CaHoMiWa = Cass, Howard, Miami, and Wabash Counties		PuStSt = Pulaski, St. Joseph, and Starke Counties			
	CaTiWh = Carroll, Tippecanoe, and White Counties					

Table 59. — Net volume of growing stock and sawtimber (International 1/4-inch rule) on timberland by Forest Survey Unit, county, and major species group, Indiana, 1999-2003

Forest Survey Unit and county	Growing stock					All species	Sawtimber					
	Major species group						Major species group					
	Pine	softwoods	Other	Soft hardwoods	Hard hardwoods		Pine	softwoods	Other	Soft hardwoods	Hard hardwoods	
(In million cubic feet)												
Lower Wabash												
Clay	1.2	--	--	50.1	65.9	117.2	5.0	--	--	157.0	267.6	429.6
Daviess, Knox	--	--	--	53.2	55.4	108.6	--	--	--	236.7	232.9	469.6
Gibson	--	--	--	31.3	46.8	78.1	--	--	--	113.9	194.0	307.9
Greene	7.6	0.1	0.1	131.4	90.2	229.3	26.9	--	--	537.4	346.7	911.0
Martin	0.9	0.1	0.1	86.8	213.8	301.6	2.9	--	--	359.1	870.1	1,232.1
Parke	--	--	--	81.5	91.8	173.4	--	--	--	321.5	348.7	670.2
Pike	32.9	0.2	0.2	51.0	28.4	112.5	152.7	--	--	169.7	89.3	411.7
Posey, Vanderburgh	--	--	--	46.9	39.0	85.9	--	--	--	191.3	163.3	354.7
Putnam	--	--	--	39.9	103.3	143.2	--	--	--	159.4	387.1	546.5
Sullivan	0.2	--	--	37.0	54.3	91.5	--	--	--	136.3	207.7	344.0
Vermillion	--	--	--	12.8	29.5	42.3	--	--	--	50.4	98.5	148.9
Vigo	--	--	--	29.0	38.8	67.8	--	--	--	98.6	150.8	249.4
Total	42.9	0.4	0.4	650.9	857.2	1,551.4	187.5	--	--	2,531.3	3,356.7	6,075.5
Knobs												
Brown	--	0.1	0.1	54.1	206.3	260.4	--	--	--	185.2	855.7	1,040.9
Clark, Scott	5.8	--	--	71.9	110.8	188.5	30.1	--	--	302.1	465.0	797.2
Crawford	2.0	2.7	2.7	27.3	174.4	206.4	10.1	5.8	82.8	669.5	768.1	768.1
Dubois	0.5	--	--	35.9	60.1	96.4	2.0	--	--	127.9	232.5	362.4
Floyd, Harrison	13.4	21.7	21.7	45.7	181.1	261.9	65.3	54.0	145.5	695.0	959.7	959.7
Jackson	3.3	1.4	1.4	83.4	108.2	196.2	13.0	6.4	328.0	442.5	789.9	789.9
Lawrence	4.6	0.7	0.7	91.2	123.7	220.2	15.0	2.1	364.9	482.4	864.4	864.4
Monroe	2.0	7.4	7.4	93.8	180.9	284.2	9.1	29.6	342.4	691.6	1,072.7	1,072.7
Morgan	7.4	--	--	90.1	126.3	223.9	29.3	--	--	380.9	543.2	953.4
Orange	18.3	8.1	8.1	68.5	133.9	228.8	76.8	25.5	242.4	519.8	864.5	864.5
Owen	1.5	0.5	0.5	131.1	140.9	273.9	5.0	2.5	537.2	596.9	1,141.6	1,141.6
Perry	18.4	5.1	5.1	36.7	178.1	238.3	82.0	11.4	103.1	671.7	868.2	868.2
Spencer	--	0.3	0.3	24.5	59.4	84.2	--	--	--	70.9	240.0	310.9
Warrick	1.9	0.1	0.1	52.8	91.0	145.8	8.5	--	--	184.7	352.4	545.6
Washington	4.8	6.0	6.0	80.1	163.9	254.8	23.7	15.2	346.0	652.1	1,037.0	1,037.0
Total	83.8	54.2	54.2	987.1	2,039.0	3,164.1	369.7	152.5	3,744.0	8,110.4	12,376.5	12,376.5
(Table 59 continued on next page)												

(Table 59 continued on next page)

(Table 59 continued)

Forest Survey Unit and county	Growing stock					Sawtimber						
	Major species group					Major species group						
	Pine	Other softwoods	hardwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	hardwoods	Soft hardwoods	Hard hardwoods	All species
(In million cubic feet)												
(In million board feet) ¹												
Upland Flats												
Dearborn	0.2	15.1	22.8	77.4	115.6		--	44.4	56.0	257.8		358.1
Fayette, Union	--	1.9	23.9	45.7	71.5		--	4.8	90.5	177.8		273.1
Franklin	--	--	47.1	70.0	117.1		--	--	176.1	235.1		411.3
Jefferson	--	10.4	58.8	63.8	133.0		--	28.0	228.9	214.5		471.3
Jennings	9.9	0.1	78.8	100.1	189.0		30.4	--	262.5	380.2		673.0
Ohio, Switzerland	1.1	11.2	20.9	57.9	91.1		5.9	28.1	36.5	167.4		237.9
Ripley	--	0.9	59.1	74.9	134.8		--	2.5	238.0	321.3		561.8
Total	11.3	39.6	311.4	489.8	852.1		36.3	107.8	1,088.5	1,754.1		2,986.7
Northern												
AdHuWe	--	--	27.3	55.1	82.5		--	--	100.7	175.2		275.8
Allen	--	--	51.7	102.3	154.0		--	--	190.3	413.9		604.2
Batholomew	--	--	56.9	59.0	116.0		--	--	224.9	223.1		447.9
BeFoWa	--	--	31.6	58.5	90.1		--	--	117.4	220.1		337.5
BiDeGrMa	3.2	--	12.7	63.7	79.6		14.0	--	20.0	212.3		246.4
BoClHaTi	--	--	18.3	46.0	64.3		--	--	66.6	177.4		244.0
CaHoMiWa	14.3	--	61.1	97.6	173.0		64.1	--	194.3	347.4		605.8
CaTiWh	--	--	34.8	82.0	116.8		--	--	119.9	311.2		431.1
De Kalb, Steuben	--	--	43.7	26.6	70.4		--	--	139.5	105.7		245.2
DeHeRuWa	5.1	--	99.6	64.6	169.3		22.7	--	433.1	251.0		706.8
EiNoWh	5.3	--	76.4	76.1	157.8		19.6	--	287.0	288.3		594.9
Fulton, Marshall	--	--	25.6	17.1	42.7		--	--	87.3	66.4		153.6
HaHeJoMaSh	0.6	--	55.3	88.7	144.5		--	--	207.2	326.6		533.8
JaLaNe	1.6	--	18.6	20.3	40.4		5.3	--	41.0	69.5		115.8
Jay, Randolph	--	--	14.7	54.2	68.9		--	--	46.0	225.0		271.0
Kosciusko	--	--	55.3	27.7	83.0		--	--	215.8	94.5		310.2
La Grange	10.9	0.9	24.1	13.0	48.9		28.7	--	84.6	46.7		160.0
La Porte	0.1	--	32.9	32.5	65.5		--	--	116.2	147.2		263.4
Montgomery	--	0.2	10.0	31.9	42.1		--	--	19.6	115.2		134.8
Porter	--	--	13.2	24.9	38.1		--	--	27.5	81.3		108.8
PuStSt	--	--	32.7	72.7	105.4		--	--	95.8	279.3		375.1
Total	41.1	1.0	796.6	1,114.5	1,953.2		154.5	--	2,834.7	4,177.2		7,166.4

All table cells without observations in the inventory sample are indicated by --. Table value of 0.0 indicates the volume rounds to less than 0.1 million cubic or board feet. Columns and rows may not add to their totals due to rounding.

International 1/4-inch rule

AdHuWe = Adams, Huntington, and Wells Counties
 BeFoWa = Benton, Fountain, and Warren Counties
 BiDeGrMa = Blackford, Delaware, Grant, and Madison Counties
 BoClHaTi = Boone, Clinton, Hamilton, and Tipton Counties
 CaHoMiWa = Cass, Howard, Miami, and Wabash Counties
 CaTiWh = Carroll, Tippecanoe, and White Counties

DeHeRuWa = Decatur, Henry, Rush, and Wayne Counties
 EiNoWh = Elkhart, Noble, and Whitley Counties
 HaHeJoMaSh = Hancock, Hendricks, Johnson, Marion, and Shelby Counties
 JaLaNe = Jasper, Lake, and Newton Counties
 PuStSt = Pulaski, St. Joseph, and Starke Counties

Table 59a. — Net volume of growing stock and sawtimber (Doyle rule) on timberland by Forest Survey Unit, county, and major species group, Indiana, 1999-2003

Forest Survey Unit and county	Growing stock						Sawtimber														
	Major species group					All species	Major species group														
	Pine	Other softwoods	hardwoods	Soft hardwoods	Hard hardwoods		Pine	Other softwoods	hardwoods	Soft hardwoods	Hard hardwoods	All species									
(In million cubic feet)												(In million board feet) ¹									
Lower Wabash																					
Clay	1.2	--	--	50.1	65.9	117.2	2.4	--	--	102.0	210.6	315.0									
Daviess, Knox	--	--	--	53.2	55.4	108.6	--	--	--	155.4	174.8	330.2									
Gibson	--	--	--	31.3	46.8	78.1	--	--	--	72.4	135.2	207.5									
Greene	7.6	0.1	131.4	90.2	213.8	229.3	14.6	--	--	409.2	231.9	655.7									
Martin	0.9	0.1	86.8	86.8	213.8	301.6	1.4	--	--	246.4	587.0	834.8									
Parke	--	--	--	81.5	91.8	173.4	--	--	--	214.3	216.2	430.6									
Pike	32.9	0.2	51.0	28.4	28.4	112.5	100.5	--	--	91.8	47.2	239.5									
Posey, Vanderburgh	--	--	--	46.9	39.0	85.9	--	--	--	153.0	132.4	285.4									
Putnam	--	--	--	39.9	103.3	143.2	--	--	--	109.1	247.6	356.7									
Sullivan	0.2	--	--	37.0	54.3	91.5	--	--	--	91.7	140.8	232.5									
Vermillion	--	--	--	12.8	29.5	42.3	--	--	--	33.5	56.1	89.6									
Vigo	--	--	--	29.0	38.8	67.8	--	--	--	59.2	107.4	166.6									
Total												42.9	0.4	650.9	857.2	1,551.4	118.9	--	1,738.0	2,287.2	4,144.1
Knobs																					
Brown	--	0.1	54.1	206.3	260.4	260.4	--	--	--	126.4	545.0	671.3									
Clark, Scott	5.8	--	71.9	110.8	188.5	188.5	18.4	--	--	203.7	287.4	509.6									
Crawford	2.0	2.7	27.3	174.4	206.4	206.4	5.3	2.0	49.7	385.0	442.0	442.0									
Dubois	0.5	--	35.9	60.1	96.4	96.4	0.7	--	--	78.6	146.5	225.8									
Floyd, Harrison	13.4	21.7	45.7	181.1	261.9	261.9	37.5	25.1	88.9	433.9	585.4	585.4									
Jackson	3.3	1.4	83.4	108.2	196.2	196.2	11.3	3.8	237.1	262.4	514.6	514.6									
Lawrence	4.6	0.7	91.2	123.7	220.2	220.2	6.1	0.7	238.0	331.7	576.5	576.5									
Monroe	2.0	7.4	93.8	180.9	284.2	284.2	4.8	22.2	226.8	428.6	682.4	682.4									
Morgan	7.4	--	90.1	126.3	223.9	223.9	10.4	--	--	306.1	387.5	703.9									
Orange	18.3	8.1	68.5	133.9	228.8	228.8	52.5	13.7	152.7	328.3	547.2	547.2									
Owen	1.5	0.5	131.1	140.9	273.9	273.9	2.2	1.2	361.3	389.8	754.5	754.5									
Perry	18.4	5.1	36.7	178.1	238.3	238.3	45.2	6.3	65.8	429.1	546.3	546.3									
Spencer	--	0.3	24.5	59.4	84.2	84.2	--	--	--	38.8	151.4	190.2									
Warrick	1.9	0.1	52.8	91.0	145.8	145.8	4.6	--	--	129.6	248.8	383.1									
Washington	4.8	6.0	80.1	163.9	254.8	254.8	14.9	7.6	228.0	424.6	675.1	675.1									
Total												83.8	54.2	987.1	2,039.0	3,164.1	213.8	82.6	2,531.3	5,180.0	8,007.7

(Table 59a continued on next page)

(Table 59a continued)

Forest Survey Unit and county	Growing stock					Sawtimber				
	Major species group					Major species group				
	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species
(In million cubic feet)										
Upland Flats										
Dearborn	0.2	15.1	22.8	77.4	115.6	--	23.2	27.1	169.0	219.3
Fayette, Union	--	1.9	23.9	45.7	71.5	--	1.7	61.1	103.2	166.0
Franklin	--	--	47.1	70.0	117.1	--	--	130.5	149.8	280.3
Jefferson	--	10.4	58.8	63.8	133.0	--	12.3	157.5	144.1	313.9
Jennings	9.9	0.1	78.8	100.1	189.0	15.1	--	180.1	266.3	461.5
Ohio, Switzerland	1.1	11.2	20.9	57.9	91.1	3.5	14.6	19.1	99.4	136.7
Ripley	--	0.9	59.1	74.9	134.8	--	1.2	169.5	205.1	375.8
Total	11.3	39.6	311.4	489.8	852.1	18.7	53.0	744.9	1,136.9	1,953.5
Northern										
AdHuWe	--	--	27.3	55.1	82.5	--	--	75.3	104.1	179.4
Allen	--	--	51.7	102.3	154.0	--	--	131.4	313.1	444.5
Batholomew	--	--	56.9	59.0	116.0	--	--	171.3	143.3	314.5
BeFoWa	--	--	31.6	58.5	90.1	--	--	92.1	139.1	231.2
BiDeGrMa	3.2	--	12.7	63.7	79.6	7.0	--	13.7	131.8	152.5
BoCiHaTi	--	--	18.3	46.0	64.3	--	--	46.2	130.7	176.9
CaHoMiWa	14.3	--	61.1	97.6	173.0	39.3	--	124.4	224.6	388.4
CaTiWh	--	--	34.8	82.0	116.8	--	--	86.6	192.1	278.7
De Kalb, Steuben	--	--	43.7	26.6	70.4	--	--	107.7	61.8	169.5
DeHeRuWa	5.1	--	99.6	64.6	169.3	9.9	--	342.0	149.0	500.9
EiNoWh	5.3	--	76.4	76.1	157.8	8.6	--	202.8	193.1	404.5
Fulton, Marshall	--	--	25.6	17.1	42.7	--	--	56.6	41.2	97.8
HaHeJoMaSh	0.6	--	55.3	88.7	144.5	--	--	163.1	221.0	384.0
JaLaNe	1.6	--	18.6	20.3	40.4	2.1	--	23.1	52.9	78.1
Jay, Randolph	--	--	14.7	54.2	68.9	--	--	29.1	168.5	197.6
Kosciusko	--	--	55.3	27.7	83.0	--	--	157.9	55.9	213.9
La Grange	10.9	0.9	24.1	13.0	48.9	12.1	--	53.4	27.2	92.7
La Porte	0.1	--	32.9	32.5	65.5	--	--	73.0	103.1	176.1
Montgomery	--	0.2	10.0	31.9	42.1	--	--	9.5	63.6	73.1
Porter	--	--	13.2	24.9	38.1	--	--	15.9	47.9	63.8
PuStSt	--	--	32.7	72.7	105.4	--	--	61.2	196.4	257.6
Total	41.1	1.0	796.6	1,114.5	1,953.2	79.1	--	2,036.4	2,760.4	4,875.9
All table cells without observations in the inventory sample are indicated by --. Table value of 0.0 indicates the volume rounds to less than 0.1 million cubic or board feet. Columns and rows may not add to their totals due to rounding.										
AdHuWe = Adams, Huntington, and Wells Counties BeFoWa = Benton, Fountain, and Warren Counties BiDeGrMa = Blackford, Delaware, Grant, and Madison Counties BoCiHaTi = Boone, Clinton, Hamilton, and Tipton Counties CaHoMiWa = Cass, Howard, Miami, and Wabash Counties CaTiWh = Carroll, Tippecanoe, and White Counties DeHeRuWa = Decatur, Henry, Rush, and Wayne Counties EiNoWh = Elkhart, Noble, and Whitley Counties HaHeJoMaSh = Hancock, Hendricks, Johnson, Marion, and Shelby Counties JaLaNe = Jasper, Lake, and Newton Counties PuStSt = Pulaski, St. Joseph, and Starke Counties										

Table 60. — Average annual net growth of growing stock and sawtimber (International 1/4-inch rule) on timberland by Forest Survey Unit, county, and major species group, Indiana, 1998 to 1999-2003

Forest Survey Unit and county	Growing stock					Sawtimber				
	Major species group					Major species group				
	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species
(In million cubic feet)										
(In million board feet) ¹										
Lower Wabash										
Clay	--	--	0.5	3.8	4.3	--	--	-3.7	11.2	7.5
Davless, Knox	--	--	4.8	1.4	6.3	--	--	31.2	7.2	38.4
Gibson	--	--	1.6	3.5	5.1	--	--	4.4	14.3	18.7
Greene	0.0	0.0	2.1	5.1	7.2	1.3	--	5.6	31.3	38.2
Martin	0.2	--	2.6	5.5	8.2	0.6	--	9.4	33.7	43.7
Parke	--	--	5.6	0.4	6.0	--	--	26.6	0.0	26.6
Pike	-0.1	0.0	1.0	4.1	5.1	0.6	--	4.6	14.7	19.9
Posey, Vanderburgh	--	--	2.3	5.5	7.8	--	--	7.3	22.0	29.3
Putnam	--	0.0	2.5	8.0	10.5	--	0.0	13.1	32.8	45.9
Sullivan	--	--	-0.1	-6.2	-6.3	--	--	1.6	-28.9	-27.3
Vermillion	--	--	1.4	7.8	9.2	--	--	24.8	32.8	57.6
Vigo	--	--	3.3	1.5	4.8	--	--	16.4	6.0	22.4
Total										
	0.1	0.1	27.6	40.3	68.1	2.6	0.0	141.3	177.2	321.0
Knobs										
Brown	--	0.0	3.9	6.2	10.1	--	--	15.4	27.2	42.6
Clark, Scott	0.2	--	0.7	2.0	3.0	1.1	--	4.2	14.3	19.6
Crawford	--	0.1	1.7	-18.5	-16.7	--	0.9	9.4	-71.3	-61.0
Dubois	0.0	--	3.3	0.8	4.2	0.1	--	15.8	0.8	16.7
Floyd, Harrison	0.1	0.1	4.9	2.8	8.0	1.8	0.0	22.3	10.9	35.1
Jackson	-0.4	0.0	2.7	-0.8	1.5	0.1	--	11.3	-6.4	5.0
Lawrence	0.1	--	8.5	6.0	14.6	0.4	--	41.8	19.6	61.9
Monroe	--	0.0	1.7	6.6	8.3	--	--	10.4	28.0	38.4
Morgan	-0.6	--	4.1	4.3	7.7	1.2	--	32.6	19.8	53.6
Orange	0.8	0.5	11.3	3.7	16.4	3.8	3.5	61.4	14.2	83.0
Owen	0.1	0.0	3.2	2.7	6.0	0.3	--	12.9	19.0	32.2
Perry	0.6	-0.3	2.1	20.1	22.5	2.9	0.3	5.2	83.3	91.7
Spencer	--	--	1.7	0.1	1.8	--	--	5.4	-0.3	5.1
Warrick	--	0.1	1.0	4.1	5.2	--	--	2.4	20.5	22.8
Washington	--	0.8	8.9	12.2	21.9	--	1.3	42.5	45.5	89.2
Total										
	0.9	1.4	59.9	52.3	114.5	11.7	6.1	292.9	225.1	535.8

(Table 60 continued on next page)

(Table 60 continued)

Forest Survey Unit and county	Growing stock						Sawtimber																		
	Major species group						Major species group																		
	Pine	Other softwoods	hardwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	hardwoods	Soft hardwoods	Hard hardwoods	All species													
(In million cubic feet)													(In million board feet) ¹												
Upland Flats																									
Dearborn	0.0	0.1	1.9	2.5	4.4	4.4	--	--	7.7	10.5	18.2	18.2													
Fayette, Union	--	0.1	1.8	6.1	8.1	8.1	--	0.5	3.4	25.1	29.1	29.1													
Franklin	--	--	3.1	1.8	4.9	4.9	--	--	15.4	8.9	24.3	24.3													
Jefferson	--	0.1	2.1	0.2	2.3	2.3	--	-0.2	4.4	-2.0	2.2	2.2													
Jennings	--	0.0	3.3	1.9	5.2	5.2	--	--	5.6	3.6	9.2	9.2													
Ohio, Switzerland	--	0.1	0.8	3.5	4.4	4.4	--	0.3	8.0	3.2	11.5	11.5													
Ripley	--	0.1	4.3	4.5	8.9	8.9	--	0.1	20.9	24.0	45.1	45.1													
Total	0.0	0.5	17.3	20.5	38.2	38.2	--	0.8	65.5	73.4	139.6	139.6													
Northern																									
AdHuWe	--	--	1.2	3.9	5.2	5.2	--	--	2.9	17.4	20.4	20.4													
Allen	--	--	-0.6	11.3	10.8	10.8	--	--	9.1	52.8	62.0	62.0													
Batholomew	--	--	2.0	0.8	2.8	2.8	--	--	8.1	3.3	11.4	11.4													
BeFoWa	--	--	-1.7	1.3	-0.4	-0.4	--	--	-5.7	13.5	7.7	7.7													
BiDeGrMa	--	--	0.6	2.9	3.4	3.4	--	--	1.8	9.1	11.0	11.0													
BoClHaTi	--	--	5.4	4.7	10.1	10.1	--	--	20.1	22.0	42.1	42.1													
CaHoMiWa	0.2	--	-0.3	1.6	1.5	1.5	22.1	--	3.7	2.3	28.2	28.2													
CaTiWh	--	--	0.6	-6.1	-5.6	-5.6	--	--	3.4	-14.7	-11.3	-11.3													
De Kalb, Steuben	--	--	0.5	-0.7	-0.2	-0.2	--	--	1.4	-6.2	-4.8	-4.8													
DeHeRuWa	-0.2	--	2.9	6.5	9.3	9.3	-0.6	--	10.5	25.7	35.6	35.6													
EiNoWh	0.0	--	3.1	3.9	7.0	7.0	1.1	--	12.6	12.8	26.4	26.4													
Fulton, Marshall	--	--	-1.9	1.1	-0.8	-0.8	--	--	-13.5	7.5	-6.0	-6.0													
HaHeJoMaSh	--	--	3.0	10.8	13.9	13.9	--	--	12.4	37.5	49.9	49.9													
JaLaNe	0.0	--	1.0	-3.4	-2.4	-2.4	0.1	--	5.0	-12.1	-7.0	-7.0													
Jay, Randolph	--	--	-0.1	3.1	3.0	3.0	--	--	-1.9	10.8	8.9	8.9													
Kosciusko	--	--	2.3	0.1	2.5	2.5	--	--	10.1	1.2	11.3	11.3													
La Grange	--	0.1	1.0	0.8	1.9	1.9	--	--	2.1	4.7	6.8	6.8													
La Porte	0.1	--	-0.3	0.1	-0.1	-0.1	--	--	-1.6	1.4	-0.2	-0.2													
Montgomery	--	--	2.2	-1.5	0.7	0.7	--	--	7.6	-8.7	-1.1	-1.1													
Porter	0.0	--	2.1	3.0	5.1	5.1	--	--	10.6	7.4	18.0	18.0													
PuStSt	--	--	4.3	1.1	5.4	5.4	--	--	7.3	5.5	12.8	12.8													
Total	0.0	0.1	27.3	45.4	72.8	72.8	22.8	--	106.0	193.2	322.0	322.0													
All counties																									
All table cells without observations in the inventory sample are indicated by —. Table value of 0.0 indicates the volume rounds to less than 0.1 million cubic or board feet. Columns and rows may not add to their totals due to rounding.													CaTiWh = Carroll, Tippecanoe, and White Counties DeHeRuWa = Decatur, Henry, Rush, and Wayne Counties EiNoWh = Elkhart, Noble, and Whitley Counties HaHeJoMaSh = Hancock, Hendricks, Johnson, Marion, and Shelby Counties JaLaNe = Jasper, Lake, and Newton Counties PuStSt = Pulaski, St. Joseph, and Starke Counties												
¹ International 1/4-inch rule.																									

Table 60a. — Average annual net growth of growing stock and sawtimber (Doyle rule) on timberland by Forest Survey Unit, county, and major species group, Indiana, 1998 to 1999-2003

Forest Survey Unit and county	Growing stock						Sawtimber					
	Major species group						Major species group					
	Pine	Other softwoods	hardwoods		Hard hardwoods	All species	Pine	Other softwoods	hardwoods		Hard hardwoods	All species
			Soft	hardwoods					Soft	hardwoods		
(In million cubic feet)												
(In million board feet) ¹												
Lower Wabash												
Clay	--	--	0.5	3.8	4.3	--	--	--	-1.6	7.7	6.1	20.6
Davies, Knox	--	--	4.8	1.4	6.3	--	--	--	16.1	4.5	13.1	23.7
Gibson	--	--	1.6	3.5	5.1	--	--	--	1.9	11.3	27.2	15.6
Greene	0.0	0.0	2.1	5.1	7.2	0.8	--	--	4.5	18.4	8.0	23.0
Martin	0.2	--	2.6	5.5	8.2	0.3	--	--	7.4	19.5	-10.9	29.5
Parke	--	--	5.6	0.4	6.0	--	--	--	17.3	-1.8	13.0	193.1
Pike	-0.1	0.0	1.0	4.1	5.1	0.5	--	--	0.5	7.1	23.0	24.3
Posey, Vanderburgh	--	--	2.3	5.5	7.8	--	--	--	4.0	19.1	-12.0	18.5
Putnam	--	0.0	2.5	8.0	10.5	--	0.0	--	6.9	17.4	3.1	9.8
Sullivan	--	--	-0.1	-6.2	-6.3	--	--	--	1.1	-12.0	11.1	18.5
Vermillion	--	--	1.4	7.8	9.2	--	--	--	11.1	18.5	3.1	9.8
Vigo	--	--	3.3	1.5	4.8	--	--	--	9.8	3.1	13.0	193.1
Total												
Knobs												
Brown	--	0.0	3.9	6.2	10.1	--	--	--	11.0	16.9	27.9	27.9
Clark, Scott	0.2	--	0.7	2.0	3.0	0.6	--	--	1.9	6.9	9.4	9.4
Crawford	--	0.1	1.7	-18.5	-16.7	--	0.3	--	4.6	-93.2	-88.3	-88.3
Dubois	0.0	--	3.3	0.8	4.2	0.0	--	--	9.0	0.6	9.7	9.7
Floyd, Harrison	0.1	0.1	4.9	2.8	8.0	1.0	0.0	--	13.4	3.6	18.0	18.0
Jackson	-0.4	0.0	2.7	-0.8	1.5	0.7	--	--	6.2	-6.6	0.2	0.2
Lawrence	0.1	--	8.5	6.0	14.6	0.2	--	--	22.6	13.8	36.6	36.6
Monroe	--	0.0	1.7	6.6	8.3	--	--	--	6.3	16.0	22.3	22.3
Morgan	-0.6	--	4.1	4.3	7.7	0.3	--	--	23.9	12.4	36.5	36.5
Orange	0.8	0.5	11.3	3.7	16.4	2.3	1.8	--	33.3	5.7	43.1	43.1
Owen	0.1	0.0	3.2	2.7	6.0	0.1	--	--	7.8	9.7	17.6	17.6
Perry	0.6	-0.3	2.1	20.1	22.5	1.6	0.2	--	3.0	68.7	73.5	73.5
Spencer	--	--	1.7	0.1	1.8	--	--	--	3.6	-0.2	3.4	3.4
Warrick	--	0.1	1.0	4.1	5.2	--	--	--	1.5	11.9	13.5	13.5
Washington	--	0.8	8.9	12.2	21.9	--	0.4	--	27.8	39.4	67.7	67.7
Total												

(Table 60a continued on next page)

(Table 60a continued)

Forest Survey Unit and county	Growing stock						Sawtimber																		
	Major species group						Major species group																		
	Pine	Other softwoods	hardwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	hardwoods	Soft hardwoods	Hard hardwoods	All species													
(In million cubic feet)													(In million board feet) ¹												
Upland Flats																									
Dearborn	0.0	0.1	1.9	2.5	4.4	4.4	--	--	3.3	8.0	11.2	11.2													
Fayette, Union	--	0.1	1.8	6.1	8.1	8.1	--	0.2	2.1	13.1	15.3	15.3													
Franklin	--	--	3.1	1.8	4.9	4.9	--	--	8.8	5.0	13.8	13.8													
Jefferson	--	0.1	2.1	0.2	2.3	2.3	--	0.0	2.5	-4.1	-1.6	-1.6													
Jennings	--	0.0	3.3	1.9	5.2	5.2	--	--	3.1	2.2	5.2	5.2													
Ohio, Switzerland	--	0.1	0.8	3.5	4.4	4.4	--	0.2	3.5	1.8	5.5	5.5													
Ripley	--	0.1	4.3	4.5	8.9	8.9	--	0.1	10.1	13.4	23.5	23.5													
Total	0.0	0.5	17.3	20.5	38.2	38.2	--	0.4	33.3	39.3	73.0	73.0													
Northern																									
AdHuWe	--	--	1.2	3.9	5.2	5.2	--	--	2.9	8.9	11.8	11.8													
Allen	--	--	-0.6	11.3	10.8	10.8	--	--	5.4	59.6	64.9	64.9													
Batholomew	--	--	2.0	0.8	2.8	2.8	--	--	6.9	1.8	8.7	8.7													
BeFoWa	--	--	-1.7	1.3	-0.4	-0.4	--	--	-4.5	8.5	4.0	4.0													
BiDeGrMa	--	--	0.6	2.9	3.4	3.4	--	--	0.8	5.0	5.8	5.8													
BoClHaTi	--	--	5.4	4.7	10.1	10.1	--	--	13.7	18.7	32.4	32.4													
CaHoMiWa	0.2	--	-0.3	1.6	1.5	1.5	11.0	--	5.6	8.9	25.6	25.6													
CaTiWh	--	--	0.6	-6.1	-5.6	-5.6	--	--	2.9	-31.2	-28.3	-28.3													
De Kalb, Steuben	--	--	0.5	-0.7	-0.2	-0.2	--	--	0.7	-5.6	-4.8	-4.8													
DeHeRuWa	-0.2	--	2.9	6.5	9.3	9.3	-0.2	--	7.2	12.0	19.0	19.0													
EiNoWh	0.0	--	3.1	3.9	7.0	7.0	0.5	--	7.5	9.4	17.3	17.3													
Fulton, Marshall	--	--	-1.9	1.1	-0.8	-0.8	--	--	-5.1	4.2	-0.8	-0.8													
HaHeJoMaSh	--	--	3.0	10.8	13.9	13.9	--	--	7.3	22.9	30.2	30.2													
JaLaNe	0.0	--	1.0	-3.4	-2.4	-2.4	0.1	--	2.2	-9.7	-7.5	-7.5													
Jay, Randolph	--	--	-0.1	3.1	3.0	3.0	--	--	-1.0	7.5	6.5	6.5													
Kosciusko	--	--	2.3	0.1	2.5	2.5	--	--	7.8	0.7	8.4	8.4													
La Grange	--	0.1	1.0	0.8	1.9	1.9	--	--	1.9	2.2	4.1	4.1													
La Porte	0.1	--	-0.3	0.1	-0.1	-0.1	--	--	-0.6	0.7	0.1	0.1													
Montgomery	--	--	2.2	-1.5	0.7	0.7	--	--	3.8	-8.6	-4.7	-4.7													
Porter	0.0	--	2.1	3.0	5.1	5.1	--	--	6.5	3.3	9.8	9.8													
PuStSt	--	--	4.3	1.1	5.4	5.4	--	--	3.8	2.6	6.4	6.4													
Total	0.0	0.1	27.3	45.4	72.8	72.8	11.4	--	75.8	121.9	209.0	209.0													
All counties																									
All table cells without observations in the inventory sample are indicated by —. Table value of 0.0 indicates the volume rounds to less than 0.1 million cubic or board feet. Columns and rows may not add to their totals due to rounding.							1.1	2.0	132.0	158.5	293.6	19.7	3.2	363.8	379.6	766.2									
AdHuWe = Adams, Huntington, and Wells Counties							CaTiWh = Carroll, Tippecanoe, and White Counties						DeHeRuWa = Decatur, Henry, Rush, and Wayne Counties												
BeFoWa = Benton, Fountain, and Warren Counties							EiNoWh = Elkhart, Noble, and Whitley Counties						HaHeJoMaSh = Hancock, Hendricks, Johnson, Marion, and Shelby Counties												
BiDeGrMa = Blackford, Delaware, Grant, and Madison Counties							JaLaNe = Jasper, Lake, and Newton Counties						PuStSt = Pulaski, St. Joseph, and Starke Counties												
BoClHaTi = Boone, Clinton, Hamilton, and Tipton Counties																									
CaHoMiWa = Cass, Howard, Miami, and Wabash Counties																									

Table 61. — Average annual removals of growing stock and sawtimber (International 1/4-inch rule) on timberland by Forest Survey Unit, county, and major species group, Indiana, 1998 to 1999-2003

Forest Survey Unit and county	Growing stock						Sawtimber					
	Major species group						Major species group					
	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species		Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	
(In million cubic feet)												
(In million board feet) ¹												
Lower Wabash												
Clay	--	--	--	--	--		--	--	--	--	--	--
Daviess, Knox	--	--	1.5	--	1.5		--	--	7.5	--	--	7.5
Gibson	--	--	--	2.7	2.7		--	--	--	13.1	--	13.1
Greene	--	--	0.1	0.8	1.0		--	--	--	4.2	--	4.2
Parke	--	--	0.2	3.1	3.3		--	--	--	13.5	--	13.5
Pike	--	--	0.1	1.8	1.9		--	--	--	4.5	--	4.5
Posey, Vanderburgh	--	--	2.8	--	2.8		--	--	14.6	--	--	14.6
Putnam	--	0.1	14.3	12.3	26.7		--	0.3	74.9	55.1	--	130.3
Vermillion	--	--	--	--	--		--	--	--	--	--	--
Vigo	--	--	0.0	1.5	1.5		--	--	--	7.1	--	7.1
Total	--	0.1	19.1	22.2	41.4		--	0.3	97.0	97.5	--	194.8
Knobs												
Clark, Scott	--	--	--	1.3	1.3		--	--	--	6.4	--	6.4
Crawford	--	--	0.0	5.2	5.2		--	--	--	25.5	--	25.5
Dubois	--	--	4.5	--	4.5		--	--	23.9	--	--	23.9
Floyd, Harrison	--	--	13.5	24.5	38.0		--	--	70.8	115.1	--	185.9
Jackson	--	--	5.1	--	5.1		--	--	22.0	--	--	22.0
Lawrence	--	--	1.4	3.1	4.5		--	--	7.0	15.0	--	21.9
Monroe	--	--	--	0.4	0.4		--	--	--	1.7	--	1.7
Orange	--	0.1	0.6	1.1	1.8		--	--	--	4.8	--	4.8
Owen	--	--	5.2	0.7	5.9		--	--	23.4	--	--	23.4
Perry	3.3	--	--	8.6	11.9		14.4	--	--	31.9	--	46.3
Washington	--	--	--	1.8	1.8		--	--	--	8.8	--	8.8
Total	3.3	0.1	30.1	46.8	80.3		14.4	--	147.1	209.2	--	370.7
Upland Flats												
Fayette, Union	--	--	0.0	20.7	20.7		--	--	--	102.4	--	102.4
Total	--	--	0.0	20.7	20.7		--	--	--	102.4	--	102.4

(Table 61 continued on next page)

(Table 61 continued)

Forest Survey Unit and county	Growing stock					Sawtimber				
	Major species group				All species	Major species group				
	Pine	Other softwoods	Soft hardwoods	Hard hardwoods		Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species
(In million cubic feet)										
(In million board feet) ¹										
Northern										
Batholomew	--	--	0.7	--	0.7	--	--	1.9	--	1.9
BeFoWa	--	--	--	4.1	4.1	--	--	--	18.4	18.4
BiDeGrMa	--	--	0.9	--	0.9	--	--	4.5	--	4.5
CaHoMiWa	--	--	0.4	--	0.4	--	--	--	--	--
De Kalb, Steuben	--	--	0.5	0.7	1.2	--	--	--	1.4	1.4
DeHeRuWa	--	--	0.3	3.5	3.8	--	--	--	13.7	13.7
EiNoWh	--	--	10.3	--	10.3	--	--	43.0	--	43.0
HaHeJoMaSh	--	--	1.8	0.7	2.5	--	--	7.9	--	7.9
La Grange	--	--	0.1	--	0.1	--	--	--	--	--
Montgomery	--	--	--	--	--	--	--	--	--	--
Porter	--	--	1.0	4.7	5.7	--	--	--	--	--
PuStSt	--	--	--	--	--	--	--	--	--	--
Total	--	--	15.9	13.8	29.7	--	--	57.4	33.6	91.0
All counties	3.3	0.2	65.1	103.5	172.1	14.4	0.3	301.5	442.7	758.8
All table cells without observations in the inventory sample are indicated by —. Table value of 0.0 indicates the volume rounds to less than 0.1 million cubic or board feet. Columns and rows may not add to their totals due to rounding.										
¹ International 1/4-inch rule.										
CaTiWh = Carroll, Tippecanoe, and White Counties DeHeRuWa = Decatur, Henry, Rush, and Wayne Counties EiNoWh = Elkhart, Noble, and Whitley Counties HaHeJoMaSh = Hancock, Hendricks, Johnson, Marion, and Shelby Counties JaLaNe = Jasper, Lake, and Newton Counties PuStSt = Pulaski, St. Joseph, and Starke Counties										

Table 61a. — Average annual removals of growing stock and sawtimber (Doyle rule) on timberland by Forest Survey Unit, county, and major species group, Indiana, 1998 to 1999-2003

Forest Survey Unit and county	Growing stock						Sawtimber					
	Major species group						Major species group					
	Pine	Other softwoods	hardwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	hardwoods	Soft hardwoods	Hard hardwoods	All species
(In million cubic feet)												
(In million board feet) ¹												
Lower Wabash												
Clay	--	--	--	--	--	--	--	--	--	--	--	--
Daviess, Knox	--	--	1.5	--	--	1.5	--	--	4.4	--	--	4.4
Gibson	--	--	--	2.7	2.7	2.7	--	--	--	--	7.5	7.5
Greene	--	--	0.1	0.8	0.8	1.0	--	--	--	--	2.5	2.5
Parke	--	--	0.2	3.1	3.1	3.3	--	--	--	--	12.0	12.0
Pike	--	--	0.1	1.8	1.8	1.9	--	--	--	--	2.4	2.4
Posey, Vanderburgh	--	--	2.8	--	--	2.8	--	--	8.6	--	--	8.6
Putnam	--	0.1	14.3	12.3	12.3	26.7	--	0.1	45.4	48.3	--	93.8
Vermillion	--	--	--	--	--	--	--	--	--	--	--	--
Vigo	--	--	0.0	1.5	1.5	1.5	--	--	--	--	5.1	5.1
Total	--	0.1	19.1	22.2	22.2	41.4	--	0.1	58.4	77.8	--	136.3
Knobs												
Clark, Scott	--	--	--	1.3	1.3	1.3	--	--	--	3.3	--	3.3
Crawford	--	--	0.0	5.2	5.2	5.2	--	--	--	16.8	--	16.8
Dubois	--	--	4.5	--	--	4.5	--	--	15.9	--	--	15.9
Floyd, Harrison	--	--	13.5	24.5	24.5	38.0	--	--	54.9	79.3	--	134.1
Jackson	--	--	5.1	--	--	5.1	--	--	15.6	--	--	15.6
Lawrence	--	--	1.4	3.1	3.1	4.5	--	--	4.2	10.8	--	15.0
Monroe	--	--	--	0.4	0.4	0.4	--	--	--	1.2	--	1.2
Orange	--	0.1	0.6	1.1	1.1	1.8	--	--	--	3.7	--	3.7
Owen	--	--	5.2	0.7	0.7	5.9	--	--	13.8	--	--	13.8
Perry	3.3	--	--	8.6	8.6	11.9	6.1	--	--	20.2	--	26.3
Washington	--	--	--	1.8	1.8	1.8	--	--	--	5.3	--	5.3
Total	3.3	0.1	30.1	46.8	46.8	80.3	6.1	--	104.3	140.7	--	251.1
Upland Flats												
Fayette, Union	--	--	0.0	20.7	20.7	20.7	--	--	--	89.7	--	89.7
Total	--	--	0.0	20.7	20.7	20.7	--	--	--	89.7	--	89.7
(Table 61a continued on next page)												

(Table 61a continued on next page)

(Table 61a continued)

Forest Survey Unit and county	Growing stock						Sawtimber											
	Major species group					All species	Major species group											
	Pine	Other softwoods	hardwoods	Soft hardwoods	Hard hardwoods		Pine	Other softwoods	hardwoods	Soft hardwoods	Hard hardwoods	All species						
(In million cubic feet)													(In million board feet) ¹					
Northern																		
Batholomew	--	--	0.7	--	--	0.7	--	--	0.8	--	--	0.8						
BeFoWa	--	--	--	4.1	--	4.1	--	--	--	--	13.5	13.5						
BiDeGrMa	--	--	0.9	--	--	0.9	--	--	2.6	--	--	2.6						
CaHoMiWa	--	--	0.4	--	--	0.4	--	--	--	--	--	--						
De Kalb, Steuben	--	--	0.5	0.7	--	1.2	--	--	--	--	0.7	0.7						
DeHeRuWa	--	--	0.3	3.5	--	3.8	--	--	--	--	8.3	8.3						
EINoWh	--	--	10.3	--	--	10.3	--	--	33.8	--	--	33.8						
HaHeJoMaSh	--	--	1.8	0.7	--	2.5	--	--	4.7	--	--	4.7						
La Grange	--	--	0.1	--	--	0.1	--	--	--	--	--	--						
Montgomery	--	--	--	--	--	--	--	--	--	--	--	--						
Porter	--	--	1.0	4.7	--	5.7	--	--	--	--	--	--						
PuStSt	--	--	--	--	--	--	--	--	--	--	--	--						
Total	--	--	15.9	13.8	--	29.7	--	--	41.9	--	22.5	64.4						
All counties	3.3	0.2	65.1	103.5	--	172.1	6.1	0.1	204.6	--	330.6	541.3						
All table cells without observations in the inventory sample are indicated by —. Table value of 0.0 indicates the volume rounds to less (Table 61a continued on next page) than 0.1 million cubic or board feet. Columns and rows may not add to their totals due to rounding.																		
Doyle rule.																		
AdHuWe = Adams, Huntington, and Wells Counties						CaTiWh = Carroll, Tippecanoe, and White Counties												
BeFoWa = Benton, Fountain, and Warren Counties						DeHeRuWa = Decatur, Henry, Rush, and Wayne Counties												
BiDeGrMa = Blackford, Delaware, Grant, and Madison Counties						EINoWh = Elkhart, Noble, and Whitley Counties												
BoCiHaTi = Boone, Clinton, Hamilton, and Tipton Counties						HaHeJoMaSh = Hancock, Hendricks, Johnson, Marion, and Shelby Counties												
CaHoMiWa = Cass, Howard, Miami, and Wabash Counties						JaLaNe = Jasper, Lake, and Newton Counties												
						PuStSt = Pulaski, St. Joseph, and Starke Counties												

Table 65. — Sampling errors by Forest Survey Unit and county for area of timberland, volume, average annual net growth, average annual removals, and average annual mortality on timberland, Indiana, 1999-2003

(Sampling error in percent)

Forest Survey Unit and county	Forest area	Timberland area	Growing stock				Sawtimber			
			Volume	Average annual net growth	Average annual removals	Average annual mortality	Volume	Average annual net growth	Average annual removals	Average annual mortality
Lower Wabash										
Clay	27.58	27.58	29.38	94.00	--	100.00	30.71	100.00	--	100.00
Daviess, Knox	33.77	33.77	38.36	69.47	100.00	100.00	38.89	66.95	100.00	100.00
Gibson	29.22	29.22	33.18	60.87	100.00	93.21	34.07	62.31	100.00	--
Greene	20.04	20.04	25.85	43.18	100.00	71.54	28.78	43.48	100.00	100.00
Martin	15.84	15.84	18.07	74.92	--	73.89	19.08	74.07	--	--
Parke	21.55	21.88	25.59	89.34	100.00	100.00	26.85	97.53	100.00	100.00
Pike	25.24	25.24	29.51	55.22	100.00	60.20	32.13	65.89	100.00	78.91
Posey, Vanderburgh	37.00	38.90	43.86	100.00	100.00	100.00	46.34	100.00	100.00	--
Putnam	25.19	25.19	28.88	47.90	70.11	86.82	32.22	45.34	70.92	99.77
Sullivan	30.09	30.09	33.77	98.54	--	77.72	36.88	94.85	--	79.40
Vermillion	45.27	45.27	49.21	73.91	--	78.36	51.16	83.75	--	--
Vigo	34.41	34.41	43.85	59.68	100.00	100.00	48.70	65.67	100.00	100.00
Total	4.54	4.59	6.55	21.32	42.65	32.93	7.47	22.95	44.42	44.42
Knobs										
Brown	17.36	19.53	20.94	59.50	--	57.90	21.63	55.78	--	62.63
Clark, Scott	22.55	22.55	25.88	52.45	89.71	100.00	26.82	55.29	89.71	--
Crawford	20.21	20.21	20.98	100.00	87.00	77.92	21.87	100.00	87.36	81.95
Dubois	26.78	26.78	27.80	72.43	89.71	68.57	29.52	82.92	89.71	--
Floyd, Harrison	16.45	16.45	18.26	74.17	61.78	100.00	19.07	74.86	63.68	100.00
Jackson	21.54	22.04	25.90	100.00	100.00	54.89	27.38	100.00	100.00	67.91
Lawrence	20.44	20.83	25.30	46.36	100.00	100.00	27.69	47.18	100.00	100.00
Monroe	19.03	19.58	24.21	52.59	100.00	76.20	27.78	57.97	100.00	100.00
Morgan	22.04	22.04	25.79	61.07	--	100.00	27.16	47.82	--	100.00
Orange	20.46	20.46	23.28	37.35	100.00	60.51	25.12	38.43	100.00	--
Owen	19.41	19.41	21.12	45.60	100.00	69.62	21.83	43.83	100.00	99.57
Perry	18.13	18.13	20.77	49.57	51.02	77.88	23.01	55.17	53.05	99.28
Spencer	29.24	29.24	35.59	72.48	--	100.00	38.01	67.24	--	--
Warrick	26.71	26.71	28.71	51.67	--	89.71	29.39	49.90	--	89.71
Washington	19.38	19.38	22.39	53.56	85.93	81.36	23.43	49.42	84.49	89.71
Total	2.27	2.48	3.87	17.82	29.52	26.20	4.55	16.59	31.09	31.09

(Table 65 continued on next page)

(Table 65 continued)

Forest Survey Unit and county			Forest area	Timberland area	Growing stock				Sawtimber			
					Volume	Average annual net growth	Average annual removals	Average annual mortality	Volume	Average annual net growth	Average annual removals	Average annual mortality
Upland Flats												
Dearborn	21.56	21.56	25.69	52.64	--	68.75	28.76	51.37	--	--		
Fayette, Union	31.11	31.11	35.48	67.40	91.79	--	35.60	67.31	91.97	--		
Franklin	25.20	26.01	28.84	50.87	--	70.93	31.16	49.86	--	--		
Jefferson	21.45	22.19	28.47	100.00	--	91.97	33.51	100.00	--	--		
Jennings	19.98	19.98	25.62	53.02	--	100.00	28.41	75.99	--	--		
Ohio, Switzerland	22.11	22.11	24.25	56.15	--	56.00	28.02	52.60	--	--		
Ripley	22.60	25.26	27.45	39.07	--	82.28	28.09	36.19	--	91.97		
Total	3.91	4.39	7.33	24.32	91.79	34.27	9.07	27.58	91.97	91.97		
Northern												
AdHuWe	25.54	26.20	29.59	72.11	--	58.65	32.43	72.27	--	86.73		
Allen	27.59	27.59	29.94	96.76	--	82.80	31.14	90.56	--	--		
Batholomew	31.79	31.79	33.03	64.80	100.00	--	33.71	66.48	100.00	--		
BeFoWa	29.06	29.06	33.79	100.00	100.00	76.99	36.55	100.00	100.00	100.00		
BiDeGrMa	26.05	26.05	27.26	50.08	100.00	100.00	30.36	52.18	100.00	--		
BoClHaTi	38.62	40.23	50.14	100.00	--	86.73	55.01	100.00	--	--		
CaHoMiWa	20.11	20.11	22.56	100.00	100.00	53.48	25.09	79.89	--	77.67		
CaTiWh	22.82	24.07	30.19	100.00	--	64.46	32.56	100.00	--	100.00		
De Kalb, Steuben	35.92	38.56	47.30	100.00	100.00	100.00	47.75	100.00	100.00	--		
DeHeRuWa	22.63	22.63	31.16	57.41	100.00	66.01	32.95	55.74	100.00	70.89		
EINoWh	21.53	21.80	26.29	54.35	87.23	94.51	27.52	56.91	87.23	100.00		
Fulton, Marshall	39.51	39.51	45.77	100.00	--	100.00	48.56	100.00	--	100.00		
HaHeJoMaSh	21.45	21.45	28.85	44.07	100.00	100.00	31.89	44.70	100.00	--		
JaLaNe	30.75	30.75	32.72	100.00	--	92.62	37.12	100.00	--	--		
Jay, Randolph	44.84	44.84	50.41	100.00	--	100.00	51.44	100.00	--	100.00		
Kosciusko	35.47	35.47	41.38	100.00	--	100.00	44.70	100.00	--	100.00		
La Grange	38.32	38.32	47.79	100.00	100.00	72.76	54.38	100.00	--	100.00		
La Porte	33.97	33.97	48.26	100.00	--	100.00	50.31	100.00	--	100.00		
Montgomery	36.43	37.92	42.67	100.00	--	51.18	46.52	100.00	--	51.72		
Porter	32.78	36.47	42.90	62.27	100.00	100.00	50.60	69.85	--	--		
PuStSt	24.16	25.52	30.42	73.90	--	72.61	33.83	92.30	--	82.44		
Total	3.96	4.15	5.93	32.15	43.31	20.95	6.77	33.19	50.08	50.08		
All counties			1.72	1.82	2.72	12.15	20.87	14.42	3.17	12.33	20.34	

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