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Michigan's Forest Resources in 2004

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Michigan's Forest Resources In 2004

ABSTRACT

The 2000-2004 annual forest inventory of Michigan has been completed. Summary resource tables can be generated through the Forest Inventory Mapmaker Web site at <http://www.fia.fs.fed.us>. Estimates from this inventory show a total of 19.3 million acres of forest land in Michigan. The estimate of total net volume of all live trees on forest land is 30.2 billion cubic feet. Timberland area totals 18.7 million acres, and net growing-stock volume on timberland is 27.3 billion cubic feet. All live aboveground tree biomass on timberland is estimated at 780 million dry tons. Between 1993 and 2004, the average annual net growth of growing stock on timberland was 923 million cubic feet per year. Average annual removals of growing stock totaled 291 million cubic feet per year, and mortality was 225 million cubic feet per year. Although these 2004 estimates generally show a healthy, growing forest, the presence of recently introduced exotic organisms is a serious health threat to Michigan's forest ecosystems.

In 2000, North Central Research Station's Forest Inventory and Analysis (NCFIA) program began fieldwork in Michigan using the national annual forest inventory system. This inventory has been conducted in partnership with the Michigan Department of Natural Resources. The field plot measurements for this inventory were completed in January of 2005 and the resulting data can be accessed at <http://www.fia.fs.fed.us>.

This inventory initiated the new NCFIA annual inventory system in which one-fifth of the field plots (considered one panel) in the State are measured each year. A complete inventory consists of measuring and compiling the data for all plots (or five panels). All panels have now been measured. Plans are to remeasure one panel every year on a 5-year cycle. For example, in Michigan, the field plots measured in 2000

will be remeasured in 2005 and the plots measured in 2001 will be remeasured in 2006.

The 2000-2004 inventory is the sixth inventory of Michigan's forest resources conducted by the Forest Service. Reports of previous inventories of Michigan are dated 1935, 1955, 1966, 1980, and 1993. Data presented in this report represent all of the field plots (or five panels) and are a combination of the first year's panel from 2000, the second year's panel from 2001, the third year's panel from 2002, the fourth year's panel from 2003, and the fifth year's panel from 2004. Earlier reports for the 2000 panel (Leatherberry 2002), the combined 2000 and 2001 panels (Leatherberry and Brand 2003), and the combined 2000-2003 panels (Leatherberry *et al.* 2005) have also been published. No report was published from the 2000-2002 panels. The results presented in this report are estimates based on sampling techniques presented by Bechtold and Patterson (2005). These estimates were compiled assuming the 2000, 2001, 2002, 2003, and 2004 data represent one sample.

Data from new inventories are often compared with data from earlier inventories to determine trends in forest resources. However, for the comparison 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 inventory of Michigan in 1993 (Leatherberry and Spencer 1996, Schmidt *et al.* 1997). Although these changes will have little impact on statewide estimates of forest area, timber volume, and tree biomass, they may significantly impact condition classification variables such as forest type and stand-size class. For growth, removals, and mortality estimates, the 1993 tree measurements were linked to trees measured in the 2000-2004 inventory to obtain estimates of average change

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over the period between the two inventories. Changes in inventory procedures may limit comparison of inventory estimates among separate inventories in this report. Only comparisons that are appropriate and not impacted by changes in procedures are discussed in this report. More in-depth analysis is being conducted and results will be published in other reports. All the tables in this report and many others can be generated at our Web site (<http://www.fia.fs.fed.us>).

RESULTS

Area

There are 36.4 million acres of land in Michigan. Forest land totals 19.3 million acres, or about 53 percent, of the State's total land area (table 1). On Michigan's forest land there are a wide variety of tree species. The tree species forming a plurality of composition within a given area is designated the forest type (e.g., maple/beech/birch). Table 1 displays the various forest type groups and "local" forest types present in Michigan.

Forest land has three components:

- 1) Timberland¹—forest land that is not restricted from harvesting by statute, administrative regulation, or designation and is capable of growing trees at a rate of 20 cubic feet per acre per year

2) Reserved forest land—land that is restricted from harvesting by statute, administrative regulation, or designation. (e.g., state parks, national parks and lakeshores, and Federal wilderness areas)

3) Other forest land—land that is not capable of growing trees at a rate of 20 cubic feet per acre per year and not restricted from harvesting.

Timberland area in Michigan totals 18.7 million acres, accounting for 97 percent of forest land area in Michigan (table 2). Since the first statewide inventory in 1935, timberland area has hovered around 19 million acres (fig. 1). The general stability in timberland area for most of the 20th century can be attributed to forest management activities dedicated to reforestation. For example, between 1933 and the start of World War II, the Civilian Conservation Corps (CCC) planted about 500 million trees in Michigan. Also, the significant amount of public ownership—38 percent of forest is publicly owned—helps maintain a stable base of timberland area. However, between 1966 and 1980, the area of timberland in Michigan declined to a historical low of 17.5 million acres. Much of the

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

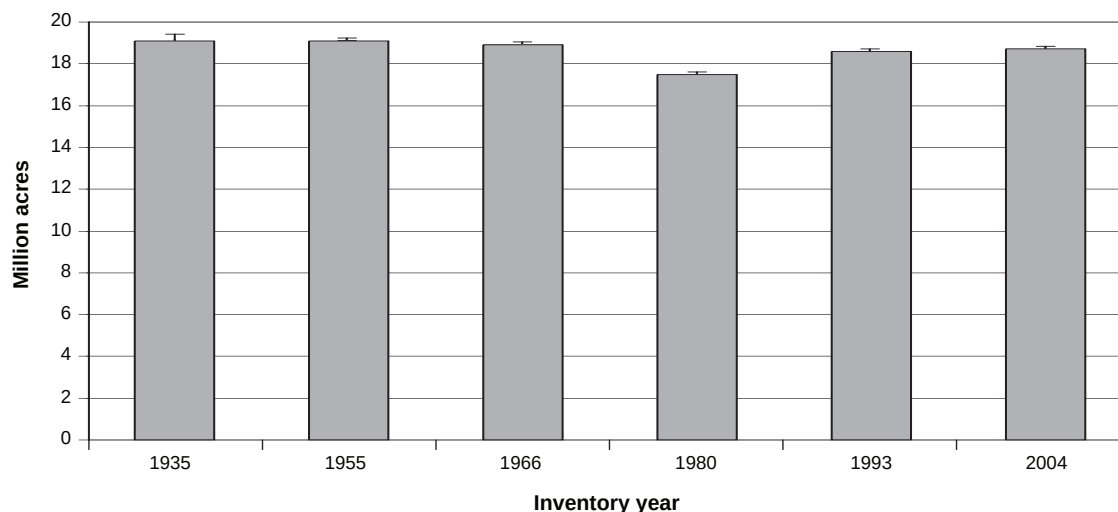


Figure 1.—Area of timberland in Michigan, 1935-2004. The vertical line at the top of each bar represents the sample error associated with each inventory.

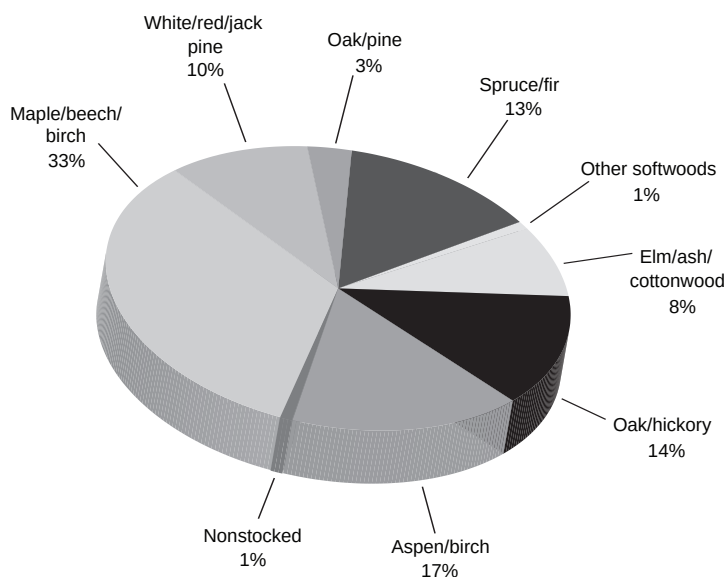
decline in timberland area was related to increased tillage and the pasturing of livestock on marginal timberland. During the 1980s and early 1990s, the area of timberland rebounded to about 18.3 million acres. The increase came predominantly from abandoned croplands and pasture and from marginal forest lands that were productive enough to be reclassified as timberland (Schmidt *et al.* 1997). Between 1993 and 2004, Michigan's timberland area is estimated to have increased by about 300 thousand acres to 18.7 million acres (fig. 1). Although not a substantial increase, it is noteworthy nonetheless considering that suburban development and the construction of homes in rural areas continues. Also, resort communities or enclaves, including golf courses, continue to expand into timberland areas. Timberland that converted to other land uses has apparently been supplanted by land, some of it agricultural land, that reverted back to forest.

In Michigan, private owners hold 63 percent of the timberland area (table 2). Private owners hold timberland for a variety of reasons. Among private owners, family forest owners predominate, and recreation and esthetic enjoyment are important reasons for owning timberland in Michigan (Leatherberry *et al.* 1998). Although family forest landowners predominate, corporations hold considerable timberland in Michigan. Timberland owned by family and corporate owners, as well as public timberland, provides recreation opportunities, timber products, wildlife habitat, watershed protection, and other environmental benefits. The conservation and restoration of the pine resource in Michigan is an example of how timberland owners in Michigan provide environmental benefits. Before the period of extensive logging in the late 1800s and early 1900s, pines were an important component of the State's forests. But logging largely decimated the pine resource. However, some pockets where pines survived logging were placed in public ownership. Places such as Hartwick Pines State Park and Estivant Pines contain remnant old

growth pine forests. Extensive pine restoration programs were carried out on private and public land in the 1930s and again in the 1950s to early 1960s. A little more than a fifth of the timberland area in the softwood type groups was planted, and more than half of that was planted on publicly owned land (table 2). The restoration of the pine resource in Michigan ensures a level of biological diversity that may not exist otherwise.

Hardwood forests occupy 75 percent of the State's timberland area. The maple/beech/birch forest type group is the most extensive forest type group in Michigan, occupying one-third of the State's timberland area (table 3, fig. 2). The aspen/birch forest type group occurs on 17 percent of timberland area followed by the oak/hickory group at 14 percent and the elm/ash/cottonwood group at 8 percent of Michigan's timberland area. The most extensive hardwood forest types are the sugar maple/beech/yellow birch type (4.1 million acres), the aspen type (2.6 million acres), the hard maple/basswood type (1.2 million acres), and the white oak/red oak/hickory type (1.1 million acres).

Figure 2.—Area of timberland by forest type group, Michigan, 2004.



Among softwoods, the white pine/red pine/jack pine forest type group (1.9 million acres) and the spruce/fir group (2.5 million acres) cover almost one-fourth of the timberland area, accounting for virtually all the area in the softwood forest type groups. The most extensive softwood forest type is northern white-cedar (1.3 million acres).

Forest stands are affected by natural and human-caused events that often result in changes in stand-size characteristics of the forest. Stand-size class is a measure of the average diameter of the dominant trees in a stand. There are three stand-size classes: sawtimber, poletimber, and sapling-seedling. The area classified as sawtimber—stands with a plurality of stocking in trees more than 11.0 inches in diameter at breast height (d.b.h., 4.5 feet above ground level) for deciduous species and 9.0 inches d.b.h. for conifers—accounts for 40 percent (7.5 million acres) of the timberland area. Poletimber stands also account for 40 percent (7.5 million acres). Nineteen percent of the timberland area (3.6 million acres) is sapling-seedling stands and less than 1 percent (147 thousand acres) is classified as nonstocked (fig. 3).

Volume

The total net volume of all live trees on forest land in Michigan is 30.2 billion cubic feet, which equates to 1,566 cubic feet per acre of forest land (table 4). About 6 of every 10 cubic feet of live volume are on privately owned forest land. Slightly more than two-thirds (20.8 billion cubic feet) of net volume of all live trees is contained in hardwoods, with 15 percent of total volume in sugar maple trees and 12 percent in red maple. In softwoods, northern white-cedar accounts for 8 percent of net volume of all live trees on forest land in Michigan. The net volume of a tree is the volume of wood in the main bole from a point one foot above ground level to the point where the bole reaches a 4-inch diameter outside bark with deductions made for rot, poor form, or defect. Trees 5 inches d.b.h and larger are not included in the estimates of net volume.

Growing-stock volume on timberland is a measure that has traditionally been used to ascertain wood volume useful for commercial purposes. This volume excludes rough, rotten, and dead trees, trees of noncommercial tree species, and all trees on reserved and unproductive forest lands. Michigan's growing-stock volume on timberland totals 27.3 billion cubic feet, representing 90

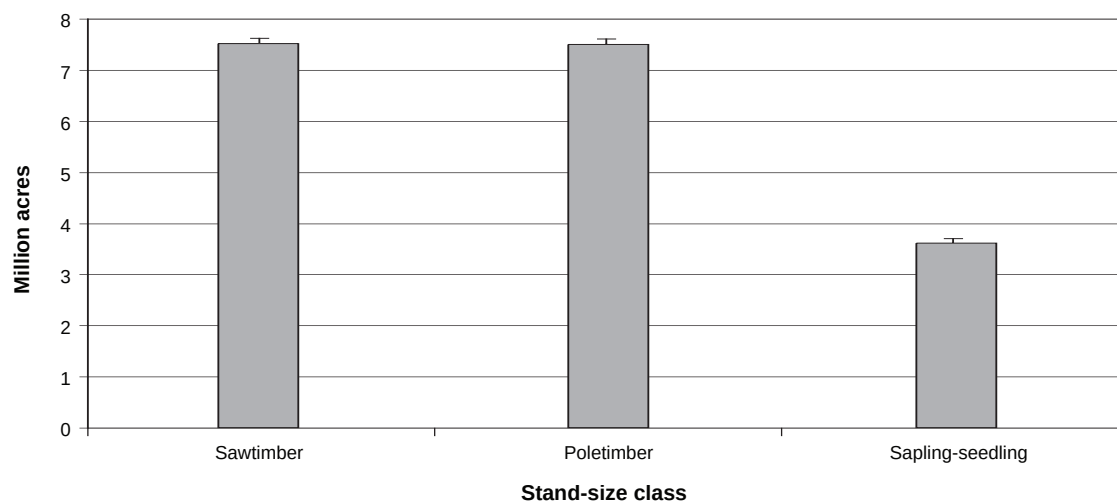


Figure 3.—*Timberland area by stand-size class in Michigan, 2004. The vertical line at the top of each bar represents the sample error associated with each estimate.*

percent of the total live volume on all forest land (table 5). Six percent of the volume of all live trees on timberland is in live cull trees—2.0 billion cubic feet. Cull trees are sometimes used for commercial purposes. For instance, rough trees may be used for making pallets or pulp chips. Dead trees have less commercial value and in many cases are only harvested for firewood. Salvable dead trees contain 785 million cubic feet of wood volume. These standing dead trees are important for wildlife species such as cavity nesting birds and mammals that require den sites.

The total growing-stock volume on timberland has increased in every inventory since 1955 although the 2004 inventory shows only a small increase over 1993. Over most of the second half of the 20th century, total growing-stock volume in Michigan increased by 2 to 3 percent per year; however, since 1993 the rate of increase has been about 0.22 percent per year. Sixty-eight percent of total growing-stock volume is in hardwood

species (table 6). In 2004, hardwood growing-stock volume stood at just less than 19 billion cubic feet (fig. 4). Unlike previous inventories, which showed a steady increase in hardwood growing-stock volume, a small decrease in hardwood growing-stock volume (0.23 percent per year) was observed between the 1993 and 2004 inventories. Softwood growing-stock volume continues to steadily increase, with a 1.4 percent per year increase observed since the previous inventory in 1993.

Sugar maple (4.1 billion cubic feet) and red maple (3.3 billion cubic feet) account for the largest part of the hardwood growing-stock volume at 40 percent of total hardwood growing-stock volume. Other hardwood species with significant growing-stock volume are quaking aspen—1.5 billion cubic feet, northern red oak—1.4 billion cubic feet, and bigtooth aspen—1.2 billion cubic feet (table 7, fig. 5).

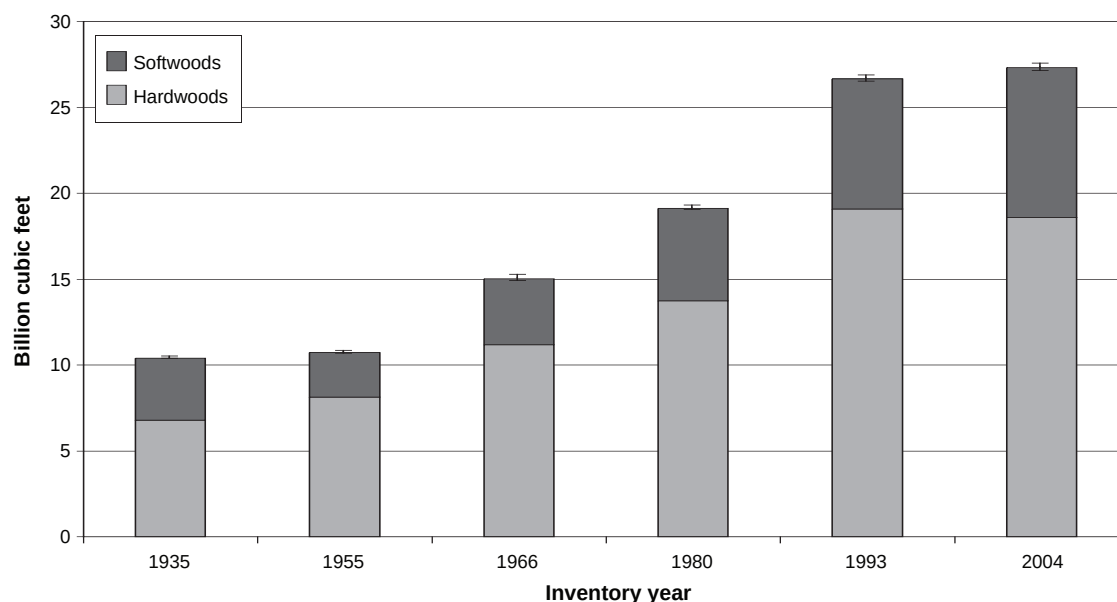


Figure 4.—Growing-stock volume on timberland, Michigan, 1935-2004. The vertical line at the top of each bar represents the sample error associated with each inventory.

Softwood species accounted for 32 percent (8.7 billion cubic feet) of the total growing-stock volume on timberland in 2004, up from the 28 percent in the 1993 inventory. Slightly more than one-fourth of all softwood growing-stock volume is in northern white-cedar trees. Red pine and eastern white pine combined, account for a little more than one-third of softwood volume (table 7).

Sawtimber volume, a subset of growing-stock volume, is the volume of the saw log portion of live growing-stock trees measured in board feet. In all FIA reports and other Forest Service publications, sawtimber volumes are based on the International 1/4-inch rule (Avery and Burkhart 1994) and excludes the small diameter trees (hardwoods less than 11 inches d.b.h. and softwoods less than 9 inches d.b.h.) and the upper portion of large trees that are generally not utilized for lumber. Sawtimber volume in Michigan totals 78.9 billion board feet (table 8). Nearly two-thirds of sawtimber volume is in hardwood trees. Of total hardwood sawtimber volume, 65 percent is in trees with diameters less than 17 inches. About 20 percent of hardwood sawtimber volume is in sugar maples, 15 percent in red maples, and 13 percent in bigtooth and quaking aspen combined. Twenty-five percent of the 29.3 billion board feet of softwood sawtimber volume is in red pines, and 19 percent is in eastern white pines.

Biomass

The aboveground biomass in all live trees in Michigan's timberland was estimated to be 770 million dry tons in 2004 (an average of 41 dry tons per acre of timberland). This estimate includes the wood and bark (not the foliage) of growing-stock trees, non-growing-stock trees, and all live 1- to 5-inch trees (table 9). Eighty-two percent of the tree biomass is in growing-stock trees, with an additional 8 percent in non-growing-stock trees, and the remaining 10 percent in trees less than 5 inches d.b.h. Seventy-seven percent (591 million dry tons) of

all live aboveground tree biomass is in hardwood species. Biomass estimates are increasing in importance for analyses related to carbon sequestration, wood fiber availability for fuel, and assessment of fuel loads in forest stands.

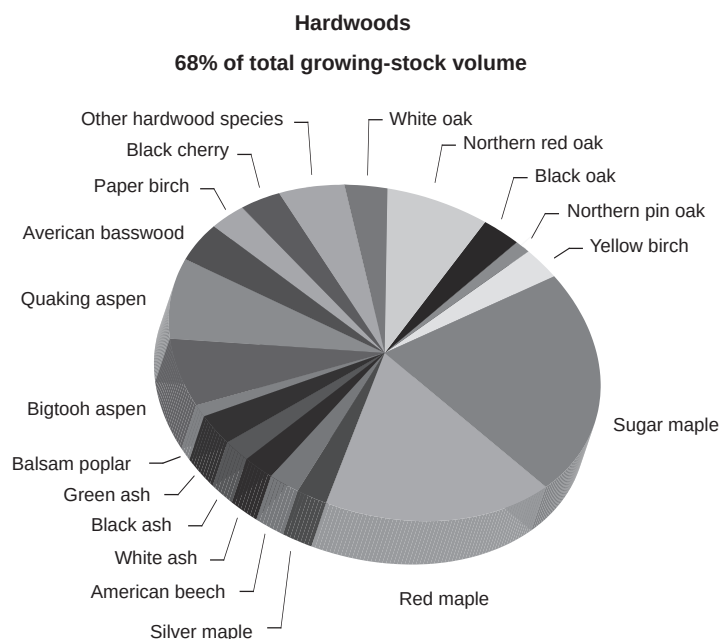
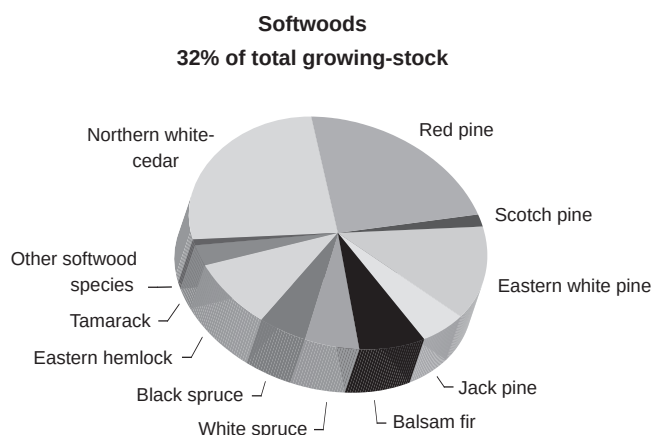


Figure 5.—Species composition of the hardwood and softwood growing-stock volume on timberland, Michigan, 2004.



Growth, Removals, and Mortality

The volume of growing-stock trees on Michigan's timberland grew at an average rate of 923 million cubic feet per year between 1993 and 2000-2004 (table 10). Hardwood growth accounted for slightly more than two-thirds (68 percent) of the total average annual growth of growing stock. Softwood growth was 296 million cubic feet per year. The three maple species (sugar, red, and silver) accounted for nearly 30 percent of the average annual net growth of growing stock on timberland between 1993 and 2000-2004. Private timberland accounted for 67 percent of total average annual growth.

Average annual removals of growing stock on timberland totaled 291 million cubic feet per year (table 11). From 1993 to 2000-2004, total average annual removals of growing-stock were 32 percent of net annual growth. Hardwood removals were 203 million cubic feet per year. Softwood removals were 87 million cubic feet per year, or about 30 percent of the total. The cottonwood and aspen group (nearly 100 percent aspen) had the highest average annual removals at 67 million cubic feet per year followed by hard maple at 36 million cubic feet, soft maple at 28 million cubic feet, and eastern white and red pine at 29 million cubic feet. Removals from private ownerships totaled 196 million cubic feet per year, accounting for 67 percent of annual removals. Although removals from public timberland account for one-third of the average annual removals, in the case of both eastern white and red pine, and jack pine, average annual removals were greater on public land than private land. Much of this pine volume is from pine plantations established on public land during the early to mid-20th century.

Average annual mortality of growing stock on timberland from 1993 to 2000-2004 was 225 million cubic feet per year (table 12), approximately one-quarter the average annual net growth rate over the same period. Sixty-nine percent of the total, or 155 million cubic

feet per year, was among hardwoods. From 1993 to 2000-2004, total average annual mortality of growing stock were 24 percent of net annual growth. Average annual mortality of growing stock on private timberland was 59 percent of total average annual mortality. Across all species groups, the cottonwood and aspen group experienced the most mortality at 63.4 million cubic feet per year, or 28 percent of total mortality. The amount of mortality in the cottonwood and aspen species group is related to the maturing of aspen stands. Mortality was high in the species group "other eastern soft hardwoods" that contains elm species, and this mortality is probably the result of Dutch elm disease expanding throughout the State. The forest health discussion below provides more information about the causes of tree mortality in Michigan.

Forest Health

Michigan faces several major forest health concerns. The introduction of exotic organisms is a serious health threat to the State's native forest ecosystems. The information presented about pathogens and insects affecting Michigan's forests was obtained from the national Forest Health Monitoring (FHM) program at: http://fhm.fs.fed.us/fhh/fhh-04/mi/mi_04.pdf (Michigan Department of Natural Resources 2004). Several special issues were identified in 2004 and some are highlighted below. For more information about forest health in Michigan, contact the Michigan Department of Natural Resources.

Emerald ash borer

The introduction of the emerald ash borer or EAB, native to China, Korea, Japan, and Far East Russia, is threatening Michigan's ash resource. The EAB probably found its way to Michigan in wooden crating or other shipping material and has killed or infected millions of trees in the Lower Peninsula. State and Federal agencies are fighting this threat to the ash resource of the

Figure 6.—
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(EAB), 2004

Entire area under quarantine
Counties that contain eradication sites with quarantined townships

Evidence suggests that the insect has been active in Michigan since at least 1997. All varieties of ash trees appear susceptible, including white ash, green ash, and black ash, as well as several horticultural varieties. Because of the EAB infestation, we expect future inventories to reveal continuing declines in the total ash resource.

Beech bark disease is a serious threat to 6.5 million acres of maple/beech/birch forest land in Michigan. The interaction of an exotic scale insect (*Cryptococcus fagisuga*) and a native and exotic canker-causing fungus (*Nectria* sp.) causes beech bark disease. Once infected by the fungus, trees usually decline and trunks may break at canker sites.

8

Eastern larch beetle

Eastern larch beetle populations in the eastern and south central Upper Peninsula declined in 2004. This bark beetle has killed tamarack in stands ranging in size from a cluster of a few trees to stands of 100 acres. Because many infested trees enter the fall with apparently healthy crowns, mortality is often overlooked until trees fail to leaf out the following spring. Upon closer inspection, these “green” trees are completely girdled with beetle galleries. Both native tamarack and exotic larch species are susceptible to this beetle. Apparently healthy trees can be attacked and killed by the bark beetle. However, many infestations are associated with stressed trees. Stresses from the drought of 2000-2001 and repeated defoliation by the larch casebearer are likely predisposing factors contributing to the current epidemic. The larch casebearer is an exotic insect introduced to the Lake States in the early 1900s. It derives its

name from the “case” it constructs from a mined-out needle. Defoliation for two or more consecutive years can cause tree decline and mortality. Populations generally collapse after a single year of damage thanks to two parasites imported from Europe

Gypsy moth

Gypsy moth populations continue an upward trend statewide. This follows a long period of population decline that began in the early 1990s and culminated in 2001 when, for the first time in over a decade, aerial surveys detected no defoliation in the State. Since then, egg mass numbers have been increasing steadily and defoliation has been locally heavy in some northern Lower Peninsula and western Upper Peninsula counties. A total of 45 thousand acres were defoliated statewide in 2004, up from 38 thousand acres in 2003 (fig. 7).

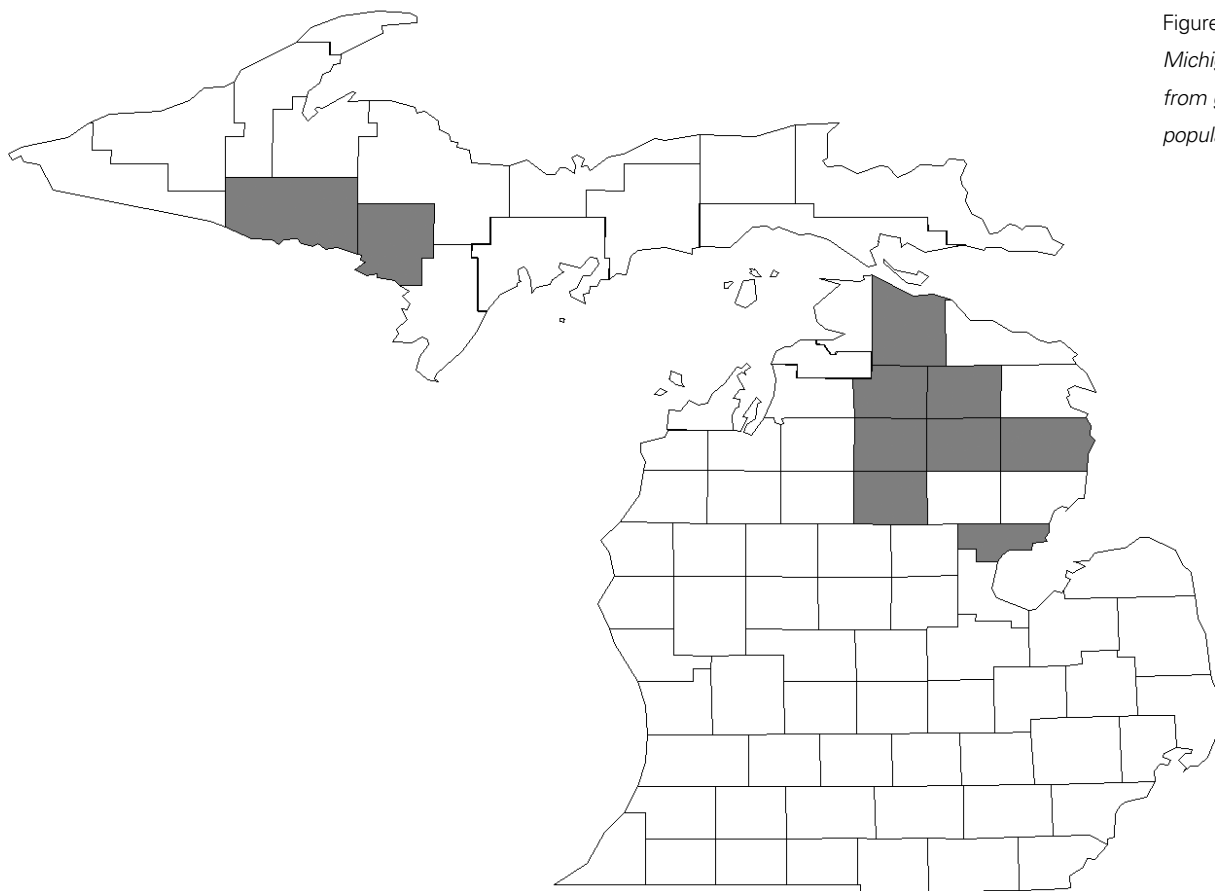


Figure 7.—Counties in Michigan with defoliation from gypsy moth populations, 2004.

Oak wilt

Incidence of the vascular disease oak wilt continues to increase (fig. 8). To slow the overland spread of oak wilt, harvesting restrictions are being exercised on State land. Forest stands with oak trees are not being cut between April 15 and July 15 in areas where the risk of oak wilt is high. These dates mark the period when the sap-feeding beetles responsible for spreading oak wilt are most active. These small (1/4-inch long) beetles are attracted to fresh tree wounds and transmit spores to oak trees that have been damaged during logging operations.

Jack pine budworm

The jack pine budworm is considered the most significant pest of jack pine. Stands older than 45 years that are growing on very sandy sites and suffering from drought or other stresses are very vulnerable to damage. Harvesting and other management activities can help to avoid

budworm-caused tree mortality while providing suitable conditions for jack pine regeneration. A buildup of jack pine budworm populations began in the eastern Upper Peninsula in 2000 and had spread to most jack pine areas of the Upper Peninsula by 2004. In 2004, more than 140 thousand acres of jack pine were moderately to heavily defoliated. Heavily defoliated areas in the central Upper Peninsula included young plantations with 30-80 percent reduction in total foliage. Most of these younger trees have viable buds on terminal branches, giving hope for survival in 2005.

In the Lower Peninsula, jack pine budworm numbers declined slightly in 2004 following an upswing that began in 2001. About 172 thousand acres were defoliated, down from 196 thousand acres in 2003. Stands that were defoliated previously and show that signs of heavy population buildup are at risk of mortality.

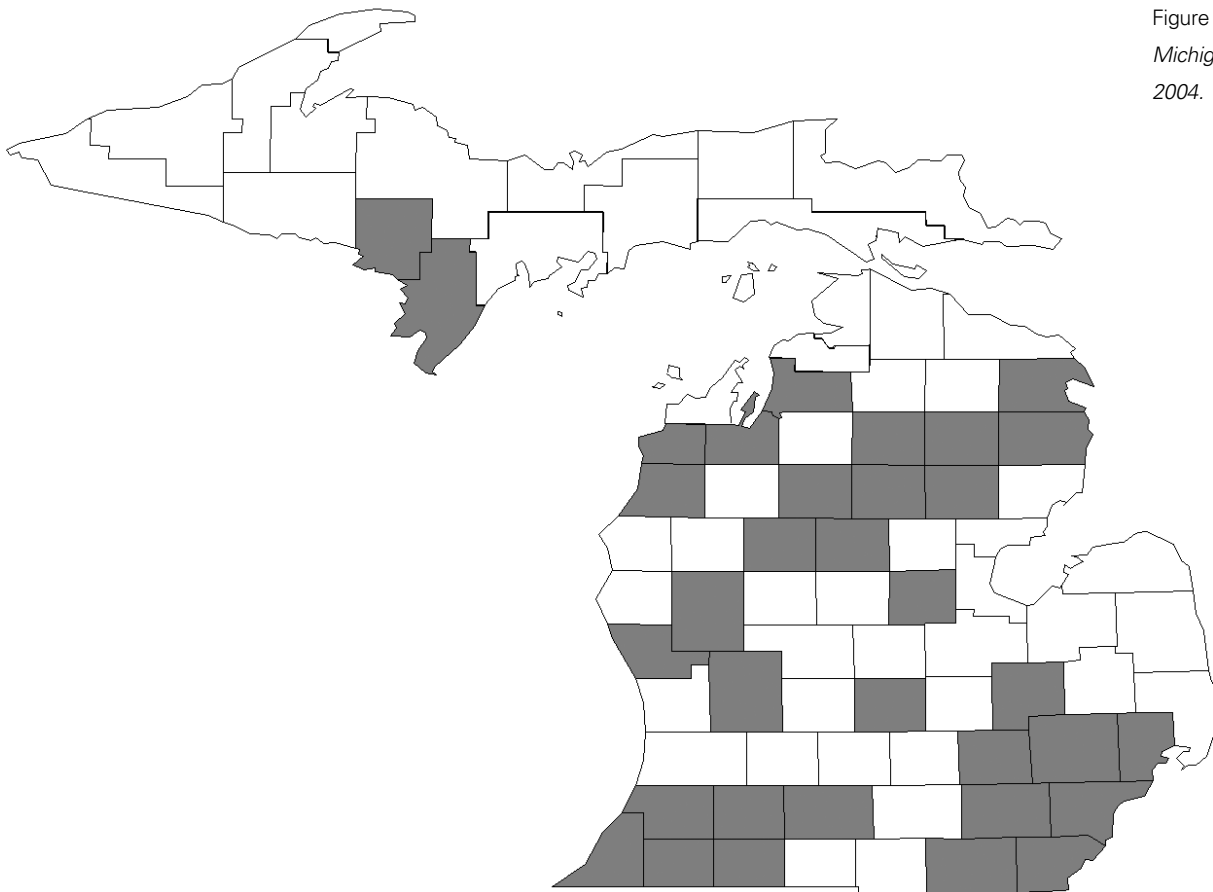


Figure 8.—Counties in Michigan with oak wilt, 2004.

Summary

The estimated 18.7 million acres of timberland present in Michigan in 2004 is only slightly higher than the 18.6 acres of timberland present in 1993, which suggests a leveling off of increases in timberland area since the low of the 1970s and 1980s. Sawtimber- and poletimber-size stands each account for about 40 percent of timberland area with only 20 percent of the area in younger seedling and sapling stands, suggesting a relatively mature forest. More than two-thirds of all live tree volume is contained in hardwoods; however, hardwood volume showed a slight decrease from 1993. Growing-stock volume totals 27.3 billion cubic feet. Between 1993 and 2004, Michigan forests averaged 923 million cubic feet of net

growth each year for growing stock, 291 million cubic feet per year of removals from growing stock, and nearly 225 million cubic feet per year of growing stock lost to mortality. Because of the emerald ash borer infestation, we expect future inventories to reveal an increase in ash removals and loss to mortality. In addition to the emerald ash borer, other pests and diseases threaten the forest resources of Michigan. For instance, beech bark disease is expected to increase in the future affecting the American beech resource. To control or eradicate forest pests and diseases, forest health managers have established quarantine areas, conducted public education and awareness campaigns, and implemented silvicultural approaches to ameliorate the effects of pests and diseases.

Appendix

ACCURACY OF THE INVENTORY

Sampling errors measure the uncertainty in estimates due to not observing every member of the population. In the case of the 2000-2004 Michigan forest inventory, a total sample of 18,910 plots were observed over the entire State, an intensity of one plot every 1,975 acres. Sampling errors for the estimates of statewide totals in this report are

	Estimate	Sampling error (%)
Area of forest land (thousand acres)	19,312.3	0.37
Area of timberland (thousand acres)	18,747.3	0.41
All live volume on forest land (thousand cubic feet)	30,245,431	0.74
All live volume on timberland (thousand cubic feet)	29,285,254	0.77
Growing-stock volume on timberland (thousand cubic feet)	27,304,880	0.79
Sawtimber volume on timberland (thousand board feet)	78,894,630	1.07
All live aboveground biomass on timberland (dry tons)	769,845,303	0.72
Growing-stock growth on timberland (thousand cubic feet per year)	923,285	3.36
Growing-stock mortality on timberland (thousand cubic feet per year)	224,533	4.91
Growing-stock removals on timberland (thousand cubic feet per year)	291,233	7.05

These sampling errors mean that the chances are two out of three that if a 100-percent inventory had been taken, using the same methods, the results would have been within the limits indicated. For example, the estimated growing-stock volume in the State is 27,304.9 million cubic feet with a sampling error of +/- 0.79 percent (+/- 215.2 million cubic feet).

Inventory Methods

Since the 1993 inventory of Michigan, several changes have been made in NCFIA inventory methods to improve the quality of the inventory as well as meet increasing demands for timely forest resource information. The most significant difference between inventories was the change from periodic inventories to annual inventories. Historically, NCFIA periodically inventoried each State on a cycle that averaged about 12 years. However, the need for timely and consistent data across large regions, combined with national legislative mandates, resulted in NCFIA's implementation of an annual inventory system.

With the NCFIA annual inventory system, about one-fifth of all field plots are measured each year. With the completion of the 2004 measurements, the entire inventory cycle has now been completed. NCFIA is preparing a report that will contain a more complete analysis of the results than this report which simply presents a few summary tables and highlights a few of the major findings. This and other reports provide estimates as a moving 5-year average. For example, NCFIA will be able to generate a report based on inventory results for 2000 through 2005 or for 2001 through 2006.

Other significant changes between inventories include the implementation of new remote sensing technology, a new sampling design, and a new field plot configuration, and the gathering of additional remotely sensed and field data. The advent of remote sensing technology since the previous inventory in 1993 has allowed NCFIA to use classifications of Multi-Resolution Land Characterization (MRLC) data and other available remote sensing products to stratify the total area of the State and to improve the precision of estimates.

New algorithms were used in 2004 to assign forest type and stand-size class to each condition observed on a plot. These algorithms are being used nationwide by FIA to provide consistency from State to State and will be used to reassign the forest type and stand-size class of every plot measured in the 1993 inventory when it is updated. This will be done so that changes in forest type and stand-size class will more accurately reflect actual changes in the forest and not changes in how values are computed. The list of recognized forest types, grouping of these forest types for reporting purposes, models used to assign stocking values to individual trees, definition of nonstocked, and names given to the forest types changed with the new algorithms. As a result, comparisons between the published 2004 inventory results and those published for the 1993 inventory may not be valid. For additional details about algorithms used in both inventories, please contact NCFIA.

Sampling Phases

The 2004 Michigan survey was based on a three-phase inventory. The first phase used classified satellite imagery to stratify the State and aerial photographs to select plots for measurement. The second phase measured the traditional FIA suite of mensurational variables, and the third phase focused on a suite of variables related to the health of the forest.

The only land that could not be sampled was (1) private land where field personnel could not obtain permission from the owner to measure the field plot and (2) plots that could not be accessed because of a hazard or danger to field personnel. The methods used in the preparation of this report make the necessary adjustments to account for sites where access was denied or hazardous.

Phase 1

The 2004 inventory used a classification of satellite imagery. FIA used the imagery to form two initial strata—forest and nonforest. Pixels within 60 m (2 pixel widths) of a forest/nonforest

boundary formed two additional strata—forest edge and nonforest edge. Forest pixels within 60m on the forest side of a forest/nonforest boundary were classified into a forest edge stratum. Pixels within 60 m of the boundary on the nonforest side were classified into a nonforest edge stratum. In addition, all strata were divided into public or private ownership based on information available in the Protected Lands Database (DellaSala *et al.* 2001). The estimated population total for a variable is the sum across all strata of the product of each stratum's area (from the pixel count) and the variable's mean per unit area (from plot measurements) for the stratum.

Phase 2

Phase 2 of the inventory consisted of the measurement of 18,267 field plots in Michigan. Current FIA precision standards for annual inventories require a sampling intensity of one plot for approximately every 6,000 acres. FIA has divided the entire area of the United States into nonoverlapping hexagons, each of which contains 5,937 acres (McRoberts 1999). An array of field plots was established by selecting one plot from each hexagon based on the following rules: (1) if a Forest Health Monitoring (FHM) plot (Mangold 1998) fell within a hexagon, it was selected; (2) if no FHM plot fell within a hexagon, the existing NCFIA plot from the 1993 inventory nearest the hexagon center was selected; and (3) if neither FHM nor existing NCFIA plots fell within the hexagon, a new NCFIA plot was established in the hexagon (McRoberts 1999). This array of plots is designated the Federal base sample and is considered an equal probability sample; its measurement in Michigan is funded by the Federal government. The State of Michigan provided additional funds to intensify the sampling of phase 2 plots. Instead of a single intensity survey (1 plot for approximately every 6,000 acres), a triple intensity survey was conducted (1 plot for approximately every 2,000 acres). The 2000-2004 annual inventories collected data from 18,910 phase 2 field plots; 10,354 of these plots contained forest land.

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

Phase 3

NCFIA has two categories of field plot measurements—phase 2 field plots (standard FIA plots) and phase 3 plots (forest health plots)—to optimize our ability to collect data when available for measurement. Both types of plots are systematically distributed both geographically and temporally. Phase 3 plots are measured with the full suite of forest health monitoring vegetative and health variables (Mangold 1998) collected as well as the full suite of measures associated with phase 2 plots. Phase 3 plots must be measured between June 1 and August 30 to accommodate the additional measurement of nonwoody understory vegetation, ground cover, soils, and other variables. The 2000-2004 annual inventory results represent field measures on 10,354 phase 2 forested plots and 215 phase 3 field plots.

The new national FIA plot configuration (fig. 9) was first used for data collection in Michigan in 2000, the first annual inventory year. This configuration will be used in subsequent years. The national plot configuration requires mapping forest conditions on each plot.

The overall plot layout for the new configuration consists of four subplots. The centers of subplots 2, 3, and 4 are located 120 feet from the center of subplot 1. The azimuths to subplots 2, 3, and 4 are 0, 120, and 240 degrees, respectively. The center of the new plot is located at the same point as the center of the previous plot if a previous

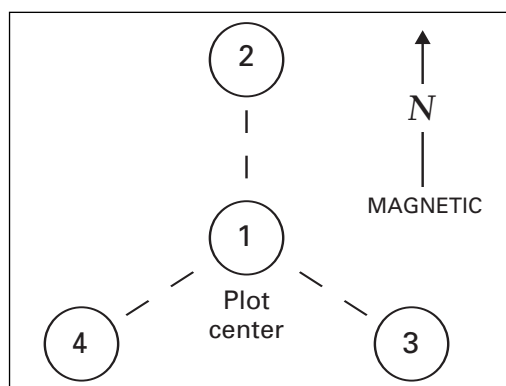


Figure 9.—NCFIA field plot configuration.

plot existed within the sample unit. Trees with a d.b.h. 5 inches and larger are measured on a 24-foot-radius (1/24 acre) circular subplot. All trees less than 5 inches d.b.h. are measured on a 6.8-foot-radius (1/300 acre) circular microplot located 12 feet east of the center of each of the four subplots. Forest conditions that occur on any of the four subplots are recorded. Factors that differentiate forest conditions are changes in forest type, stand-size class, land use, ownership, and density. Each condition that occurs anywhere on any of the subplots is identified, described, and mapped if the area of the condition meets or exceeds 1 acre in size.

Field plot measurements are combined with phase 1 estimates in the compilation process and table production. The number of tables presented here is limited. However, at www.fia.fs.fed.us, other tabular data can be generated. For additional information, contact:

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Table 1. — Area of forest land by forest type group, forest type, and owner category, Michigan, 2000-2004

(In thousand acres)

Forest type group/ forest type	Owner category			
	All owners	Public	Private	Unidentified owner
Softwood type groups				
White / red / jack pine group				
Jack pine	710.0	546.6	163.3	--
Red pine	857.5	561.5	296.0	--
Eastern white pine	260.4	121.5	138.9	--
White pine / hemlock	26.0	13.4	12.6	--
Eastern hemlock	202.0	82.2	119.8	--
All forest types	2,055.8	1,325.2	730.6	--
Spruce / fir group				
Balsam fir	396.4	157.5	238.9	--
White spruce	145.1	62.7	82.4	--
Black spruce	468.7	258.0	210.7	--
Tamarack	202.5	99.7	102.8	--
Northern white-cedar	1,368.0	639.4	728.6	--
All forest types	2,580.7	1,217.4	1,363.3	--
Pinyon / juniper group				
Eastern redcedar	3.3	--	3.3	--
All forest types	3.3	--	3.3	--
Douglas-fir group				
Douglas-fir	4.5	2.1	2.5	--
All forest types	4.5	2.1	2.5	--
Fir / spruce / mountain hemlock group				
Blue spruce	13.6	--	13.6	--
All forest types	13.6	--	13.6	--
Exotic softwoods group				
Exotic softwoods group	1.4	--	1.4	--
Scotch pine	135.3	6.3	129.0	--
Australian pine	0.2	--	0.2	--
Other exotic softwoods	21.8	0.5	21.3	--
Norway spruce	0.3	--	0.3	--
All forest types	158.9	6.8	152.1	--
All softwood groups	4,816.7	2,551.4	2,265.3	--
Hardwood type groups				
Oak / pine group				
Oak / pine group	1.4	1.1	0.3	--
White pine / red oak / white ash	167.0	59.4	107.6	--
Eastern redcedar / hardwood	8.8	--	8.8	--
Other pine / hardwood	362.6	208.6	154.0	--
All forest types	539.9	269.1	270.7	--

(Table 1 continued on next page)

(Table 1 continued)

Forest type group/ forest type	Owner category			Unidentified owner
	All owners	Public	Private	
Hardwood type groups				
Oak / hickory group				
Oak / hickory group	4.5	0.5	4.0	--
Post oak / blackjack oak	228.2	80.4	147.7	--
White oak / red oak / hickory	1,130.2	363.7	766.5	--
White oak	204.5	85.7	118.9	--
Northern red oak	512.2	194.0	318.2	--
Yellow-poplar / white oak / red oak	12.5	--	12.5	--
Sassafras / persimmon	59.0	9.3	49.7	--
Bur oak	7.4	0.7	6.7	--
Black walnut	14.0	0.5	13.5	--
Black locust	5.9	0.5	5.3	--
Chestnut oak / black oak / scarlet oak	64.3	32.3	32.1	--
Red maple / oak	154.1	28.0	126.1	--
Mixed upland hardwoods	194.3	21.9	172.4	--
All forest types	2,591.1	817.6	1,773.5	--
Oak / gum / cypress group				
Sweetbay / swamp tupelo / red maple	56.6	12.6	44.1	--
All forest types	56.6	12.6	44.1	--
Elm / ash / cottonwood group				
Elm / ash / cottonwood group	2.7	--	2.7	--
Black ash / American elm / red maple	659.9	181.9	478.0	--
River birch / sycamore	34.8	13.0	21.8	--
Cottonwood	37.4	5.6	31.8	--
Willow	58.9	9.3	49.6	--
Sycamore / pecan / American elm	48.0	9.2	38.8	--
Sugarberry / hackberry / elm / green ash	317.5	47.5	270.0	--
Silver maple / American elm	112.9	31.3	81.6	--
Red maple / lowland	178.0	64.2	113.7	--
Cottonwood / willow	22.4	4.1	18.3	--
All forest types	1,472.5	366.1	1,106.5	--
Maple / beech / birch group				
Maple / beech / birch group	7.3	0.5	6.8	--
Sugar maple / beech / yellow birch	4,092.6	1,228.6	2,864.0	--
Black cherry	194.8	65.8	129.0	--
Cherry / ash / yellow-poplar	231.3	65.9	165.4	--
Hard maple / basswood	1,198.9	396.8	802.1	--
Elm / ash / locust	109.9	15.0	94.9	--
Red maple / upland	627.7	190.9	436.8	--
All forest types	6,462.5	1,963.5	4,499.0	--
Aspen / birch group				
Aspen / birch group	3.8	0.1	3.7	--
Aspen	2,571.2	1,168.3	1,402.9	--
Paper birch	374.8	163.9	210.9	--
Balsam poplar	259.9	47.0	212.9	--
All forest types	3,209.6	1,379.3	1,830.4	--
Exotic hardwoods group				
Other exotic hardwoods	6.9	2.1	4.8	--
All forest types	6.9	2.1	4.8	--

(Table 1 continued)

Forest type group/ forest type	Owner category			Unidentified owner
	All owners	Public	Private	
Hardwood type groups				
Nonstocked				
Nonstocked	0.5	--	0.5	--
All forest types	0.5	--	0.5	--
All hardwood groups	14,339.7	4,810.1	9,529.5	--
Nonstocked	155.6	57.8	97.8	--
All forest groups	19,311.9	7,419.4	11,892.6	--

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 2. — Area of timberland by major forest type group, stand origin, and owner category, Michigan, 2000-2004

(in thousand acres)

Major forest type group and stand origin	Owner category		
	All owners	Public	Unidentified owner
Softwood type groups			
Natural	3,586.5	1,811.1	1,775.4
Planted	1,009.8	570.8	439.0
All softwood types	4,596.2	2,381.9	2,214.3
Hardwood type groups			
Natural	13,821.2	4,451.8	9,369.4
Planted	177.9	95.1	82.7
All hardwood types	13,999.1	4,547.0	9,452.2
Nonstocked	150.3	52.6	97.8
All groups	18,745.7	6,981.4	11,764.3

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 3. — Area of timberland by forest type group, forest type, and stand-size class, Michigan, 2000-2004

(In thousand acres)

Forest type group/ forest type	Stand-size class				
	All stands	Sawtimber	Poletimber	Sapling- seedling	Non- stocked
Softwood type groups					
White / red / jack pine group					
Jack pine	654.1	172.8	293.9	187.4	--
Red pine	849.7	480.1	312.3	57.1	--
Eastern white pine	251.8	161.2	65.8	24.7	--
White pine / hemlock	26.0	26.0	--	--	--
Eastern hemlock	165.1	149.5	13.7	1.8	--
All forest types	1,946.6	989.6	685.9	271.1	--
Spruce / fir group					
Balsam fir	376.1	60.9	139.8	175.4	--
White spruce	139.2	41.6	65.4	32.1	--
Black spruce	452.6	38.7	186.3	227.7	--
Tamarack	197.4	35.1	71.1	91.2	--
Northern white-cedar	1,306.1	443.3	727.7	135.1	--
All forest types	2,471.4	619.5	1,190.3	661.5	--
Pinyon / juniper group					
Eastern redcedar	3.3	--	1.1	2.1	--
All forest types	3.3	--	1.1	2.1	--
Douglas-fir group					
Douglas-fir	4.5	2.1	2.5	--	--
All forest types	4.5	2.1	2.5	--	--
Fir / spruce / mountain hemlock group					
Blue spruce	13.6	1.1	2.5	10.0	--
All forest types	13.6	1.1	2.5	10.0	--
Exotic softwoods group					
Exotic softwoods group	1.4	0.4	0.8	0.2	--
Scotch pine	133.2	38.2	59.9	35.1	--
Australian pine	0.2	--	0.2	--	--
Other exotic softwoods	21.8	13.7	4.4	3.7	--
Norway spruce	0.3	--	0.3	--	--
All forest types	156.8	52.3	65.6	39.0	--
All softwood groups	4,596.2	1,664.5	1,947.9	983.8	--
Hardwood type groups					
Oak / pine group					
Oak / pine group	1.4	--	1.4	--	--
White pine / red oak / white ash	161.4	62.2	79.2	20.0	--
Eastern redcedar / hardwood	8.8	--	5.3	3.5	--
Other pine / hardwood	345.0	128.1	103.7	113.2	--
All forest types	516.6	190.3	189.6	136.7	--

(Table 3 continued on next page)

(Table 3 continued)

Forest type group/ forest type	Stand-size class				
	All stands	Sawtimber	Poletimber	Sapling- seedling	Non- stocked
Hardwood type groups					
Oak / hickory group					
Oak / hickory group	4.5	--	1.5	3.1	--
Post oak / blackjack oak	224.0	108.7	66.7	48.6	--
White oak / red oak / hickory	1,126.5	688.1	319.2	119.2	--
White oak	202.9	141.3	44.3	17.3	--
Northern red oak	501.1	377.4	97.8	25.9	--
Yellow-poplar / white oak / red oak	12.5	6.0	6.5	--	--
Sassafras / persimmon	59.0	15.8	26.0	17.3	--
Bur oak	7.4	4.8	2.6	--	--
Black walnut	14.0	9.5	1.8	2.8	--
Black locust	5.9	2.4	1.8	1.7	--
Chestnut oak / black oak / scarlet oak	64.3	25.0	19.1	20.2	--
Red maple / oak	154.1	49.7	81.3	23.1	--
Mixed upland hardwoods	194.3	59.6	45.3	89.4	--
All forest types	2,570.5	1,488.2	713.8	368.5	--
Oak / gum / cypress group					
Sweetbay / swamp tupelo / red maple	56.6	25.3	23.9	7.4	--
All forest types	56.6	25.3	23.9	7.4	--
Elm / ash / cottonwood group					
Elm / ash / cottonwood group	2.7	0.0	2.1	0.6	--
Black ash / American elm / red maple	639.0	178.8	328.1	132.1	--
River birch / sycamore	34.8	9.4	4.6	20.8	--
Cottonwood	37.4	31.1	5.3	1.0	--
Willow	58.9	11.3	8.0	39.6	--
Sycamore / pecan / American elm	48.0	9.6	18.4	20.0	--
Sugarberry / hackberry / elm / green ash	314.8	143.2	113.9	57.7	--
Silver maple / American elm	112.9	85.1	22.6	5.2	--
Red maple / lowland	175.7	59.0	64.1	52.5	--
Cottonwood / willow	22.4	14.1	6.3	2.0	--
All forest types	1,446.6	541.6	573.5	331.5	--
Maple / beech / birch group					
Maple / beech / birch group	7.3	0.3	5.3	1.7	--
Sugar maple / beech / yellow birch	3,971.1	2,055.7	1,646.2	269.3	--
Black cherry	191.9	33.0	38.9	120.0	--
Cherry / ash / yellow-poplar	227.7	42.6	68.7	116.4	--
Hard maple / basswood	1,178.1	652.2	486.4	39.5	--
Elm / ash / locust	109.9	22.0	61.1	26.8	--
Red maple / upland	617.5	203.3	347.8	66.4	--
All forest types	6,303.5	3,009.1	2,654.4	640.0	--
Aspen / birch group					
Aspen / birch group	3.8	0.6	0.4	2.8	--
Aspen	2,523.0	477.1	1,080.1	965.7	--
Paper birch	317.1	72.7	200.0	44.4	--
Balsam poplar	253.9	32.5	99.6	121.8	--
All forest types	3,097.8	583.0	1,380.1	1,134.7	--
Exotic hardwoods group					
Other exotic hardwoods	6.9	2.1	2.4	2.4	--
All forest types	6.9	2.1	2.4	2.4	--

(Table 3 continued on next page)

(Table 3 continued)

Forest type group/ forest type	Stand-size class				
	All stands	Sawtimber	Poletimber	Sapling- seedling	Non- stocked
Hardwood type groups					
Nonstocked					
Nonstocked	0.5	--	--	0.5	--
All forest types	0.5	--	--	0.5	--
All hardwood groups	13,999.1	5,839.6	5,537.6	2,621.9	--
Nonstocked	150.3	--	--	--	150.3
All forest groups	18,745.7	7,504.1	7,485.6	3,605.7	150.3

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

Table 4. — Net volume of all live trees on forest land by species group, species, and owner category, Michigan, 2000-2004

(In thousand cubic feet)

Species group/ species	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Other yellow pines				
Scotch pine	155,933	5,934	149,999	--
All species	155,933	5,934	149,999	--
Eastern white and red pines				
Red pine	1,985,301	1,322,978	662,322	--
Eastern white pine	1,291,163	587,831	703,332	--
All species	3,276,464	1,910,809	1,365,655	--
Jack pine				
Jack pine	527,742	376,004	151,739	--
All species	527,742	376,004	151,739	--
Spruce and balsam fir				
Balsam fir	680,811	263,292	417,519	--
White spruce	550,843	262,056	288,787	--
Black spruce	469,225	249,079	220,145	--
All species	1,700,879	774,427	926,452	--
Eastern hemlock				
Eastern hemlock	905,149	374,663	530,486	--
All species	905,149	374,663	530,486	--
Other eastern softwoods				
Eastern redcedar	6,042	1,240	4,802	--
Larch spp.	826	592	34	--
Tamarack (native)	261,005	121,786	139,219	--
Norway spruce	30,205	1,232	28,973	--
Blue spruce	6,199	238	5,961	--
Austrian pine	19,606	33	19,574	--
Douglas-fir	8,629	1,533	7,096	--
Northern white-cedar	2,583,137	1,172,369	1,410,768	--
All species	2,915,450	1,299,023	1,616,427	--
Total softwoods	9,481,616	4,740,860	4,740,757	--
Hardwoods				
Select white oaks				
White oak	640,613	232,241	408,372	--
Swamp white oak	67,697	12,043	55,654	--
Bur oak	83,843	10,478	73,365	--
Chinkapin oak	5,904	581	5,323	--
All species	798,056	255,342	542,714	--
Select red oaks				
Northern red oak	1,504,738	536,366	968,371	--
Shumard oak	--	--	--	--
All species	1,504,738	536,366	968,371	--
Other white oaks				
Chestnut oak	826	--	826	--
All species	826	--	826	--

(Table 4 continued on next page)

(Table 4 continued)

Species group/ species	Owner category			
	All owners	Public	Private	Unidentified owner
Hardwoods				
Other red oaks				
Scarlet oak	825	646	178	--
Northern pin oak	245,721	95,648	150,072	--
Shingle oak	96	--	96	--
Pin oak	9,496	2,836	6,660	--
Black oak	550,306	189,178	361,128	--
All species	806,444	288,308	518,135	--
Hickory				
Bitternut hickory	65,997	6,695	59,303	--
Pignut hickory	46,176	7,512	38,664	--
Pecan	--	--	--	--
Shellbark hickory	7,858	651	7,207	--
Shagbark hickory	62,720	6,102	56,618	--
Mockernut hickory	7,211	1,829	5,382	--
All species	189,962	22,789	167,173	--
Yellow birch				
Yellow birch	664,063	277,079	386,984	--
All species	664,063	277,079	386,984	--
Hard maple				
Black maple	6,453	3,484	2,969	--
Sugar maple	4,535,293	1,530,302	3,004,991	--
All species	4,541,746	1,533,786	3,007,960	--
Soft maple				
Red maple	3,642,455	1,194,995	2,447,460	--
Silver maple	487,588	115,924	371,664	--
All species	4,130,043	1,310,919	2,819,124	--
Beech				
American beech	524,459	198,655	325,805	--
All species	524,459	198,655	325,805	--
Tupelo and blackgum				
Blackgum	11,748	1,536	10,212	--
All species	11,748	1,536	10,212	--
Ash				
White ash	439,351	99,786	339,564	--
Black ash	386,528	130,634	255,894	--
Green ash	540,267	88,845	451,421	--
Blue ash	635	--	635	--
All species	1,366,781	319,266	1,047,515	--
Cottonwood and aspen				
Cottonwood and poplar spp.				
Balsam poplar	228,597	71,194	157,403	--
Eastern cottonwood	147,047	14,456	132,591	--
Bigtooth aspen	1,233,816	470,491	763,326	--
Quaking aspen	1,632,161	676,354	955,807	--
All species	3,241,620	1,232,494	2,009,126	--

(Table 4 continued on next page)

(Table 4 continued)

Species group/ species	Owner category			
	All owners	Public	Private	Unidentified owner
Hardwoods				
Basswood				
American basswood	840,800	299,590	541,210	--
All species	840,800	299,590	541,210	--
Yellow-poplar				
Yellow-poplar	56,597	5,760	50,837	--
All species	56,597	5,760	50,837	--
Black walnut				
Black walnut	59,545	5,879	53,666	--
All species	59,545	5,879	53,666	--
Other eastern soft hardwoods				
Boxelder	35,175	3,862	31,313	--
Buckeye, horsechestnut spp.	40	--	40	--
Ohio buckeye	96	--	96	--
European alder	557	--	557	--
River birch	249	52	196	--
Paper birch	703,026	320,014	383,012	--
Northern catalpa	432	--	432	--
Hackberry	5,580	472	5,108	--
Walnut spp.	134	--	134	--
Butternut	7,504	66	7,438	--
Cucumbertree	--	--	--	--
American sycamore	33,082	1,759	31,323	--
Black cherry	748,825	203,072	545,753	--
Black willow	54,444	6,057	48,386	--
White willow	1,581	265	1,316	--
Sassafras	67,579	12,268	55,310	--
American elm	216,704	32,592	184,112	--
Siberian elm	1,500	270	1,230	--
Slippery elm	25,602	2,063	23,539	--
All species	1,902,109	582,813	1,319,295	--
Other eastern hard hardwoods				
Flowering dogwood	598	309	289	--
Honeylocust	1,814	66	1,748	--
Kentucky coffeetree	263	--	263	--
White mulberry	1,105	72	1,033	--
Red mulberry	1,782	38	1,743	--
Black locust	27,490	1,166	26,324	--
Rock elm	1,171	--	1,171	--
All species	34,223	1,651	32,572	--

(Table 4 continued on next page)

(Table 4 continued)

Species group/ species	Owner category			
	All owners	Public	Private	Unidentified owner
Hardwoods				
Eastern noncommercial hardwoods				
Striped maple	1,023	264	759	--
Mountain maple	122	17	105	--
Ailanthus	850	18	832	--
Serviceberry spp.	2,638	1,030	1,607	--
Common serviceberry	18	--	18	--
Pawpaw	--	--	--	--
American hornbeam, musclewood	1,320	59	1,261	--
American chestnut	731	--	731	--
Hawthorn spp.	3,050	253	2,798	--
Cockspur hawthorn	212	152	61	--
Downy hawthorn	141	--	141	--
Apple spp.	13,064	1,394	11,670	--
Eastern hophornbeam	58,114	15,306	42,808	--
Cherry and plum spp.	283	--	283	--
Pin cherry	2,982	454	2,528	--
Chokecherry	1,217	353	864	--
Willow spp.	656	--	656	--
Peachleaf willow	1,945	310	1,635	--
Bebb willow	107	69	39	--
American mountain-ash	725	234	491	--
Russian-olive	--	--	--	--
Other or unknown tree	45	--	45	--
All species	89,243	19,911	69,332	--
Total hardwoods	20,763,004	6,892,147	13,870,857	--
All species groups	30,244,620	11,633,007	18,611,614	--

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

Table 5. — Net volume of all live trees and salvageable dead trees on timberland by class of timber and softwood/hardwood species category, Michigan, 2000-2004

(In thousand cubic feet)

Class of timber	All species	Softwood species	Hardwood species
Live trees			
Growing-stock trees			
Sawtimber			
Saw log portion	12,807,826	4,943,071	7,864,755
Upper stem portion	3,704,167	699,373	3,004,794
Total	16,511,993	5,642,444	10,869,549
Poletimber	10,791,204	3,086,905	7,704,299
All growing-stock trees	27,303,197	8,729,349	18,573,848
Cull trees			
Rough trees ¹			
Sawtimber size	1,192,779	188,927	1,003,852
Poletimber size	629,518	124,468	505,050
Total	1,822,297	313,395	1,508,902
Rotten trees ¹			
Sawtimber size	123,511	22,655	100,856
Poletimber size	34,468	7,268	27,199
Total	157,979	29,924	128,055
All live cull trees	1,980,276	343,319	1,636,957
All live trees	29,283,473	9,072,668	20,210,805
Salvageable dead trees			
Sawtimber size	400,216	164,316	235,900
Poletimber size	384,809	122,534	262,275
All salvageable dead trees	785,025	286,850	498,175
All classes	30,068,498	9,359,517	20,708,981

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

¹ Includes noncommercial species.

Table 6. — Net volume of growing stock on timberland by forest type group, forest type, and softwood/hardwood species category, Michigan, 2000-2004

(In thousand cubic feet)

Forest type group/ forest type	All species	Softwood species	Hardwood species
Softwood type groups			
White / red / jack pine group			
Jack pine	520,625	469,268	51,358
Red pine	1,797,329	1,672,011	125,318
Eastern white pine	526,648	458,086	68,562
White pine / hemlock	72,060	59,844	12,216
Eastern hemlock	402,067	277,595	124,472
All forest types	3,318,729	2,936,804	381,926
Spruce / fir group			
Balsam fir	314,612	230,970	83,642
White spruce	172,636	144,358	28,278
Black spruce	372,173	338,724	33,450
Tamarack	155,352	143,371	11,981
Northern white-cedar	2,362,761	2,060,378	302,384
All forest types	3,377,535	2,917,802	459,734
Pinyon / juniper group			
Eastern redcedar	370	268	103
All forest types	370	268	103
Douglas-fir group			
Douglas-fir	5,113	5,113	--
All forest types	5,113	5,113	--
Fir / spruce / mountain hemlock group			
Blue spruce	5,518	5,484	34
All forest types	5,518	5,484	34
Exotic softwoods group			
Exotic softwoods group	2,227	2,106	121
Scotch pine	144,712	130,708	14,003
Australian pine	41	41	--
Other exotic softwoods	36,445	31,310	5,134
Norway spruce	655	655	--
All forest types	184,079	164,821	19,259
All softwood groups	6,891,345	6,030,291	861,054
Hardwood type groups			
Oak / pine group			
Oak / pine group	2,258	441	1,817
White pine / red oak / white ash	235,511	137,182	98,328
Eastern redcedar / hardwood	2,488	553	1,935
Other pine / hardwood	373,789	202,093	171,696
All forest types	614,046	340,270	273,776

(Table 6 continued on next page)

(Table 6 continued)

Forest type group/ forest type	All species	Softwood species	Hardwood species
Hardwood type groups			
Oak / hickory group			
Oak / hickory group	5,658	--	5,658
Post oak / blackjack oak	201,465	16,665	184,800
White oak / red oak / hickory	1,773,820	95,729	1,678,091
White oak	311,226	13,119	298,107
Northern red oak	890,738	39,324	851,414
Yellow-poplar / white oak / red oak	28,564	655	27,909
Sassafras / persimmon	72,519	2,439	70,079
Bur oak	19,860	41	19,819
Black walnut	21,283	--	21,283
Black locust	4,578	1,371	3,206
Chestnut oak / black oak / scarlet oak	63,008	6,853	56,155
Red maple / oak	221,740	9,758	211,983
Mixed upland hardwoods	187,832	13,533	174,299
All forest types	3,802,291	199,486	3,602,805
Oak / gum / cypress group			
Sweetbay / swamp tupelo / red maple	97,957	9,758	88,199
All forest types	97,957	9,758	88,199
Elm / ash / cottonwood group			
Elm / ash / cottonwood group	3,481	--	3,481
Black ash / American elm / red maple	801,437	172,259	629,179
River birch / sycamore	26,099	2,372	23,727
Cottonwood	70,898	459	70,439
Willow	13,315	1,275	12,040
Sycamore / pecan / American elm	49,823	3,839	45,985
Sugarberry / hackberry / elm / green ash	364,690	13,173	351,518
Silver maple / American elm	281,606	5,820	275,787
Red maple / lowland	218,182	27,147	191,035
Cottonwood / willow	48,081	668	47,413
All forest types	1,877,612	227,011	1,650,600
Maple / beech / birch group			
Maple / beech / birch group	9,231	675	8,556
Sugar maple / beech / yellow birch	6,972,762	998,438	5,974,324
Black cherry	109,560	6,188	103,372
Cherry / ash / yellow-poplar	192,607	16,547	176,060
Hard maple / basswood	2,332,309	58,863	2,273,447
Elm / ash / locust	99,600	2,549	97,051
Red maple / upland	1,016,655	121,344	895,311
All forest types	10,732,724	1,204,604	9,528,120

(Table 6 continued on next page)

(Table 6 continued)

Forest type group/ forest type	All species	Softwood species	Hardwood species
Hardwood type groups			
Aspen / birch group			
Aspen / birch group	3,296	1,451	1,845
Aspen	2,674,989	506,716	2,168,273
Paper birch	395,129	138,805	256,324
Balsam poplar	203,626	65,471	138,155
All forest types	3,277,040	712,442	2,564,598
Exotic hardwoods group			
Other exotic hardwoods			
All forest types	1,537	23	1,514
All hardwood groups	1,537	23	1,514
Nonstocked	20,403,207	2,693,595	17,709,612
All forest groups	8,645	5,463	3,182
All forest groups	27,303,197	8,729,349	18,573,848

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

Table 7. — Net volume of growing stock on timberland by species group, species, and diameter class, Michigan, 2000-2004

(In thousand cubic feet)

Species group/ species	All classes	Diameter class (inches at breast height)										
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+	
Softwoods												
Other yellow pines												
Scotch pine	137,897	21,563	34,536	38,304	25,712	8,968	6,854	1,960	--	--	--	--
All species	137,897	21,563	34,536	38,304	25,712	8,968	6,854	1,960	--	--	--	--
Eastern white and red pines												
Red pine	1,944,953	176,671	378,321	416,940	348,443	241,869	163,746	88,591	65,432	64,940	--	--
Eastern white pine	1,197,493	64,210	90,203	114,521	118,899	122,162	127,162	122,631	110,448	264,822	62,435	62,435
All species	3,142,446	240,881	468,524	531,461	467,342	364,031	290,908	211,222	175,881	329,761	62,435	62,435
Jack pine												
Jack pine	486,770	91,184	148,569	123,897	74,168	31,371	13,100	3,777	704	--	--	--
All species	486,770	91,184	148,569	123,897	74,168	31,371	13,100	3,777	704	--	--	--
Spruce and balsam fir												
Balsam fir	657,122	247,231	216,063	118,877	48,414	18,144	6,080	928	1,385	--	--	--
White spruce	493,612	67,140	92,838	86,378	89,459	66,130	42,114	20,388	19,984	9,180	--	--
Black spruce	451,089	161,072	150,831	81,701	33,280	14,633	4,070	2,422	2,206	876	--	--
All species	1,601,823	475,443	459,732	286,956	171,154	98,907	52,263	23,737	23,575	10,056	--	--
Eastern hemlock												
Eastern hemlock	756,683	20,235	44,946	68,407	91,408	107,262	113,136	104,051	80,083	117,081	10,074	10,074
All species	756,683	20,235	44,946	68,407	91,408	107,262	113,136	104,051	80,083	117,081	10,074	10,074
Other eastern softwoods												
Eastern redcedar	4,508	1,099	1,228	1,038	464	679	--	--	--	--	--	--
Larch spp.	626	63	49	--	195	319	--	--	--	--	--	--
Tamarack (native)	249,037	61,925	65,538	54,441	34,298	17,974	10,235	4,007	620	--	--	--
Norway spruce	29,243	3,806	5,107	7,452	5,727	2,862	1,823	2,466	--	--	--	--
Blue spruce	5,831	1,886	1,505	1,531	908	--	--	--	--	--	--	--
Austrian pine	18,610	1,316	3,996	5,615	4,652	3,032	--	--	--	--	--	--
Douglas-fir	8,265	415	1,451	511	1,493	765	942	580	778	1,328	--	--
Northern white-cedar	2,287,611	395,151	536,757	477,396	340,837	229,461	140,046	70,982	43,183	43,656	10,141	10,141
All species	2,603,731	465,660	615,631	547,983	388,574	255,093	153,046	78,036	44,581	44,985	10,141	10,141
Total softwoods	8,729,349	1,314,966	1,771,938	1,597,007	1,218,358	865,633	629,307	422,783	324,824	501,883	82,650	82,650
Hardwoods												
Select white oaks												
White oak	568,620	32,289	53,649	70,490	82,489	71,579	63,040	63,863	44,940	68,885	17,396	17,396
Swamp white oak	64,694	3,106	5,577	6,334	8,048	9,077	5,887	5,605	6,067	14,994	--	--
Bur oak	74,651	1,986	2,869	6,312	5,818	6,500	6,109	5,943	8,760	14,826	15,527	15,527
Chinkapin oak	3,244	110	233	487	673	--	438	581	722	--	--	--
All species	711,210	37,491	62,328	83,623	97,028	87,156	75,474	75,992	60,489	98,705	32,924	32,924
Select red oaks												
Northern red oak	1,390,606	45,698	85,555	157,505	205,396	193,021	227,079	167,744	109,107	170,721	28,781	28,781
Shumard oak	--	--	--	--	--	--	--	--	--	--	--	--
All species	1,390,606	45,698	85,555	157,505	205,396	193,021	227,079	167,744	109,107	170,721	28,781	28,781
Other white oaks												
Chestnut oak	826	--	56	--	--	--	770	--	--	--	--	--
All species	826	--	56	--	--	--	770	--	--	--	--	--
Other red oaks												
Scarlet oak	705	80	114	--	230	--	282	--	--	--	--	--
Northern pin oak	212,727	9,982	20,171	29,213	34,753	35,225	26,715	17,280	16,252	23,137	--	--
Shingle oak	52	--	52	--	--	--	--	--	--	--	--	--
Pin oak	8,966	213	379	732	1,662	1,426	770	2,391	532	861	--	--
Black oak	494,725	14,284	31,885	48,939	50,755	68,678	63,764	61,965	52,902	82,485	19,067	19,067
All species	717,175	24,559	52,601	78,884	87,400	105,329	91,530	81,636	69,685	106,484	19,067	19,067

(Table 7 continued on next page)

(Table 7 continued on next page)

(Table 7 continued)

Species group/ species	All classes	Diameter class (inches at breast height)											29.0+
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9			
Hardwoods													
Hickory													
Bitternut hickory	64,084	4,106	7,351	9,419	10,490	9,000	6,285	8,381	5,141	3,911	--	--	
Pignut hickory	40,710	2,271	3,287	3,166	7,401	7,262	6,019	2,903	3,912	4,489	--	--	
Pecan	--	--	--	--	--	--	--	--	--	--	--	--	
Shelbark hickory	7,858	267	559	1,223	963	1,214	1,605	--	--	2,026	--	--	
Shagbark hickory	55,769	4,094	6,464	6,973	9,900	7,262	9,128	2,778	6,478	2,693	--	--	
Mockernut hickory	6,349	322	781	799	2,142	1,044	437	--	824	--	--	--	
All species	174,769	11,060	18,442	21,580	30,896	25,781	23,474	14,062	16,355	13,119	--	--	
Yellow birch													
Yellow birch	520,292	40,039	70,595	80,285	75,711	64,591	59,745	42,399	29,970	43,953	13,004	13,004	
All species	520,292	40,039	70,595	80,285	75,711	64,591	59,745	42,399	29,970	43,953	13,004	13,004	
Hard maple													
Black maple	3,674	173	281	873	--	310	--	--	869	1,168	--	--	
Sugar maple	4,145,925	403,479	674,859	796,487	729,626	572,850	379,834	252,103	133,881	183,858	18,948	18,948	
All species	4,149,599	403,652	675,140	797,360	729,626	573,159	379,834	252,103	134,750	185,027	18,948	18,948	
Soft maple													
Red maple	3,271,730	402,922	600,424	651,887	532,699	387,141	266,002	171,559	108,467	128,491	22,136	22,136	
Silver maple	438,066	18,640	29,089	45,701	52,420	47,604	54,116	46,714	40,056	71,029	32,697	32,697	
All species	3,709,796	421,563	629,513	697,588	585,119	434,745	320,118	218,273	148,523	199,521	54,833	54,833	
Beech													
American beech	421,777	32,280	43,728	57,338	62,450	52,669	55,390	46,598	29,474	41,850	--	--	
All species	421,777	32,280	43,728	57,338	62,450	52,669	55,390	46,598	29,474	41,850	--	--	
Tupelo and blackgum													
Blackgum	10,722	1,420	2,650	2,516	815	1,373	763	1,187	--	--	--	--	
All species	10,722	1,420	2,650	2,516	815	1,373	763	1,187	--	--	--	--	
Ash													
White ash	407,360	23,579	41,367	59,332	62,394	69,485	50,849	34,077	21,250	38,738	6,287	6,287	
Black ash	351,205	103,027	90,168	65,049	40,063	28,810	15,584	4,451	2,186	1,868	--	--	
Green ash	513,994	54,003	80,117	95,115	86,512	70,264	49,201	30,350	20,071	25,431	2,930	2,930	
Blue ash	635	--	79	--	--	--	--	556	--	--	--	--	
All species	1,273,195	180,610	211,731	219,496	188,969	168,558	115,634	69,435	43,507	66,037	9,218	9,218	
Cottonwood and aspen													
Cottonwood and poplar spp.													
Balsam poplar	219,953	31,719	38,817	40,635	35,921	30,546	18,762	14,375	4,890	4,288	--	--	
Eastern cottonwood	137,471	2,166	3,942	6,095	7,566	14,619	10,710	19,350	15,613	37,664	19,746	19,746	
Bigtooth aspen	1,175,284	129,397	158,591	200,822	213,553	191,800	141,483	64,844	41,789	33,005	--	--	
Quaking aspen	1,487,387	206,838	252,990	274,609	256,932	217,572	136,522	76,533	44,631	20,760	--	--	
All species	3,020,096	370,120	454,339	522,161	513,972	454,536	307,477	175,103	106,923	95,717	19,746	19,746	
Basswood													
American basswood	783,171	35,902	87,210	136,119	167,835	140,300	93,111	50,465	34,104	29,953	8,173	8,173	
All species	783,171	35,902	87,210	136,119	167,835	140,300	93,111	50,465	34,104	29,953	8,173	8,173	
Yellow-poplar													
Yellow-poplar	55,097	610	1,791	1,803	4,042	8,527	7,468	7,323	6,999	14,853	1,681	1,681	
All species	55,097	610	1,791	1,803	4,042	8,527	7,468	7,323	6,999	14,853	1,681	1,681	
Black walnut													
Black walnut	51,564	2,697	5,019	5,886	7,550	6,322	3,108	6,348	5,146	4,851	4,637	4,637	
All species	51,564	2,697	5,019	5,886	7,550	6,322	3,108	6,348	5,146	4,851	4,637	4,637	

(Table 7 continued on next page)

(Table 7 continued)

Species group/ species	All classes	Diameter class (inches at breast height)											29.0+
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9			
Hardwoods													
Other eastern soft hardwoods													
Boxelder	17,479	2,895	4,139	4,446	2,516	1,294	846	564	778	--	--	--	
Ohio buckeye	75	--	75	--	--	--	--	--	--	--	--	--	
European alder	210	151	59	--	--	--	--	--	--	--	--	--	
River birch	166	113	54	--	--	--	--	--	--	--	--	--	
Paper birch	587,104	91,489	139,836	139,023	104,266	59,489	27,355	16,140	6,671	2,836	--	--	
Northern catalpa	414	33	--	--	139	242	--	--	--	--	--	--	
Hackberry	5,138	396	869	1,069	1,062	364	600	--	778	--	--	--	
Walnut spp.	134	--	--	134	--	--	--	--	--	--	--	--	
Butternut	5,576	163	286	223	477	1,565	881	594	1,387	--	--	--	
Cucumbertree	--	--	--	--	--	--	--	--	--	--	--	--	
American sycamore	32,256	208	689	1,227	1,729	2,205	2,807	7,927	6,658	6,045	2,760	--	
Black cherry	598,029	57,072	87,803	107,244	116,604	81,677	59,904	34,113	20,830	24,449	8,334	--	
Black willow	35,838	1,008	2,502	3,300	2,850	4,304	5,153	4,917	3,274	6,066	2,465	--	
White willow	296	31	--	--	--	265	--	--	--	--	--	--	
Sassafras	56,071	9,652	13,169	10,936	9,246	5,866	3,874	1,522	1,806	--	--	--	
American elm	194,370	45,227	45,677	36,468	27,793	17,272	10,479	5,235	2,377	3,841	--	--	
Siberian elm	1,056	88	544	248	176	--	--	--	--	--	--	--	
Slippery elm	24,133	3,720	3,886	4,733	3,713	2,684	1,454	1,851	--	2,090	--	--	
All species	1,558,344	212,247	299,588	309,051	270,572	177,227	113,354	72,863	44,559	45,326	13,559	--	
Other eastern hard hardwoods													
Flowering dogwood	81	24	56	--	--	--	--	--	--	--	--	--	
Honeylocust	1,734	199	66	--	--	--	870	599	--	--	--	--	
Kentucky coffeetree	160	80	81	--	--	--	--	--	--	--	--	--	
White mulberry	593	72	--	--	--	--	--	521	--	--	--	--	
Red mulberry	318	80	84	154	--	--	--	--	--	--	--	--	
Black locust	21,863	3,005	5,326	3,517	1,773	1,616	2,141	1,410	1,191	1,885	--	--	
Rock elm	860	126	--	--	--	318	416	--	--	--	--	--	
All species	25,609	3,586	5,614	3,670	1,773	1,934	3,427	2,529	1,191	1,885	--	--	
Total hardwoods	18,573,848	1,823,534	2,705,901	3,174,864	3,029,151	2,495,229	1,877,757	1,284,060	840,782	1,118,001	224,569	--	
All species groups	27,303,197	3,138,500	4,477,839	4,771,871	4,247,510	3,360,862	2,507,064	1,706,843	1,165,605	1,619,883	307,219	--	

All table cells without observations in the inventory sample are indicated by --. Table value of 0 indicates

the volume rounds to less than 1 thousand cubic feet. Columns and rows may not add to their totals due to rounding.

Table 8. — Net volume of sawtimber on timberland by species group, species, and diameter class, Michigan, 2000-2004

(In thousand and board feet) ¹

Species group/ species	All classes	Diameter class (inches at breast height)									
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+		
Softwoods											
Other yellow pines											
Scotch pine	399,696	180,516	125,759	46,085	36,538	10,799	--	--	--	--	--
All species	399,696	180,516	125,759	46,085	36,538	10,799	--	--	--	--	--
Eastern white and red pines											
Red pine	7,300,949	2,095,847	1,787,631	1,277,502	890,855	494,122	373,304	381,688	--	--	--
Eastern white pine	5,461,166	522,931	559,920	600,158	648,913	648,029	599,830	1,507,671	373,715	--	--
All species	12,762,116	2,618,778	2,347,551	1,877,661	1,539,768	1,142,151	973,135	1,889,359	373,715	--	--
Jack pine											
Jack pine	1,213,772	592,702	365,410	161,042	69,872	20,786	3,960	--	--	--	--
All species	1,213,772	592,702	365,410	161,042	69,872	20,786	3,960	--	--	--	--
Spruce and balsam fir											
Balsam fir	945,295	568,091	238,993	93,071	32,307	5,056	7,776	--	--	--	--
White spruce	1,780,012	437,218	466,575	356,393	233,328	115,941	116,039	54,519	--	--	--
Black spruce	739,421	424,672	178,070	80,822	23,270	14,142	13,162	5,282	--	--	--
All species	3,464,728	1,429,982	883,638	530,287	288,905	135,139	136,977	59,801	--	--	--
Eastern hemlock											
Eastern hemlock	3,625,070	330,241	441,808	535,810	586,505	557,641	441,038	670,634	61,394	--	--
All species	3,625,070	330,241	441,808	535,810	586,505	557,641	441,038	670,634	61,394	--	--
Other eastern softwoods											
Eastern redcedar	11,433	5,332	2,424	3,677	--	--	--	--	--	--	--
Larch spp.	2,661	--	978	1,683	--	--	--	--	--	--	--
Tamarack (native)	627,317	271,243	177,451	96,077	56,379	22,611	3,554	--	--	--	--
Norway spruce	100,843	35,020	27,896	14,616	9,753	13,559	--	--	--	--	--
Blue spruce	11,741	7,273	4,468	--	--	--	--	--	--	--	--
Austrian pine	64,405	26,372	22,701	15,332	--	--	--	--	--	--	--
Douglas-fir	34,114	2,433	7,286	3,955	5,027	3,169	4,382	7,863	--	--	--
Northern white-cedar	6,999,453	2,388,968	1,726,582	1,192,057	747,566	388,443	241,638	252,786	61,413	--	--
All species	7,851,967	2,736,642	1,969,785	1,327,397	818,725	427,782	249,575	260,648	61,413	--	--
Total softwoods	29,317,348	7,888,861	6,133,950	4,478,282	3,340,311	2,294,296	1,804,684	2,880,442	496,522	--	--
Hardwoods											
Select white oaks											
White oak	1,888,867	--	335,859	311,263	286,516	299,258	216,433	346,563	92,976	--	--
Swamp white oak	229,172	--	32,686	39,254	26,769	26,253	29,062	75,148	--	--	--
Bur oak	310,106	--	23,377	28,112	27,539	27,872	42,249	74,871	86,085	--	--
Chinkapin oak	10,734	--	2,638	--	1,948	2,719	3,429	--	--	--	--
All species	2,438,879	--	394,560	378,628	342,772	356,103	291,173	496,582	179,061	--	--
Select red oaks											
Northern red oak	5,039,581	--	832,822	840,212	1,033,660	789,929	527,987	861,003	153,968	--	--
All species	5,039,581	--	832,822	840,212	1,033,660	789,929	527,987	861,003	153,968	--	--
Other white oaks											
Chestnut oak	3,425	--	--	--	3,425	--	--	--	--	--	--
All species	3,425	--	--	--	3,425	--	--	--	--	--	--
Other red oaks											
Scarlet oak	2,241	--	950	--	1,292	--	--	--	--	--	--
Northern pin oak	701,084	--	142,583	155,781	123,202	82,516	79,548	117,453	--	--	--
Pin oak	34,733	--	6,738	6,265	3,476	11,198	2,595	4,460	--	--	--
Black oak	1,878,599	--	207,332	300,832	292,840	294,813	257,383	420,657	104,742	--	--
All species	2,616,657	--	357,603	462,878	420,810	388,527	339,527	542,571	104,742	--	--
Hickory											
Bitternut hickory	183,433	--	38,290	36,485	27,250	37,825	24,106	19,477	--	--	--
Pignut hickory	134,700	--	26,917	29,050	26,063	13,011	18,259	21,400	--	--	--
Shellbark hickory	25,135	--	3,362	4,955	6,894	--	--	9,924	--	--	--
Shagbark hickory	162,139	--	36,687	29,300	39,783	12,664	30,451	13,254	--	--	--
Mockernut hickory	18,136	--	8,018	4,233	1,911	--	3,975	--	--	--	--
All species	523,543	--	113,273	104,023	101,901	63,500	76,791	64,055	--	--	--

Table 8 continued on next page)

(Table 8 continued on next page)

(Table 8 continued)

Species group/ species	All classes	Diameter class (inches at breast height)							
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Hardwoods									
Yellow birch									
Yellow birch	1,598,915	--	330,162	302,826	292,097	212,918	154,235	233,790	72,887
All species	1,598,915	--	330,162	302,826	292,097	212,918	154,235	233,790	72,887
Hard maple									
Black maple	11,438	--	--	1,348	--	--	4,230	5,860	--
Sugar maple	10,274,353	--	3,020,879	2,560,850	1,775,477	1,215,886	661,242	937,680	102,339
All species	10,285,791	--	3,020,879	2,562,198	1,775,477	1,215,886	665,472	943,540	102,339
Soft maple									
Red maple	7,225,565	--	2,172,245	1,707,463	1,228,059	817,117	530,478	649,293	120,910
Silver maple	1,616,945	--	211,115	208,304	247,492	220,627	194,434	358,552	176,421
All species	8,842,511	--	2,383,361	1,915,767	1,475,551	1,037,744	724,912	1,007,845	297,331
Beech									
American beech	1,411,587	--	275,176	249,485	273,837	237,070	152,644	223,375	--
All species	1,411,587	--	275,176	249,485	273,837	237,070	152,644	223,375	--
Tupelo and blackgum									
Blackgum	18,392	--	3,252	5,947	3,533	5,660	--	--	--
All species	18,392	--	3,252	5,947	3,533	5,660	--	--	--
Ash									
White ash	1,293,006	--	256,237	306,975	233,988	161,965	103,518	196,829	33,495
Black ash	423,742	--	172,993	133,287	74,815	22,136	10,947	9,565	--
Green ash	1,276,956	--	354,624	309,148	226,383	144,292	97,576	129,297	15,636
Blue ash	2,745	--	--	--	--	2,745	--	--	--
All species	2,996,449	--	783,853	749,409	535,186	331,139	212,041	335,691	49,131
Cottonwood and aspen									
Balsam poplar	494,112	--	153,116	138,241	87,717	69,201	24,001	21,836	--
Eastern cottonwood	579,736	--	27,344	58,513	45,231	86,171	72,174	185,215	105,087
Bigtooth aspen	3,156,231	--	910,592	875,473	672,670	317,353	209,067	171,077	--
Quaking aspen	3,426,411	--	1,090,142	989,459	645,852	372,429	222,336	106,193	--
All species	7,656,490	--	2,181,193	2,061,687	1,451,469	845,154	527,578	484,321	105,087
Basswood									
American basswood	2,389,122	--	707,103	634,389	436,909	244,078	168,607	152,997	45,039
All species	2,389,122	--	707,103	634,389	436,909	244,078	168,607	152,997	45,039
Yellow-poplar									
Yellow-poplar	248,258	--	17,154	38,642	35,268	35,741	35,106	77,183	9,163
All species	248,258	--	17,154	38,642	35,268	35,741	35,106	77,183	9,163
Black walnut									
Black walnut	183,921	--	32,356	29,230	14,997	31,105	25,885	25,095	25,252
All species	183,921	--	32,356	29,230	14,997	31,105	25,885	25,095	25,252
Other eastern soft hardwoods									
Boxelder	26,746	--	10,508	5,763	3,930	2,730	3,815	--	--
Paper birch	937,863	--	427,695	261,818	125,861	76,058	32,267	14,164	--
Northern catalpa	1,677	--	573	1,104	--	--	--	--	--
Hackberry	12,165	--	4,173	1,510	2,695	--	3,788	--	--
Butternut	23,381	--	1,926	7,292	4,285	2,922	6,957	--	--
American sycamore	152,509	--	7,377	10,181	13,701	39,830	34,132	32,207	15,080
Black cherry	1,546,127	--	478,236	361,205	275,880	162,047	102,032	122,119	44,608
Black willow	129,512	--	10,310	17,163	21,936	22,061	15,231	29,618	13,193
White willow	1,167	--	--	1,167	--	--	--	--	--
Sassafras	98,795	--	38,327	26,267	18,016	7,320	8,865	--	--
American elm	279,573	--	107,143	72,576	46,082	24,069	11,036	18,667	--
Siberian elm	678	--	678	--	--	--	--	--	--
Slippery elm	50,491	--	14,361	11,230	6,376	8,516	--	10,009	--
All species	3,260,684	--	1,101,307	777,274	518,762	345,552	218,123	226,784	72,882

(Table 8 continued on next page)

(Table 8 continued)

Species group/ species	All classes	Diameter class (inches at breast height)									
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+		
Hardwoods											
Other eastern hard hardwoods											
Honeylocust	6,863	--	--	--	3,985	2,878	--	--	--	--	
White mulberry	2,457	--	--	--	--	2,457	--	--	--	--	
Black locust	46,978	--	7,469	7,323	9,959	6,758	5,855	9,614	--	--	
Rock elm	3,165	--	--	1,310	1,854	--	--	--	--	--	
All species	59,462	--	7,469	8,634	15,798	12,092	5,855	9,614	--	--	
Total hardwoods	49,573,667	--	12,541,523	11,121,229	8,731,452	6,152,196	4,125,936	5,684,447	1,216,884	--	
All species groups	78,891,015	7,888,861	18,675,473	15,599,511	12,071,763	8,446,492	5,930,620	8,564,889	1,713,406	--	

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

¹ International 1/4-inch rule.

Table 9. — All live aboveground tree biomass on timberland by owner category, softwood/hardwood species category, and tree biomass component, Michigan, 2000-2004

(In thousand dry tons)

Owner category and softwood/hardwood category	All components	All live 1-5 inch trees	Tree biomass component					
			Growing-stock trees			Non-growing-stock trees		
			Total	Boles	Stumps, tops, and limbs	Total	Boles	Stumps, tops, and limbs
Public								
Softwoods	85,374	9,575	72,728	57,192	15,536	3,071	2,346	725
Hardwoods	188,201	19,038	153,848	111,522	42,326	15,316	11,189	4,127
Total	273,576	28,613	226,577	168,714	57,862	18,386	13,534	4,852
Private								
Softwoods	93,229	11,758	77,216	58,990	18,225	4,256	3,159	1,097
Hardwoods	402,995	36,487	329,905	239,077	90,828	36,603	26,832	9,771
Total	496,224	48,244	407,120	298,067	109,053	40,859	29,991	10,868
All ownerships								
Softwoods	178,603	21,333	149,944	116,183	33,761	7,326	5,504	1,822
Hardwoods	591,196	55,524	483,753	350,599	133,154	51,919	38,021	13,898
Total	769,800	76,857	633,697	466,781	166,916	59,245	43,525	15,720

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 ton. Columns and rows may not add to their totals due to rounding.

Table 10. — Average annual net growth of growing stock on timberland by species group and owner category, Michigan, 1993 to 2000-2004

(In thousand cubic feet per year)

Species group	Owner category		
	All owners	Public	Unidentified owner
Softwoods			
Other yellow pines	11,084	56	11,028
Eastern white and red pines	125,816	58,439	67,377
Jack pine	12,961	9,644	3,317
Spruce and balsam fir	45,956	18,579	27,377
Eastern hemlock	21,640	6,558	15,082
Other eastern softwoods	78,320	27,663	50,657
Total softwoods	295,776	120,939	174,837
Hardwoods			
Select white oaks	20,472	4,979	15,493
Select red oaks	45,299	10,680	34,618
Other red oaks	23,382	4,462	18,920
Hickory	6,593	2,222	4,371
Yellow birch	9,575	3,426	6,148
Hard maple	125,659	41,466	84,193
Soft maple	147,155	41,040	106,115
Beech	16,311	8,005	8,306
Tupelo and blackgum	96	--	96
Ash	50,233	7,441	42,792
Cottonwood and aspen	112,482	43,266	69,215
Basswood	11,594	1,498	10,096
Yellow-poplar	3,702	1,785	1,917
Black walnut	3,566	254	3,311
Other eastern soft hardwoods	49,228	9,507	39,721
Other eastern hard hardwoods	2,156	161	1,995
Total hardwoods	627,503	180,194	447,309
All species groups	923,279	301,133	622,146

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

Table 11. — Average annual removals of growing stock on timberland by species group and owner category, Michigan, 1993 to 2000-2004

(In thousand cubic feet per year)

Species group	Owner category		
	All owners	Public	Unidentified owner
Softwoods			
Other yellow pines	8,189	1,424	6,765
Eastern white and red pines	28,638	18,827	9,811
Jack pine	14,370	12,488	1,882
Spruce and balsam fir	22,640	6,526	16,114
Eastern hemlock	3,256	819	2,436
Other eastern softwoods	10,872	1,843	9,029
Total softwoods	87,965	41,927	46,038
Hardwoods			
Select white oaks	4,000	934	3,066
Select red oaks	17,916	4,546	13,370
Other red oaks	3,589	1,330	2,260
Hickory	840	--	840
Yellow birch	2,478	1,156	1,322
Hard maple	35,968	8,401	27,567
Soft maple	27,555	9,694	17,861
Beech	7,196	913	6,283
Ash	7,105	1,424	5,682
Cottonwood and aspen	66,717	18,179	48,538
Basswood	6,933	2,485	4,448
Yellow-poplar	1,061	--	1,061
Black walnut	318	--	318
Other eastern soft hardwoods	20,911	4,190	16,722
Other eastern hard hardwoods	676	--	676
Total hardwoods	203,264	53,252	150,012
All species groups	291,229	95,179	196,050

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

Table 12. — Average annual mortality of growing stock on timberland by species group and owner category, Michigan, 1993 to 2000-2004

(In thousand cubic feet per year)

Species group	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Other yellow pines	3,124	366	2,759	--
Eastern white and red pines	8,679	6,456	2,223	--
Jack pine	9,118	7,221	1,897	--
Spruce and balsam fir	34,466	16,814	17,652	--
Eastern hemlock	2,434	968	1,466	--
Other eastern softwoods	11,644	6,997	4,647	--
Total softwoods	69,464	38,821	30,644	--
Hardwoods				
Select white oaks	3,175	752	2,423	--
Select red oaks	9,004	3,124	5,880	--
Other red oaks	4,105	2,341	1,764	--
Hickory	395	--	395	--
Yellow birch	3,616	1,291	2,325	--
Hard maple	11,455	4,213	7,242	--
Soft maple	14,478	4,561	9,917	--
Beech	658	--	658	--
Ash	6,567	2,004	4,564	--
Cottonwood and aspen	63,367	24,214	39,153	--
Basswood	4,299	2,497	1,802	--
Black walnut	387	--	387	--
Other eastern soft hardwoods	33,559	8,227	25,332	--
Other eastern hard hardwoods	--	--	--	--
Total hardwoods	155,066	53,223	101,843	--
All species groups	224,530	92,044	132,487	--

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

Hansen, Mark H.; Brand, Gary J.

2006. **Michigan's forest resources in 2004**. Resour. Bull. NC-255. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 41 p.

The sixth inventory of Michigan's forests was completed in 2004. The 18.7 million acres of timberland found is slightly higher than the 18.6 million acres found in the 1993 inventory. The standing timber volume has increased slightly at a rate of 0.22 percent per year. Detailed inventory results can be obtained at <http://www.fia.fs.fed.us>

KEY WORDS: Annual inventory, forest land, timberland, forest type, volume, biomass, growth, removals, mortality, Michigan

The Forest Inventory and Analysis Web site is: www.fia.fs.fed.us

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