United States
Department of
Agriculture

Forest
Service

North Central
Research Station

Resource Bulletin
NC-245

Michigan's Forest Resources in 2003

Earl C. Leatherberry, David Haugen, and Gary Brand

North Central Research Station
U.S. Department of Agriculture - Forest Service
1992 Folwell Avenue
Saint Paul, Minnesota 55108
2005
www.ncrs.fs.fed.us

CONTENTS

Results **1**

Area 1

Volume 4

Biomass 6

Growth, Removals, and Mortality 6

Forest Health 7

Summary **9**

Appendix **10**

Inventory Methods 10

Sampling Phases 10

Phase 1 11

Phase 2 11

Phase 3 11

Literature Cited . . . . . **.13**

Table Titles . . . . . **.13**

Tables . . . . . **.14**

Michigan's Forest Resources in 2001

The North Central Research Station's Forest Inventory and Analysis (NCFIA) program began fieldwork for the sixth forest inventory of Michigan in 2000, in partnership with the Michigan Department of Natural Resources. This inventory initiates the new annual inventory system in which one-fifth of the field plots (considered one panel) in the State are measured each year. A complete inventory consists of measuring and compiling the data for all plots in all five panels. Once all panels have been measured, each will be remeasured approximately every 5 years. For example, in Michigan, the field plots measured in 2003 will be remeasured in 2008.

In 2003, NCFIA continued the annual inventory effort with the fourth panel of the sixth Michigan forest inventory. Reports of previous inventories of Michigan are dated 1935, 1955, 1966, 1980, and 1993. This sixth inventory of Michigan's forest resources will be completed in 2004. However, because each year's sample is a systematic statewide sample of the Michigan's forest and because timely information is needed about forest resources, estimates have been prepared from data gathered during the first 4 years of the inventory. Data presented in this report represent 80 percent of the field plots (or four panels) for a complete inventory 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, and the fourth year's panel from 2003. Earlier reports for the 2000 panel (Leatherberry 2002) and the combined 2000 and 2001 panels (Leatherberry and Brand 2003) have also been published. No report was published from the 2002 panel. The results presented are estimates based on sampling techniques; estimates were compiled assuming the 2000, 2001, 2002, and 2003 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). Although these changes will have some impact on statewide estimates of forest area, timber volume, and tree biomass, they may also significantly impact plot classification variables such as forest type and stand-size class. For growth, removal, and mortality estimates, the 1993 inventory (Schmidt *et al.* 1997) was processed using estimation/summary routines for the 2000–2003 panels. Although these changes allow limited comparison of inventory estimates among separate inventories in this report, it is inappropriate to compare all portions of the 2000-2003 data with those published for earlier inventories. A more in-depth analysis will be conducted following the completion of the fifth year in the 5-year cycle

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

About the Authors:

Earl C. Leatherberry is a Resource Analyst with the Forest Inventory and Analysis program, North Central Research Station, St. Paul, MN.

David Haugen is a Forester with the Forest Inventory and Analysis program, North Central Research Station, St. Paul, MN.

Gary J. Brand is a Research Forester with the Forest Inventory and Analysis program, North Central Research Station, St. Paul, MN.

land area (table 1). Michigan's forest land has a wide variety of tree species. The tree species that form 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) Timberland[1]—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 (i.e., national parks and lakeshores, and Federal wilderness areas); and 3) Other forest land—land that is not capable of growing trees at a rate of 20 cubic feet per acre per year. Timberland area in Michigan totals nearly 18.7 million acres, accounting for 97 percent of forest land area in Michigan (table 2). From the first statewide inventory of Michigan's forest resources in 1935 until the mid-1960's, timberland area hovered around 19 million acres (fig. 1). The general stability in timberland area for the first two-thirds 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 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 18.6 million acres. The increase came predominantly from abandoned cropland and pasture, and marginal forest land that was productive enough to be reclassified as timberland (Schmidt *et al.* 1997). Between 1993 and 2003, Michigan's timberland area is estimated to have increased by about 72 thousand acres to 18.7 million acres (fig. 1). Although only a modest increase, it is noteworthy nonetheless considering that suburban development and the construction of homes in rural areas continue. Also, resort communities or enclaves, including golf courses, continue to expand into timberland areas. Timberland that converted to other land uses has been apparently

[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.

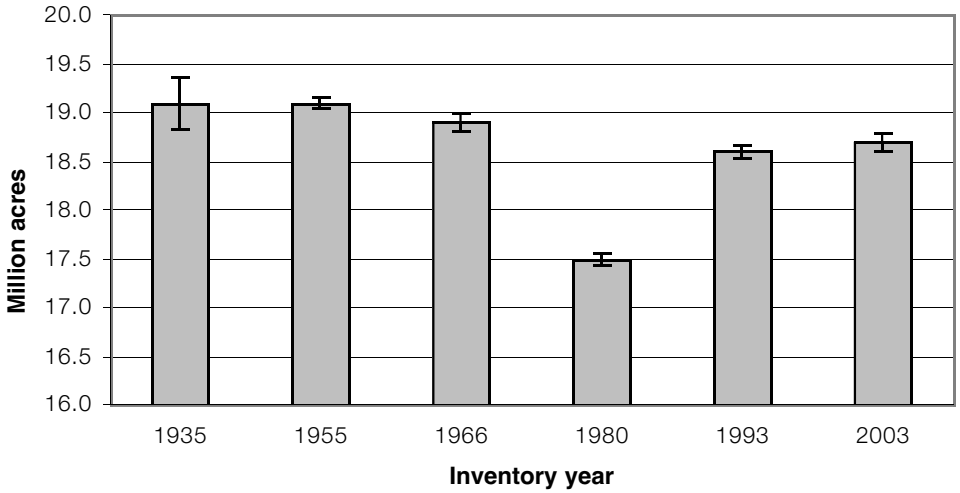

Figure 1.—Area of timberland in Michigan, 1935–2003. The vertical lines at the top of each bar represent the sampling error associated with each inventory.

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 extensive logging of the late 1800s and early 1900s, pines were an important component of the State's forests. Logging largely decimated the pine resource, but some pockets of pines that survived logging were placed in public ownership. Places such as Hartwick Pines State Park and Estivant Pines are remnant old-growth pine forest. 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 half of that was planted on public ownerships (table 2). The restoration of the pine resource in Michigan ensures a level of biological diversity that may not exist otherwise.

Hardwood forests occupy about three-fourths of the State's timberland area. The maple/beech/birch forest type group is the most extensive forest type group in Michigan, occupying an estimated one-third of the State's timberland area (table 3, fig. 2). The aspen/birch forest type group occurs on about 16 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 million acres), the aspen type (2.5 million acres), the hard maple/basswood type (1.2 million acres), and the white oak/ red oak/ hickory type (1.1 million acres).

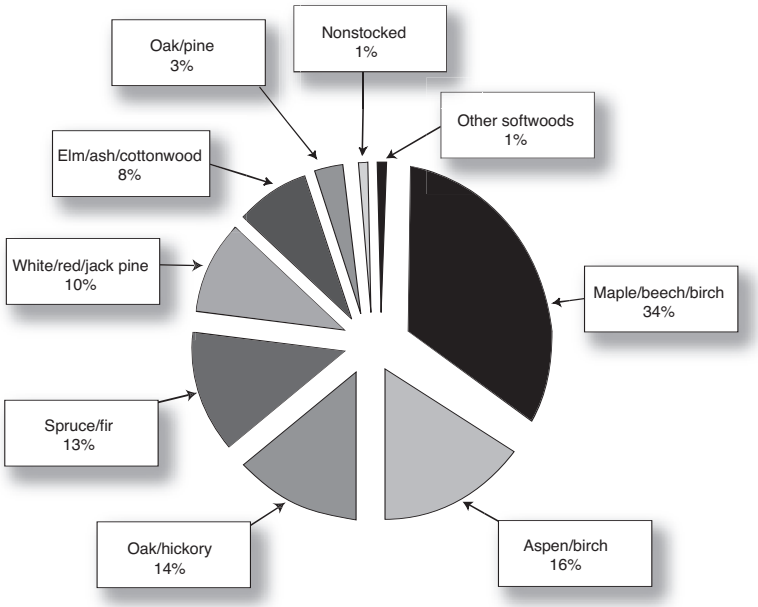

Figure 2.—*Area of forest land in Michigan by forest type group and percentage of timberland area, 2003.*

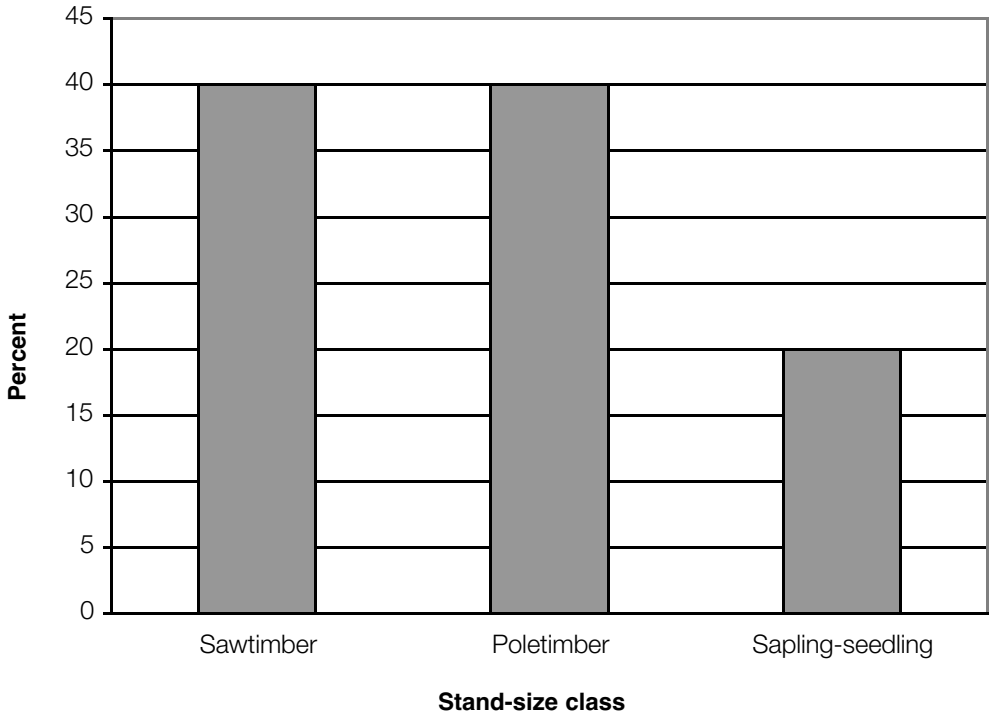

Figure 3.—Stand-size class as a percentage of total timberland area in Michigan, 2003.

Under softwoods, the white pine/red pine/jack pine forest type group and the spruce/fir group cover almost one-fourth of the timberland area, accounting for virtually all 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 remaining area (3.6 million acres) is sapling-seedling-sized stands. About 1 percent (147 thousand acres) of the timberland area in Michigan is classified as nonstocked (fig. 3).

Volume

Total net volume of all live trees on forest land in Michigan is 30.2 billion cubic feet, which equates to 1,570 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 (20.7 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. Net volume is computed from a 1-foot stump to a 4-inch top diameter outside bark for live trees at least 5 inches diameter at breast height (d.b.h.).

Growing-stock volume on timberland is a measure that has traditionally been used to ascertain wood volume useful for commercial purposes. Growing-stock volume is the

amount of solid wood on timberland in commercial trees 5.0 inches d.b.h. and over from 1 foot above ground (stump) to a minimum 4-inch top diameter with deductions made for poor form or defect. Growing-stock volume excludes rough, rotten, and dead trees and noncommercial tree species. Michigan's growing-stock volume totals 27.3 billion cubic feet, representing 93 percent of the total live volume (table 5). Six percent of volume of all live trees on timberland is in live cull trees—1.9 billion cubic feet. Cull volume is often used for commercial purposes. For instance, rough trees are sometimes used for making pallets or for chipping. Dead trees are also used for commercial purposes—they are an important source of firewood. Salvable dead trees contain almost 977 million cubic feet of wood volume. Salvable dead trees are important for wildlife species such as cavity nesting birds and mammals that require den sites.

Total growing-stock volume has increased in every inventory since 1955. Three-fourth of total growing-stock volume is now in hardwood species (table 6). In 2003, hardwood growing-stock volume stood at just less than 19 billion cubic feet (fig. 4). It appears that the steady increases in hardwood growing-stock volume over the years are beginning to flatten

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 (1.1 billion cubic feet) (table 7).

Softwood growing-stock volume has increased during every inventory since 1955 (fig. 5). Slightly more than one-fourth of all softwood growing-stock volume is in northern white-cedar trees. Red pine and eastern white pine, combined, accounts 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 sawtimber measured in board feet. Sawtimber volume is generally measured with the International 1/4-inch rule (Avery and

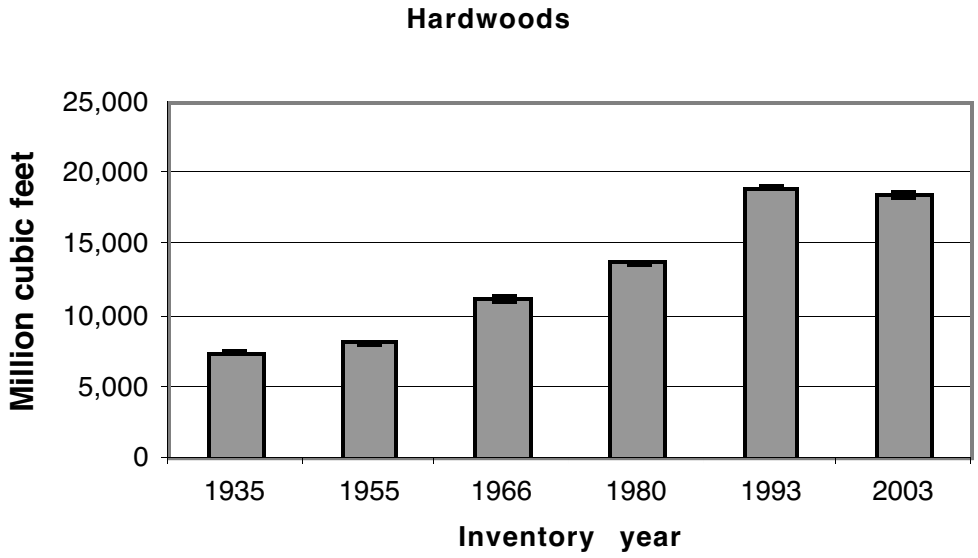

Figure 4.—Hardwood growing-stock volume, Michigan, 1935–2003. The vertical line at the top of each bar represents the sampling error associated with each inventory.

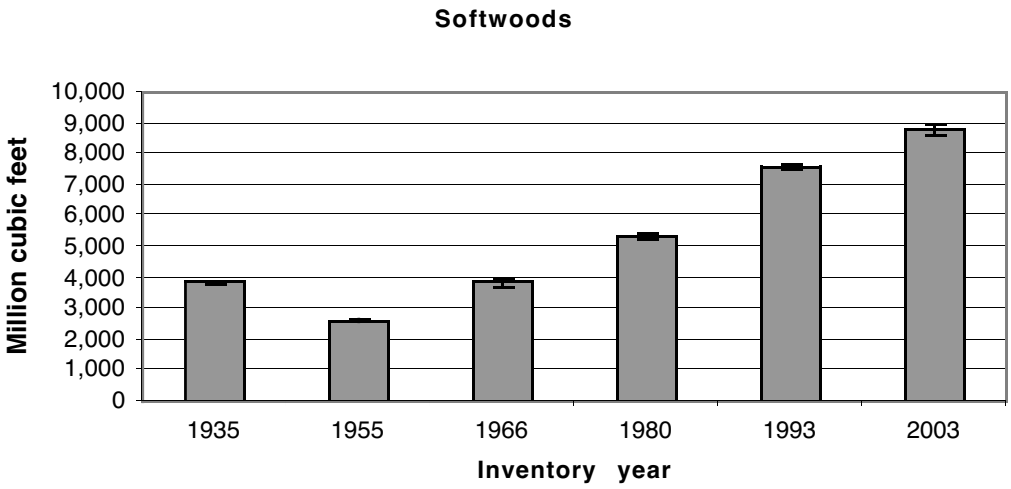

Figure 5 —*Softwood growing-stock volume, Michigan, 1935–2003. The vertical line at the top of each bar represents the sampling error associated with each inventory.*

Burkhart 1994). Sawtimber volume in Michigan totals 79.1 billion board feet (table 8). 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 one-fifth 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 29.5 billion board feet of softwood sawtimber volume is in red pines, and 19 percent is in eastern white pines.

Biomass

Live aboveground tree biomass in Michigan's timberland area was estimated to be 769 million dry tons in 2003 (an average of 41 dry tons per acre of timberland). All live aboveground tree biomass is estimated for 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 (589 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 assessments of fuel loads in forest stands.

Growth, Removals, and Mortality

The growing stock on Michigan's timberland grew, on average, by 930 million cubic feet per year between 1993 and 2000–2003 (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 298 million cubic feet per year. Maple species accounted for nearly 30 percent of the average annual net growth of growing stock on timberland between 1993 and 2000–2003. Private timberland accounted for 68 percent of total average annual growth.

Average annual removals of growing stock on timberland totaled 311 million cubic feet per year (table 11). From 1993 to 2000–2003, total average annual removals of growing stock were 33 percent of net annual growth. Hardwood removals were 218 million cubic feet per year. Softwood removals were 93 million cubic feet per year, or about 30 percent of the total. The cottonwood and aspen group

had the highest average annual removals at 69 million cubic feet per year followed by hard maple at 37 million cubic feet, soft maple at 29 million cubic feet, and eastern white and red pine at 28 million cubic feet. Removals from private ownerships totaled 213 million cubic feet per year, accounting for 68 percent of annual removals. Although removals from public timberland account for about 32 percent of 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 all growing stock on timberland from 1993 to 2000–2003 was 228 million cubic feet per year (table 12). Sixty-nine percent of the total, or 158 million cubic feet per year, was among hardwoods. 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 61.1 million cubic feet per year, or 27 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

The information presented about pathogens and insects affecting Michigan's forests was obtained from the National Forest Health Monitoring (FHM) Program at: http://www.na.fs.fed.us/spfo/fhm/index.htm. Several special issues were identified in 2003 and some are highlighted below. For more information about forest health in Michigan, contact the Michigan Department of Natural Resources.

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 introduction of the emerald ash borer, native to China, Korea, Japan, and Far East Russia, is threatening Michigan's ash resource. The emerald ash borer probably found its way to Michigan in wooden crating or other shipping material. The small, green beetles have infested or killed 6 million trees in 13 counties in southeast Michigan (fig. 6).

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. Forest health managers identified several small populations of emerald ash borer outside the quarantined counties in 2003 and are evaluating and taking actions to eradicate them. Because of the emerald ash borer infestation, we expect future inventories to reveal continuing declines in the total ash resource.

Figure 6.—*Counties in Michigan quarantined by Michigan Department of Agriculture to eradicate the emerald ash borer, 2003.*

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.

The beech resource in areas infested with beech scale for 10 years or more is greatly impacted. Currently, the disease is concentrated in two primary epicenters—Luce County in the Upper Peninsula and Mason County in the Lower Peninsula. In 2003, 2,000 acres of beech forest in Luce County were salvaged.

The eastern larch beetle populations in the eastern and the south central Upper Peninsula declined in 2003. This bark beetle has killed tamarack in stands ranging in size from a cluster of a few trees to stands of 100 acres. Because infested trees often 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 of larch casebearers generally collapse after a single year of damage thanks to two parasites imported from Europe.

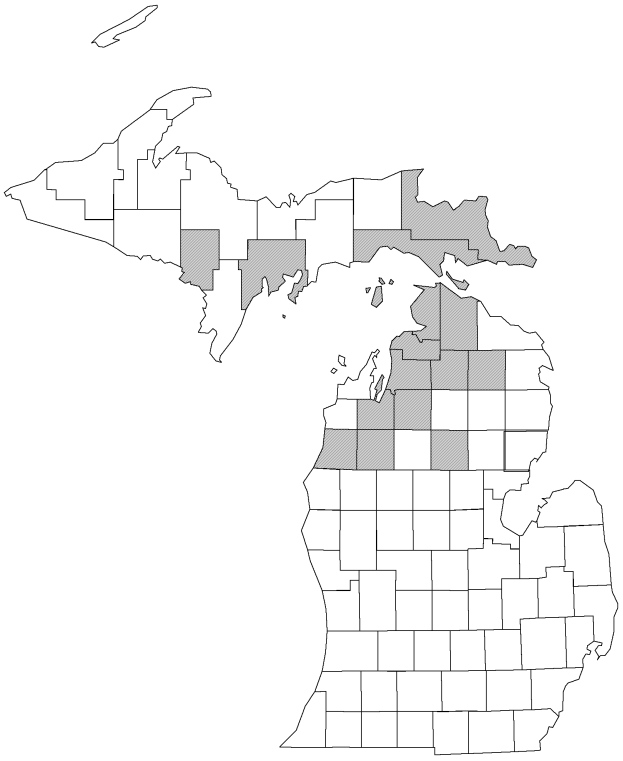

Figure 7.—*Counties in Michigan with defoliation from gypsy moth populations, 2003.*

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 was locally heavy in some northern Lower Peninsula counties (fig 7).

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.

Fewer acres were defoliated by the forest tent caterpillar in 2003 than in 2002. Affected areas were counties bordering Wisconsin in the south central Upper Peninsula. Epidemics occur about every 10–15 years in the Great

Lakes region, and last for 2–5 years. This is the tail end of a 4- to 5-year epidemic that defoliated nearly 12 million acres in its peak year, 2001.

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 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. In 2003, nearly 132 thousand acres of jack pine were moderately to heavily defoliated. This epidemic is expected to spread westward affecting most of the Upper Peninsula jack pine resource in the next 2–3 years. In the Lower Peninsula, jack pine budworm numbers rebounded in 2003 after having declined from 2001. Stands that were defoliated previously and show signs of heavy population buildup are at risk of mortality.

The red-headed pine sawfly is an important defoliator of young red and jack pines. Heaviest infestations are in pines growing under stress, particularly those at the edges of hardwood forests, on poor soils, and with heavy competitive vegetation. In general, the sawfly infests and damages trees less than 15 feet tall. Moderate to heavy defoliation stunts height growth of infested trees, and forking may result from top kill. Complete defoliation usually kills the tree. Building sawfly populations were detected in many areas of the eastern Upper Peninsula and the northern Lower Peninsula.

SUMMARY

The estimated 18.7 million acres of timberland present in 2003 is only slightly higher than the 18.6 acres of timberland present in 1983, which suggests a leveling off of increases in timberland area since the low of the 1970s and 1980s. Sawtimber- and poletimber-sized stands account for about 80 percent of timberland area, suggesting a relatively mature forest. Over two-thirds of all live tree volume is contained in hardwoods; however, it appears that hardwood volume increases are slowing. Growing-stock volume totals 27.3 billion cubic feet. Between 1993 and 2003, Michigan forests averaged 930 million cubic feet of net growth each year for growing stock; 310 million cubic feet per year of removals from growing stock; and nearly 228 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 threat posed by 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.

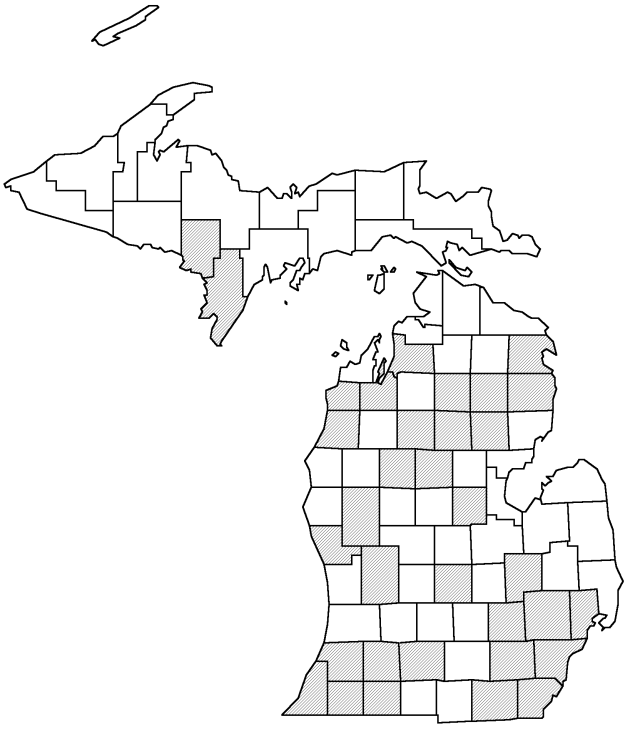

Figure 8.—*Counties in Michigan with oak wilt, 2003.*

APPENDIX

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. After 5 years, an entire inventory cycle will be completed. After the first 5 years, NCFIA will report and analyze results as a moving 5-year average. For example, NCFIA will be able to generate a report based on inventory results for 2000 through 2005 or for 2001 through 2006. Although there are great advantages for an annual inventory, one difficulty is reporting before completion of an entire cycle. With the 2003 annual measurements, 80 percent of all field plots have been measured. Sampling error estimates for the 2003 inventory results are area of forest land, 0.43 percent; area of timberland, 0.47 percent; volume of growing stock on timberland, 0.89 percent; and volume of sawtimber on timberland, 1.21 percent.

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

New algorithms were used in 2003 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 2003 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 2003 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 2003 inventory used a computer assisted classification of satellite imagery. FIA used the imagery to form two initial strata—forest and nonforest. Pixels within 60 m (2 pixel widths) of a forest/nonforest boundary formed two additional strata—forest edge and nonforest edge. Forest pixels within 60 m 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. The estimated population total for a variable is the sum across all strata of the product of each stratum's estimated area and the variable's estimated mean per unit area for the stratum.

Phase 2

Phase 2 of the inventory consisted of the measurement of the annual sample of 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 1990 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 is being conducted (1 plot for approximately every 2,000 acres). The 2000–2003 annual inventories collected data from 8,301 phase 2 field plots.

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 uniformly 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. We anticipate that in Michigan the complete 5-year annual inventory will include measurement of about 10,375 phase 2 forested plots. The 2000–2003 annual inventory results represent field measures on 8,301 phase 2 forested plots and 175 phase 3 field plots.

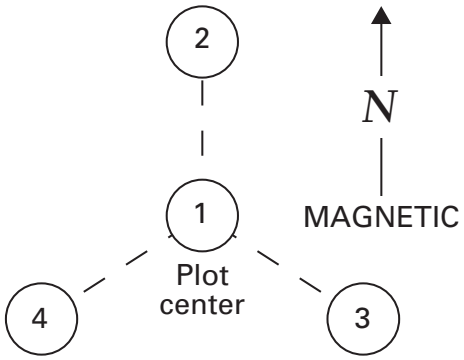

Figure 9.—NCFIA field plot configuration.

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 design 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 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 published tables generated from less than five panels of data is limited. However, at www.ncrs.fs.fed.us/4801/fiadb/index.htm, other tabular data can be generated.

For additional information, contact:

Program Manager
Forest Inventory and Analysis
North Central Research Station
1992 Folwell Ave.
St. Paul, MN 55108-1034

or

State Forester
Michigan Department of Natural Resources
Forest Management Division
Box 30452
Lansing, MI 48909-7952

LITERATURE CITED

Avery, T.E.; Burkhart, H.E. 1994.
Forest measurements. New York, NY: McGraw-Hill. 408 p.

Leatherberry, E.C. 2002.
Michigan's forest resources in 2000. Res. Note. NC-379. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 8 p. [Available only online at: http://www.ncrs.fs.fed.us.]

Leatherberry, E.C.; Brand, G.J. 2003.
Michigan's forest resources in 2001. Resour. Bull. NC-224. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 23 p. [Available only online at: http://www.ncrs.fs.fed.us.]

Leatherberry, E.C.; Spencer, J.S., Jr. 1996.
Michigan forest statistics, 1993. Resour. Bull. NC-170. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 144 p.

Leatherberry, E.C.; Kingsley, N.P.; Birch, T.W. 1998.
Private timberland owners of Michigan, 1994. Resour. Bull. NC-191. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 84 p.

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

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

Schmidt, T.L.; Spencer, J.S., Jr.; Bertsch, R. 1997
Michigan's forests 1993: an analysis. Resour. Bull NC-179. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 96 p.

TABLE TITLES

Table 1.—*Area of forest land by forest type group, forest type, and owner category, Michigan, 2000–2003*

Table 2.—*Area of timberland by major forest type group, stand origin, and owner category, Michigan, 2000–2003*

Table 3.—*Area of timberland by forest type group, forest type, and stand-size class, Michigan, 2000–2003*

Table 4.—*Net volume of all live trees on forest land by species group, species, and owner category, Michigan, 2000–2003*

Table 5.—*Net volume of all live trees and salvable dead trees on timberland by class of timber and softwood/hardwood species category, Michigan, 2000–2003*

Table 6.—*Net volume of growing stock on timberland by forest type group, forest type, and softwood/hardwood species category, Michigan, 2000–2003*

Table 7.—*Net volume of growing stock on timberland by species group, species, and diameter class, Michigan, 2000–2003*

Table 8.—*Net volume of sawtimber on timberland by species group, species, and diameter class, Michigan, 2000–2003*

Table 9.—*All live aboveground tree biomass on timberland by owner category, softwood/hardwood species category, and tree component, Michigan, 2000–2003*

Table 10.—*Average annual net growth of growing stock on timberland by species group and owner category, Michigan, 1993 to 2000–2003*

Table 11.—*Average annual removals of growing stock on timberland by species group and owner category, Michigan, 1993 to 2000–2003*

Table 12.—*Average annual mortality of growing stock on timberland by species group and owner category, Michigan, 1993 to 2000–2003*

TABLES

Table 1. -- Area of forest land by forest type group, forest type, and owner category, Michigan, 2000-2003

(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	715.3	546.1	169.2	- -
Red pine	886.0	560.8	325.2	- -
Eastern white pine	278.6	127.8	150.8	- -
White pine / hemlock	41.1	19.7	21.4	- -
Eastern hemlock	77.7	31.9	45.8	- -
All forest types	1,998.7	1,286.2	712.5	- -
Spruce / fir group				
Balsam fir	389.9	159.8	230.1	- -
White spruce	167.8	74.3	93.5	- -
Black spruce	493.7	279.6	214.1	- -
Tamarack	207.5	105.0	102.6	- -
Northern white-cedar	1,351.7	617.3	734.4	- -
All forest types	2,610.6	1,236.0	1,374.7	- -
Pinyon / juniper group				
Eastern redcedar	4.1	- -	4.1	- -
All forest types	4.1	- -	4.1	- -
Douglas-fir group				
Douglas-fir	5.6	2.5	3.0	- -
All forest types	5.6	2.5	3.0	- -
Fir / spruce / mountain hemlock group				
Blue spruce	15.2	- -	15.2	- -
All forest types	15.2	- -	15.2	- -
Exotic softwoods group				
Exotic softwoods group	1.7	- -	1.7	- -
Scotch pine	134.5	5.7	128.8	- -
Other exotic softwoods	21.4	0.6	20.7	- -
Norway spruce	0.3	- -	0.3	- -
All forest types	157.8	6.3	151.5	- -
All softwood groups	4,792.1	2,531.1	2,261.0	- -
Hardwood type groups				
Oak / pine group				
Oak / pine group	1.7	1.4	0.3	- -
White pine / red oak / white ash	164.5	62.5	102.0	- -
Eastern redcedar / hardwood	7.4	- -	7.4	- -
Other pine / hardwood	351.0	198.3	152.7	- -
All forest types	524.6	262.2	262.4	- -

(Table 1 continued on next page)

(Table 1 continued)

Forest type group/ forest type	Owner category			
	All owners	Public	Private	Unidentified owner
Hardwood type groups				
Oak / hickory group				
Oak / hickory group	5.6	0.6	5.0	- -
Post oak / blackjack oak	232.1	82.3	149.9	- -
White oak / red oak / hickory	1,114.3	358.5	755.9	- -
White oak	216.0	89.8	126.2	- -
Northern red oak	518.4	201.5	316.9	- -
Yellow-poplar / white oak / red oak	15.5	- -	15.5	- -
Sassafras / persimmon	47.7	5.8	41.9	- -
Bur oak	7.1	0.9	6.2	- -
Black walnut	15.8	0.6	15.1	- -
Black locust	7.3	0.7	6.7	- -
Chestnut oak / black oak / scarlet oak	63.0	38.3	24.7	- -
Red maple / oak	167.7	34.1	133.6	- -
Mixed upland hardwoods	202.0	16.2	185.8	- -
All forest types	2,612.5	829.3	1,783.3	- -
Oak / gum / cypress group				
Sweetbay / swamp tupelo / red maple	58.5	13.1	45.4	- -
All forest types	58.5	13.1	45.4	- -
Elm / ash / cottonwood group				
Elm / ash / cottonwood group	3.3	- -	3.3	- -
Black ash / American elm / red maple	680.7	179.4	501.3	- -
River birch / sycamore	28.5	10.3	18.3	- -
Cottonwood	39.2	8.0	31.3	- -
Willow	57.7	5.0	52.8	- -
Sycamore / pecan / American elm	51.8	8.9	42.9	- -
Sugarberry / hackberry / elm / green ash	307.0	48.7	258.3	- -
Silver maple / American elm	115.1	25.9	89.2	- -
Red maple / lowland	155.9	47.3	108.7	- -
Cottonwood / willow	17.8	0.6	17.2	- -
All forest types	1,457.1	334.0	1,123.1	- -
Maple / beech / birch group				
Maple / beech / birch group	14.3	5.9	8.3	- -
Sugar maple / beech / yellow birch	4,128.3	1,236.3	2,892.0	- -
Black cherry	184.0	63.2	120.9	- -
Cherry / ash / yellow-poplar	248.4	72.6	175.8	- -
Hard maple / basswood	1,192.3	391.7	800.6	- -
Elm / ash / locust	109.2	16.5	92.7	- -
Red maple / upland	615.7	182.6	433.1	- -
All forest types	6,492.3	1,968.8	4,523.5	- -
Aspen / birch group				
Aspen / birch group	4.7	0.1	4.6	- -
Aspen	2,528.0	1,165.0	1,363.0	- -
Paper birch	387.7	180.2	207.6	- -
Balsam poplar	242.7	45.4	197.4	- -
All forest types	3,163.2	1,390.7	1,772.5	- -
Exotic hardwoods group				
Other exotic hardwoods	3.0	- -	3.0	- -
All forest types	3.0	- -	3.0	- -

(Table 1 continued on next page)

(Table 1 continued)

Forest type group/ forest type	Owner category			
	All owners	Public	Private	Unidentified owner
Hardwood type groups				
All hardwood groups	14,311.3	4,798.1	9,513.2	- -
Nonstocked	150.7	55.6	95.0	- -
All forest groups	19,254.0	7,384.8	11,869.3	- -

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 2. -- Area of timberland by major forest type group, stand origin, and owner category, Michigan, 2000-2003

(In thousand acres)

Major forest type group and stand origin	Owner category			
	All owners	Public	Private	Unidentified owner
Softwood type groups				
Natural	3,557.2	1,826.9	1,730.3	- -
Planted	1,027.3	554.6	472.7	- -
All softwood types	4,584.5	2,381.6	2,202.9	- -
Hardwood type groups				
Natural	13,763.1	4,433.3	9,329.8	- -
Planted	193.6	98.6	95.0	- -
All hardwood types	13,956.7	4,531.9	9,424.8	- -
Nonstocked	146.7	51.7	95.0	- -
All groups	18,687.9	6,965.1	11,722.8	- -

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 3. -- Area of timberland by forest type group, forest type, and stand-size class, Michigan, 2000-2003

(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	662.7	157.6	304.9	200.3	- -
Red pine	874.2	499.9	315.0	59.2	- -
Eastern white pine	265.7	171.2	71.1	23.4	- -
White pine / hemlock	41.1	41.1	- -	- -	- -
Eastern hemlock	55.8	49.9	5.9	- -	- -
All forest types	1,899.6	919.8	696.9	282.9	- -
Spruce / fir group					
Balsam fir	372.9	71.7	137.1	164.1	- -
White spruce	159.1	51.0	77.5	30.5	- -
Black spruce	479.0	41.5	199.9	237.6	- -
Tamarack	202.4	36.2	66.2	100.0	- -
Northern white-cedar	1,291.5	458.0	716.7	116.8	- -
All forest types	2,504.9	658.4	1,197.4	649.1	- -
Pinyon / juniper group					
Eastern redcedar	4.1	- -	1.4	2.7	- -
All forest types	4.1	- -	1.4	2.7	- -
Douglas-fir group					
Douglas-fir	5.6	2.5	3.0	- -	- -
All forest types	5.6	2.5	3.0	- -	- -
Fir / spruce / mountain hemlock group					
Blue spruce	15.2	1.3	3.1	10.8	- -
All forest types	15.2	1.3	3.1	10.8	- -
Exotic softwoods group					
Exotic softwoods group	1.7	0.4	0.9	0.3	- -
Scotch pine	131.8	42.4	58.4	31.0	- -
Other exotic softwoods	21.4	14.3	2.5	4.6	- -
Norway spruce	0.3	- -	0.3	- -	- -
All forest types	155.2	57.1	62.1	35.9	- -
All softwood groups	4,584.5	1,639.2	1,963.9	981.5	- -
Hardwood type groups					
Oak / pine group					
Oak / pine group	1.7	- -	1.7	- -	- -
White pine / red oak / white ash	157.6	49.4	84.1	24.2	- -
Eastern redcedar / hardwood	7.4	- -	3.0	4.3	- -
Other pine / hardwood	336.3	138.4	102.6	95.4	- -
All forest types	503.0	187.8	191.4	123.9	- -

(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	5.6	- -	1.8	3.8	- -
Post oak / blackjack oak	226.9	107.2	69.6	50.1	- -
White oak / red oak / hickory	1,111.7	650.1	323.7	137.9	- -
White oak	213.9	144.8	48.6	20.5	- -
Northern red oak	507.3	385.7	97.5	24.0	- -
Yellow-poplar / white oak / red oak	15.5	7.4	8.1	- -	- -
Sassafras / persimmon	47.7	12.7	22.6	12.5	- -
Bur oak	7.1	4.4	2.7	- -	- -
Black walnut	15.8	10.4	1.9	3.4	- -
Black locust	7.3	3.0	2.3	2.0	- -
Chestnut oak / black oak / scarlet oak	63.0	21.9	17.2	23.9	- -
Red maple / oak	167.7	56.1	86.3	25.3	- -
Mixed upland hardwoods	202.0	62.7	54.3	85.0	- -
All forest types	2,591.5	1,466.5	736.5	388.6	- -
Oak / gum / cypress group					
Sweetbay / swamp tupelo / red maple	58.5	29.1	22.5	7.0	- -
All forest types	58.5	29.1	22.5	7.0	- -
Elm / ash / cottonwood group					
Elm / ash / cottonwood group	3.3	0.0	2.6	0.7	- -
Black ash / American elm / red maple	659.5	188.6	337.0	133.8	- -
River birch / sycamore	28.5	8.7	5.2	14.7	- -
Cottonwood	39.2	29.7	6.5	3.1	- -
Willow	57.7	11.2	9.1	37.4	- -
Sycamore / pecan / American elm	51.8	9.9	21.6	20.3	- -
Sugarberry / hackberry / elm / green ash	303.5	141.9	100.2	61.4	- -
Silver maple / American elm	115.1	91.8	16.8	6.4	- -
Red maple / lowland	153.1	52.9	57.3	43.0	- -
Cottonwood / willow	17.8	9.9	7.9	- -	- -
All forest types	1,429.6	544.7	564.1	320.7	- -
Maple / beech / birch group					
Maple / beech / birch group	14.3	5.7	6.5	2.1	- -
Sugar maple / beech / yellow birch	3,998.5	2,080.4	1,659.2	258.9	- -
Black cherry	180.4	33.7	33.1	113.7	- -
Cherry / ash / yellow-poplar	243.9	44.3	75.7	123.9	- -
Hard maple / basswood	1,174.4	644.3	487.1	42.9	- -
Elm / ash / locust	109.2	26.7	56.1	26.4	- -
Red maple / upland	603.4	197.4	333.2	72.8	- -
All forest types	6,324.1	3,032.4	2,651.0	640.7	- -
Aspen / birch group					
Aspen / birch group	4.7	0.8	0.5	3.5	- -
Aspen	2,477.5	483.7	1,070.0	923.8	- -
Paper birch	327.1	80.7	200.7	45.7	- -
Balsam poplar	237.6	27.2	94.5	115.9	- -
All forest types	3,046.9	592.4	1,365.7	1,088.8	- -
Exotic hardwoods group					
Other exotic hardwoods	3.0	- -	- -	3.0	- -
All forest types	3.0	- -	- -	3.0	- -
All hardwood groups	13,956.7	5,852.9	5,531.1	2,572.7	- -

(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					
Nonstocked	146.7	- -	- -	- -	146.7
All forest groups	18,687.9	7,492.0	7,495.0	3,554.2	146.7

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, 2000-2003

(In thousand cubic feet)

Species group/ species	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Other yellow pines				
Scotch pine	160,610	5,710	154,900	- -
All species	160,610	5,710	154,900	- -
Eastern white and red pines				
Red pine	2,042,016	1,326,126	715,890	- -
Eastern white pine	1,325,168	607,274	717,895	- -
All species	3,367,184	1,933,400	1,433,784	- -
Jack pine				
Jack pine	529,972	369,157	160,815	- -
All species	529,972	369,157	160,815	- -
Spruce and balsam fir				
Balsam fir	681,654	260,356	421,298	- -
White spruce	571,155	273,835	297,320	- -
Black spruce	469,320	250,167	219,153	- -
All species	1,722,128	784,357	937,771	- -
Eastern hemlock				
Eastern hemlock	893,752	383,680	510,072	- -
All species	893,752	383,680	510,072	- -
Other eastern softwoods				
Eastern redcedar	5,890	1,331	4,559	- -
Larch spp.	739	697	43	- -
Tamarack (native)	251,968	114,767	137,201	- -
Norway spruce	32,514	1,545	30,970	- -
Blue spruce	6,784	298	6,486	- -
Austrian pine	16,875	39	16,836	- -
Douglas-fir	10,713	1,892	8,821	- -
Northern white-cedar	2,560,361	1,151,435	1,408,926	- -
All species	2,885,845	1,272,005	1,613,840	- -
Total softwoods	9,559,492	4,748,309	4,811,183	- -
Hardwoods				
Select white oaks				
White oak	634,560	227,485	407,075	- -
Swamp white oak	68,860	11,427	57,433	- -
Bur oak	91,945	10,995	80,949	- -
Chinkapin oak	7,399	729	6,670	- -
All species	802,763	250,635	552,128	- -
Select red oaks				
Northern red oak	1,510,513	556,370	954,144	- -
Shumard oak		- -		- -
All species	1,510,513	556,370	954,144	- -
Other white oaks				
Chestnut oak	1,031	- -	1,031	- -
All species	1,031	- -	1,031	- -

(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	820	820	- -	- -
Northern pin oak	244,185	94,299	149,885	- -
Shingle oak	120	- -	120	- -
Pin oak	9,607	3,122	6,485	- -
Black oak	518,039	188,401	329,637	- -
All species	772,771	286,643	486,128	- -
Hickory				
Bitternut hickory	64,596	3,918	60,678	- -
Pignut hickory	41,852	6,940	34,912	- -
Pecan		- -		- -
Shellbark hickory	9,817	838	8,979	- -
Shagbark hickory	56,924	3,744	53,180	- -
Mockernut hickory	8,550	2,310	6,240	- -
All species	181,739	17,751	163,989	- -
Yellow birch				
Yellow birch	674,090	280,839	393,252	- -
All species	674,090	280,839	393,252	- -
Hard maple				
Black maple	7,664	3,991	3,673	- -
Sugar maple	4,508,323	1,510,793	2,997,530	- -
All species	4,515,986	1,514,784	3,001,202	- -
Soft maple				
Red maple	3,623,875	1,169,231	2,454,644	- -
Silver maple	520,456	97,397	423,059	- -
All species	4,144,331	1,266,628	2,877,703	- -
Beech				
American beech	517,845	190,531	327,315	- -
All species	517,845	190,531	327,315	- -
Tupelo and blackgum				
Blackgum	12,905	1,943	10,961	- -
All species	12,905	1,943	10,961	- -
Ash				
White ash	454,850	111,538	343,312	- -
Black ash	375,225	130,562	244,663	- -
Green ash	525,899	78,954	446,945	- -
Blue ash	692	- -	692	- -
All species	1,356,665	321,054	1,035,611	- -
Cottonwood and aspen				
Balsam poplar	229,274	67,731	161,543	- -
Eastern cottonwood	139,658	11,909	127,749	- -
Bigtooth aspen	1,216,868	460,940	755,927	- -
Quaking aspen	1,639,300	681,495	957,805	- -
All species	3,225,100	1,222,076	2,003,024	- -
Basswood				
American basswood	835,685	296,723	538,962	- -
All species	835,685	296,723	538,962	- -

(Table 4 continued on next page)

(Table 4 continued)

Species group/ species	Owner category			
	All owners	Public	Private	Unidentified owner
Hardwoods				
Yellow-poplar				
Yellow-poplar	45,938	6,102	39,836	- -
All species	45,938	6,102	39,836	- -
Black walnut				
Black walnut	57,106	5,590	51,516	- -
All species	57,106	5,590	51,516	- -
Other eastern soft hardwoods				
Boxelder	33,208	2,838	30,371	- -
Ohio buckeye	120	- -	120	- -
European Alder	689	- -	689	- -
River birch	310	65	245	- -
Paper birch	719,673	328,815	390,858	- -
Northern catalpa	533	- -	533	- -
Hackberry	5,640	41	5,600	- -
Butternut	7,326	20	7,306	- -
American sycamore	31,237	686	30,551	- -
Black cherry	723,608	191,262	532,346	- -
Black willow	54,726	5,788	48,938	- -
White willow	1,966	329	1,636	- -
Sassafras	58,674	9,449	49,225	- -
American elm	223,856	33,050	190,806	- -
Siberian elm	344	284	60	- -
Slippery elm	25,681	968	24,712	- -
All species	1,887,592	573,595	1,313,997	- -
Other eastern hard hardwoods				
Flowering dogwood	492	130	362	- -
Honeylocust	2,177	84	2,094	- -
Kentucky coffeetree	100	- -	100	- -
White mulberry	504	90	414	- -
Red mulberry	1,836	47	1,788	- -
Black locust	27,766	1,452	26,314	- -
Rock elm	1,408	- -	1,408	- -
All species	34,283	1,802	32,481	- -

(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	974	331	643	- -
Mountain maple	151	21	130	- -
Ailanthus	1,064	23	1,041	- -
Serviceberry spp.	2,441	909	1,532	- -
Pawpaw		- -		- -
American hornbeam, musclewood	1,047	45	1,002	- -
American chestnut	917	- -	917	- -
Hawthorn spp.	3,419	164	3,255	- -
Cockspur hawthorn	177	177	- -	- -
Downy hawthorn	147	- -	147	- -
Apple spp.	12,278	1,326	10,951	- -
Eastern hophornbeam	58,479	15,979	42,500	- -
Cherry and plum spp.	377	- -	377	- -
Pin cherry	2,992	527	2,465	- -
Chokecherry	928	373	555	- -
Willow spp.	791	- -	791	- -
Peachleaf willow	2,430	384	2,046	- -
American mountain-ash	738	153	585	- -
Russian-olive		- -	- -	- -
Other or unknown tree	21	- -	21	- -
All species	89,371	20,410	68,960	- -
Total hardwoods	20,665,714	6,813,475	13,852,240	- -
All species groups	30,225,206	11,561,784	18,663,423	- -

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

Table 5. -- Net volume of all live trees and salvable dead trees on timberland by class of timber and softwood/hardwood species category, Michigan, 2000-2003

(In thousand cubic feet)

Class of timber	All species	Softwood species	Hardwood species
Live trees			
Growing-stock trees			
Sawtimber			
Saw log portion	12,841,304	4,978,246	7,863,059
Upper stem portion	3,705,375	702,152	3,003,223
Total	16,546,679	5,680,398	10,866,282
Poletimber	10,778,661	3,104,670	7,673,990
All growing-stock trees	27,325,340	8,785,068	18,540,272
Cull trees			
Rough trees[1]			
Sawtimber size	1,147,692	196,238	951,454
Poletimber size	638,494	131,663	506,831
Total	1,786,186	327,901	1,458,286
Rotten trees[1]			
Sawtimber size	129,339	24,172	105,168
Poletimber size	34,353	6,981	27,371
Total	163,692	31,153	132,539
All live cull trees	1,949,878	359,054	1,590,825
All live trees	29,275,218	9,144,121	20,131,097
Salvable dead trees			
Sawtimber size	497,984	204,405	293,579
Poletimber size	478,963	152,626	326,338
All salvable dead trees	976,948	357,031	619,917
All classes	30,252,166	9,501,152	20,751,014

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

[1] Includes noncommercial species.

Table 6. -- Net volume of growing stock on timberland by forest type group, forest type, and softwood/hardwood species category, Michigan, 2000-2003

(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	524,305	471,558	52,748
Red pine	1,841,356	1,709,753	131,603
Eastern white pine	574,321	499,265	75,056
White pine / hemlock	113,957	88,547	25,411
Eastern hemlock	150,307	102,902	47,405
All forest types	3,204,247	2,872,024	332,222
Spruce / fir group			
Balsam fir	325,990	237,037	88,953
White spruce	206,861	174,048	32,813
Black spruce	395,249	356,206	39,043
Tamarack	153,837	142,914	10,923
Northern white-cedar	2,376,119	2,055,972	320,148
All forest types	3,458,056	2,966,176	491,880
Pinyon / juniper group			
Eastern redcedar	461	333	129
All forest types	461	333	129
Douglas-fir group			
Douglas-fir	6,266	6,266	- -
All forest types	6,266	6,266	- -
Fir / spruce / mountain hemlock group			
Blue spruce	6,418	6,377	41
All forest types	6,418	6,377	41
Exotic softwoods group			
Exotic softwoods group	2,702	2,553	149
Scotch pine	149,231	134,581	14,650
Other exotic softwoods	34,759	29,817	4,942
Norway spruce	821	821	- -
All forest types	187,514	167,773	19,741
All softwood groups	6,862,962	6,018,949	844,013
Hardwood type groups			
Oak / pine group			
Oak / pine group	2,841	554	2,287
White pine / red oak / white ash	213,830	125,140	88,690
Eastern redcedar / hardwood	1,624	283	1,342
Other pine / hardwood	393,977	212,902	181,075
All forest types	612,272	338,878	273,394

(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	7,038	- -	7,038
Post oak / blackjack oak	191,157	14,839	176,318
White oak / red oak / hickory	1,697,547	98,591	1,598,956
White oak	320,745	13,415	307,329
Northern red oak	907,821	39,882	867,939
Yellow-poplar / white oak / red oak	35,480	815	34,665
Sassafras / persimmon	67,419	1,834	65,585
Bur oak	22,173	- -	22,173
Black walnut	24,283	- -	24,283
Black locust	5,731	1,719	4,012
Chestnut oak / black oak / scarlet oak	50,199	5,188	45,011
Red maple / oak	239,071	9,416	229,655
Mixed upland hardwoods	205,351	16,420	188,932
All forest types	3,774,015	202,118	3,571,897
Oak / gum / cypress group			
Sweetbay / swamp tupelo / red maple	110,147	8,458	101,689
All forest types	110,147	8,458	101,689
Elm / ash / cottonwood group			
Elm / ash / cottonwood group	4,341	- -	4,341
Black ash / American elm / red maple	832,819	172,268	660,550
River birch / sycamore	28,897	2,016	26,881
Cottonwood	66,455	576	65,880
Willow	13,802	1,603	12,199
Sycamore / pecan / American elm	54,199	4,801	49,398
Sugarberry / hackberry / elm / green ash	351,625	13,685	337,940
Silver maple / American elm	316,042	6,803	309,239
Red maple / lowland	176,418	25,853	150,565
Cottonwood / willow	33,151	829	32,322
All forest types	1,877,749	228,434	1,649,315
Maple / beech / birch group			
Maple / beech / birch group	28,607	12,452	16,155
Sugar maple / beech / yellow birch	7,027,450	1,068,607	5,958,843
Black cherry	109,520	6,547	102,973
Cherry / ash / yellow-poplar	205,854	16,960	188,894
Hard maple / basswood	2,328,178	55,843	2,272,335
Elm / ash / locust	108,205	2,493	105,713
Red maple / upland	993,964	112,936	881,029
All forest types	10,801,779	1,275,838	9,525,942

(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	4,155	1,840	2,315
Aspen	2,671,281	507,980	2,163,301
Paper birch	410,474	140,724	269,751
Balsam poplar	190,968	56,007	134,962
All forest types	3,276,878	706,550	2,570,328
All hardwood groups	20,452,841	2,760,276	17,692,564
Nonstocked	9,537	5,842	3,695
All forest groups	27,325,340	8,785,068	18,540,272

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

Table 7. -- Net volume of growing stock on timberland by species group, species, and diameter class, Michigan, 2000-2003

(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	142,632	22,800	34,286	38,948	24,956	11,120	8,144	2,379	- -	- -	- -
All species	142,632	22,800	34,286	38,948	24,956	11,120	8,144	2,379	- -	- -	- -
Eastern white and red pines											
Red pine	1,997,386	179,144	385,884	437,393	361,190	243,805	160,016	93,443	68,382	68,130	- -
Eastern white pine	1,231,070	64,785	94,879	118,320	120,899	125,731	133,343	125,158	112,223	274,885	60,846
All species	3,228,456	243,929	480,763	555,713	482,089	369,536	293,358	218,601	180,605	343,015	60,846
Jack pine											
Jack pine	488,951	94,136	153,887	120,156	71,993	32,155	13,131	2,639	854	- -	- -
All species	488,951	94,136	153,887	120,156	71,993	32,155	13,131	2,639	854	- -	- -
Spruce and balsam fir											
Balsam fir	659,075	248,053	216,183	118,915	48,772	19,243	5,047	1,162	1,701	- -	- -
White spruce	514,878	71,192	97,161	93,507	93,021	67,384	42,103	20,187	20,157	10,166	- -
Black spruce	451,661	161,042	151,704	80,900	33,829	15,186	3,879	2,218	1,831	1,073	- -
All species	1,625,614	480,287	465,048	293,321	175,622	101,812	51,029	23,567	23,689	11,239	- -
Eastern hemlock											
Eastern hemlock	735,334	19,774	44,107	65,437	84,090	99,987	110,186	103,290	81,810	117,809	8,842
All species	735,334	19,774	44,107	65,437	84,090	99,987	110,186	103,290	81,810	117,809	8,842
Other eastern softwoods											
Eastern redcedar	4,352	805	1,048	1,090	567	841	- -	- -	- -	- -	- -
Larch spp.	739	43	62	- -	241	394	- -	- -	- -	- -	- -
Tamarack (native)	238,519	57,519	59,919	52,411	35,965	16,721	11,236	3,964	784	- -	- -
Norway spruce	31,325	3,437	4,767	8,080	6,191	3,525	2,252	3,073	- -	- -	- -
Blue spruce	6,401	1,775	1,649	1,859	1,118	- -	- -	- -	- -	- -	- -
Austrian pine	15,879	1,371	3,308	4,991	3,670	2,540	- -	- -	- -	- -	- -
Douglas-fir	10,267	512	1,803	633	1,825	944	1,181	728	976	1,665	- -
Northern white-cedar	2,256,599	390,667	536,968	467,676	334,133	226,686	137,760	66,242	41,239	44,279	10,949
All species	2,564,082	456,128	609,525	536,741	383,710	251,650	152,428	74,006	42,999	45,945	10,949
Total softwoods	8,785,068	1,317,054	1,787,616	1,610,316	1,222,460	866,261	628,277	424,483	329,957	518,007	80,637
Hardwoods											
Select white oaks											
White oak	569,768	31,986	54,446	69,852	84,994	76,991	65,172	65,515	47,196	64,444	9,173
Swamp white oak	65,873	3,086	5,279	6,615	8,430	8,636	6,771	4,859	5,935	16,263	- -
Bur oak	85,699	2,346	3,345	7,057	5,283	7,331	5,717	6,732	9,994	18,519	19,375
Chinkapin oak	4,066	138	293	609	844	- -	549	729	905	- -	- -
All species	725,406	37,556	63,361	84,133	99,551	92,958	78,208	77,835	64,030	99,226	28,548
Select red oaks											
Northern red oak	1,400,112	45,108	86,878	160,911	206,545	190,329	229,137	167,134	111,151	176,229	26,691
Shumard oak		- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
All species	1,400,112	45,108	86,878	160,911	206,545	190,329	229,137	167,134	111,151	176,229	26,691
Other white oaks											
Chestnut oak	1,031	- -	69	- -	- -	- -	962	- -	- -	- -	- -
All species	1,031	- -	69	- -	- -	- -	962	- -	- -	- -	- -
Other red oaks											
Scarlet oak	820	26	146	- -	296	- -	351	- -	- -	- -	- -
Northern pin oak	211,868	9,239	19,941	27,671	33,667	32,853	28,850	16,826	18,799	24,021	- -
Shingle oak	65	- -	65	- -	- -	- -	- -	- -	- -	- -	- -
Pin oak	9,056	206	312	475	1,488	1,782	596	2,458	667	1,073	- -
Black oak	467,286	14,338	32,773	48,912	49,965	68,583	58,018	60,848	50,203	69,210	14,437
All species	689,095	23,809	53,236	77,058	85,416	103,218	87,816	80,131	69,669	94,305	14,437

(Table 7 continued on next page)

(Table 7 continued)

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+
Hardwoods											
Hickory											
Bitternut hickory	62,898	4,006	6,867	8,571	10,128	9,431	5,307	9,740	3,984	4,864	- -
Pignut hickory	39,091	2,270	3,130	3,069	7,574	5,895	5,246	2,593	3,678	5,637	- -
Pecan		- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Shellbark hickory	9,817	300	699	1,534	1,209	1,522	2,022	- -	- -	2,532	- -
Shagbark hickory	50,916	4,141	6,279	6,212	9,181	7,323	7,791	819	5,818	3,350	- -
Mockernut hickory	7,891	334	977	1,005	2,693	1,318	540	- -	1,025	- -	- -
All species	170,613	11,051	17,951	20,390	30,785	25,489	20,906	13,152	14,505	16,382	- -
Yellow birch											
Yellow birch	530,600	40,977	72,324	79,680	76,129	67,776	61,374	45,660	32,335	43,583	10,762
All species	530,600	40,977	72,324	79,680	76,129	67,776	61,374	45,660	32,335	43,583	10,762
Hard maple											
Black maple	4,224	216	352	1,095	- -	- -	- -	- -	1,093	1,468	- -
Sugar maple	4,133,236	400,612	671,741	788,427	717,198	584,226	383,125	257,906	131,209	180,805	17,987
All species	4,137,460	400,828	672,092	789,522	717,198	584,226	383,125	257,906	132,301	182,274	17,987
Soft maple											
Red maple	3,257,643	400,001	601,471	646,517	542,152	380,627	256,763	176,133	103,341	127,755	22,883
Silver maple	477,402	20,733	32,374	49,212	56,090	53,902	58,104	53,287	39,898	79,443	34,358
All species	3,735,046	420,734	633,844	695,729	598,242	434,529	314,867	229,421	143,239	207,198	57,241
Beech											
American beech	420,117	31,872	40,871	57,875	61,544	52,681	54,083	50,142	26,963	44,084	- -
All species	420,117	31,872	40,871	57,875	61,544	52,681	54,083	50,142	26,963	44,084	- -
Tupelo and blackgum											
Blackgum	11,694	1,343	2,673	2,958	1,015	1,278	945	1,482	- -	- -	- -
All species	11,694	1,343	2,673	2,958	1,015	1,278	945	1,482	- -	- -	- -
Ash											
White ash	425,139	24,707	45,068	62,678	67,829	69,228	50,050	35,818	21,363	40,561	7,836
Black ash	337,678	101,744	86,839	63,934	39,192	26,040	10,649	4,247	2,710	2,321	- -
Green ash	501,100	50,081	78,476	91,119	81,785	66,316	49,261	30,728	19,460	30,230	3,644
Blue ash	692	- -	- -	- -	- -	- -	- -	692	- -	- -	- -
All species	1,264,608	176,533	210,383	217,732	188,806	161,584	109,960	71,485	43,534	73,112	11,480
Cottonwood and aspen											
Balsam poplar	219,998	30,500	38,478	40,616	37,356	32,248	20,247	15,000	4,307	1,246	- -
Eastern cottonwood	133,766	2,187	4,105	6,043	6,885	12,181	9,670	18,852	13,919	35,490	24,434
Bigtooth aspen	1,152,590	128,813	153,687	196,117	200,968	191,122	140,382	67,566	41,567	32,368	- -
Quaking aspen	1,499,613	206,401	254,334	280,217	261,084	215,791	137,401	78,164	45,992	20,227	- -
All species	3,005,965	367,901	450,603	522,994	506,293	451,342	307,700	179,581	105,786	89,331	24,434
Basswood											
American basswood	779,258	35,087	85,210	131,361	160,045	139,241	99,601	50,745	36,416	31,417	10,134
All species	779,258	35,087	85,210	131,361	160,045	139,241	99,601	50,745	36,416	31,417	10,134
Yellow-poplar											
Yellow-poplar	44,505	658	1,520	1,936	4,020	6,749	7,476	6,651	6,526	6,804	2,164
All species	44,505	658	1,520	1,936	4,020	6,749	7,476	6,651	6,526	6,804	2,164
Black walnut											
Black walnut	50,302	2,567	4,105	3,813	6,198	6,563	2,632	6,111	6,437	6,062	5,814
All species	50,302	2,567	4,105	3,813	6,198	6,563	2,632	6,111	6,437	6,062	5,814

(Table 7 continued on next page)

(Table 7 continued)

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+
Hardwoods											
Other eastern soft hardwoods											
Boxelder	17,150	2,846	3,666	3,959	2,642	1,293	1,061	708	976	--	--
Ohio buckeye	95	--	95	--	--	--	--	--	--	--	--
European Alder	260	187	73	--	--	--	--	--	--	--	--
River birch	207	141	66	--	--	--	--	--	--	--	--
Paper birch	605,759	92,238	142,249	143,646	107,921	60,999	28,977	18,661	7,576	3,491	--
Northern catalpa	511	41	--	--	172	299	--	--	--	--	--
Hackberry	5,230	495	563	973	1,015	457	752	--	975	--	--
Butternut	5,496	74	356	--	598	1,942	1,092	738	695	--	--
American sycamore	31,237	197	617	1,324	2,151	1,832	1,328	7,173	7,108	6,046	3,460
Black cherry	571,984	56,190	85,622	106,070	111,947	76,885	52,963	31,767	18,108	24,884	7,549
Black willow	35,539	983	2,752	3,281	2,299	4,639	5,522	4,930	2,693	5,397	3,042
White willow	368	39	--	--	--	329	--	--	--	--	--
Sassafras	47,817	8,891	11,080	9,322	6,847	5,940	2,948	1,308	1,482	--	--
American elm	201,585	45,710	48,033	38,913	26,885	17,571	10,888	5,806	2,981	4,798	--
Siberian elm	278	60	--	--	217	--	--	--	--	--	--
Slippery elm	24,397	3,653	3,913	4,859	4,061	2,481	1,296	1,513	--	2,621	--
All species	1,547,912	211,744	299,084	312,347	266,757	174,666	106,828	72,604	42,594	47,236	14,051
Other eastern hard hardwoods											
Flowering dogwood	71	--	71	--	--	--	--	--	--	--	--
Honeylocust	2,115	191	84	--	--	--	1,090	751	--	--	--
Kentucky coffeetree	100	100	--	--	--	--	--	--	--	--	--
White mulberry	90	90	--	--	--	--	--	--	--	--	--
Red mulberry	397	100	106	191	--	--	--	--	--	--	--
Black locust	22,751	3,305	5,441	3,796	1,738	1,131	1,766	1,767	1,481	2,326	--
Rock elm	1,025	103	--	--	--	399	522	--	--	--	--
All species	26,548	3,889	5,701	3,986	1,738	1,530	3,379	2,518	1,481	2,326	--
Total hardwoods	18,540,272	1,811,658	2,699,907	3,162,426	3,010,281	2,494,161	1,868,999	1,312,559	836,968	1,119,570	223,742
All species groups	27,325,340	3,128,712	4,487,523	4,772,742	4,232,741	3,360,422	2,497,277	1,737,042	1,166,925	1,637,578	304,379

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

Table 8. -- Net volume of sawtimber on timberland by species group, species, and diameter class, Michigan, 2000-2003

(In thousand 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	419,403	183,603	122,137	57,142	43,412	13,108	- -	- -	- -
All species	419,403	183,603	122,137	57,142	43,412	13,108	- -	- -	- -
Eastern white and red pines									
Red pine	7,522,954	2,199,142	1,853,171	1,287,660	870,578	521,107	390,167	401,128	- -
Eastern white pine	5,608,405	540,090	569,202	617,858	680,440	661,338	609,542	1,565,238	364,698
All species	13,131,359	2,739,232	2,422,373	1,905,518	1,551,018	1,182,445	999,710	1,966,366	364,698
Jack pine									
Jack pine	1,184,015	574,703	354,832	165,157	69,941	14,575	4,807	- -	- -
All species	1,184,015	574,703	354,832	165,157	69,941	14,575	4,807	- -	- -
Spruce and balsam fir									
Balsam fir	950,110	568,035	240,715	98,723	26,753	6,332	9,551	- -	- -
White spruce	1,846,666	473,210	485,047	363,082	233,130	114,800	117,078	60,320	- -
Black spruce	737,922	420,634	180,975	83,850	22,152	12,908	10,928	6,473	- -
All species	3,534,698	1,461,880	906,737	545,655	282,035	134,040	137,558	66,793	- -
Eastern hemlock									
Eastern hemlock	3,526,015	316,414	406,650	499,344	571,339	553,674	450,634	674,023	53,937
All species	3,526,015	316,414	406,650	499,344	571,339	553,674	450,634	674,023	53,937
Other eastern softwoods									
Eastern redcedar	13,134	5,618	2,963	4,553	- -	- -	- -	- -	- -
Larch spp.	3,283	- -	1,207	2,077	- -	- -	- -	- -	- -
Tamarack (native)	625,503	261,284	186,013	89,438	61,911	22,357	4,501	- -	- -
Norway spruce	115,035	37,975	30,121	18,003	12,045	16,891	- -	- -	- -
Blue spruce	14,330	8,834	5,496	- -	- -	- -	- -	- -	- -
Austrian pine	54,085	23,424	17,879	12,781	- -	- -	- -	- -	- -
Douglas-fir	42,430	3,014	8,907	4,881	6,302	3,973	5,495	9,858	- -
Northern white-cedar	6,862,294	2,340,095	1,693,202	1,177,556	735,584	362,516	230,754	256,195	66,392
All species	7,730,094	2,680,244	1,945,788	1,309,290	815,843	405,736	240,749	266,053	66,392
Total softwoods	29,525,583	7,956,075	6,158,518	4,482,107	3,333,588	2,303,577	1,833,457	2,973,234	485,027
Hardwoods									
Select white oaks									
White oak	1,883,921	- -	345,759	334,749	296,336	307,119	227,333	324,044	48,581
Swamp white oak	235,003	- -	34,213	37,387	30,767	22,730	28,395	81,509	- -
Bur oak	359,326	- -	21,161	31,651	25,804	31,618	48,146	93,513	107,434
Chinkapin oak	13,458	- -	3,307	- -	2,442	3,409	4,299	- -	- -
All species	2,491,707	- -	404,440	403,788	355,349	364,876	308,173	499,067	156,015
Select red oaks									
Northern red oak	5,064,411	- -	837,002	828,412	1,042,839	786,936	537,967	888,230	143,025
All species	5,064,411	- -	837,002	828,412	1,042,839	786,936	537,967	888,230	143,025
Other white oaks									
Chestnut oak	4,277	- -	- -	- -	4,277	- -	- -	- -	- -
All species	4,277	- -	- -	- -	4,277	- -	- -	- -	- -
Other red oaks									
Scarlet oak	2,833	- -	1,223	- -	1,611	- -	- -	- -	- -
Northern pin oak	710,347	- -	137,701	145,467	133,133	80,188	92,068	121,790	- -
Pin oak	36,811	- -	6,067	7,832	2,651	11,443	3,255	5,562	- -
Black oak	1,736,568	- -	204,232	300,541	266,527	289,470	244,254	353,098	78,448
All species	2,486,560	- -	349,222	453,840	403,922	381,101	339,577	480,450	78,448

(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									
Hickory									
Bitternut hickory	185,152	- -	36,961	38,220	23,034	44,022	18,693	24,222	- -
Pignut hickory	129,178	- -	27,491	23,525	22,495	11,593	17,197	26,878	- -
Shellbark hickory	31,522	- -	4,226	6,213	8,684	- -	- -	12,399	- -
Shagbark hickory	144,908	- -	34,043	29,478	33,887	3,712	27,303	16,485	- -
Mockernut hickory	22,725	- -	10,081	5,343	2,359	- -	4,943	- -	- -
All species	513,485	- -	112,800	102,779	90,459	59,328	68,136	79,983	- -
Yellow birch									
Yellow birch	1,637,612	- -	332,580	317,651	300,043	229,346	166,399	231,522	60,071
All species	1,637,612	- -	332,580	317,651	300,043	229,346	166,399	231,522	60,071
Hard maple									
Black maple	12,684	- -	- -	- -	- -	- -	5,318	7,367	- -
Sugar maple	10,280,657	- -	2,967,853	2,610,523	1,790,315	1,243,693	648,029	923,244	97,001
All species	10,293,341	- -	2,967,853	2,610,523	1,790,315	1,243,693	653,346	930,611	97,001
Soft maple									
Red maple	7,189,799	- -	2,210,083	1,679,340	1,185,007	838,629	505,414	645,760	125,567
Silver maple	1,758,518	- -	225,268	235,668	265,430	251,544	193,680	401,330	185,598
All species	8,948,318	- -	2,435,351	1,915,008	1,450,437	1,090,172	699,094	1,047,090	311,165
Beech									
American beech	1,418,651	- -	271,058	249,272	267,000	255,221	140,189	235,911	- -
All species	1,418,651	- -	271,058	249,272	267,000	255,221	140,189	235,911	- -
Tupelo and blackgum									
Blackgum	21,090	- -	4,053	5,592	4,376	7,070	- -	- -	- -
All species	21,090	- -	4,053	5,592	4,376	7,070	- -	- -	- -
Ash									
White ash	1,336,513	- -	278,538	305,658	230,164	170,148	103,979	206,278	41,747
Black ash	387,218	- -	169,354	120,156	51,137	21,110	13,573	11,887	- -
Green ash	1,267,142	- -	335,220	291,984	226,457	146,072	94,427	153,537	19,445
Blue ash	3,414	- -	- -	- -	- -	3,414	- -	- -	- -
All species	2,994,287	- -	783,113	717,798	507,758	340,744	211,979	371,702	61,192
Cottonwood and aspen									
Balsam poplar	499,226	- -	159,104	146,014	94,463	72,292	21,104	6,249	- -
Eastern cottonwood	567,691	- -	24,977	48,796	40,950	83,993	64,264	174,674	130,036
Bigtooth aspen	3,104,975	- -	857,456	873,044	668,028	330,942	208,024	167,481	- -
Quaking aspen	3,451,995	- -	1,107,648	981,377	649,861	380,501	229,074	103,534	- -
All species	7,623,886	- -	2,149,186	2,049,231	1,453,302	867,728	522,465	451,938	130,036
Basswood									
American basswood	2,411,795	- -	673,981	629,114	467,238	245,148	179,862	160,604	55,850
All species	2,411,795	- -	673,981	629,114	467,238	245,148	179,862	160,604	55,850
Yellow-poplar									
Yellow-poplar	195,294	- -	17,074	30,560	35,476	32,238	32,734	35,412	11,800
All species	195,294	- -	17,074	30,560	35,476	32,238	32,734	35,412	11,800
Black walnut									
Black walnut	195,027	- -	26,478	30,462	12,637	30,048	32,377	31,364	31,660
All species	195,027	- -	26,478	30,462	12,637	30,048	32,377	31,364	31,660

(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 soft hardwoods									
Boxelder	29,899	- -	10,997	5,768	4,928	3,423	4,783	- -	- -
Paper birch	986,186	- -	442,639	268,233	133,278	87,954	36,643	17,440	- -
Northern catalpa	2,069	- -	707	1,362	- -	- -	- -	- -	- -
Hackberry	13,973	- -	3,953	1,893	3,378	- -	4,749	- -	- -
Butternut	23,944	- -	2,415	9,049	5,310	3,633	3,536	- -	- -
American sycamore	147,677	- -	9,177	8,484	6,414	36,064	36,447	32,185	18,907
Black cherry	1,446,841	- -	458,721	340,052	243,966	150,843	88,594	124,189	40,477
Black willow	126,942	- -	8,186	18,497	23,486	22,177	12,518	25,796	16,282
White willow	1,451	- -	- -	1,451	- -	- -	- -	- -	- -
Sassafras	82,177	- -	28,421	26,508	13,694	6,305	7,249	- -	- -
American elm	288,867	- -	103,396	73,779	47,842	26,692	13,837	23,321	- -
Siberian elm	837	- -	837	- -	- -	- -	- -	- -	- -
Slippery elm	51,147	- -	15,652	10,346	5,677	6,924	- -	12,548	- -
All species	3,202,012	- -	1,085,102	765,421	487,973	344,016	208,355	235,478	75,666
Other eastern hard hardwoods									
Honeylocust	8,605	- -	- -	- -	4,997	3,608	- -	- -	- -
Black locust	48,317	- -	7,346	5,131	8,217	8,472	7,285	11,865	- -
Rock elm	3,971	- -	- -	1,644	2,327	- -	- -	- -	- -
All species	60,893	- -	7,346	6,775	15,542	12,080	7,285	11,865	- -
Total hardwoods	49,562,646	- -	12,456,639	11,116,225	8,688,942	6,289,744	4,107,939	5,691,227	1,211,929
All species groups	79,088,229	7,956,075	18,615,157	15,598,332	12,022,530	8,593,321	5,941,397	8,664,461	1,696,956

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, 2000-2003

(In dry tons)

Owner category and softwood/hardwood category	All components	Tree biomass component						
		All live 1-5 inch trees	Growing-stock trees			Non-growing-stock trees		
			Total	Boles	Stumps, tops, and limbs	Total	Boles	Stumps, tops, and limbs
Public								
Softwoods	85,782,275	9,688,998	72,879,283	57,336,320	15,542,964	3,213,994	2,458,766	755,228
Hardwoods	186,535,596	18,560,007	152,965,873	110,864,956	42,100,917	15,009,717	10,952,855	4,056,861
Total	272,317,872	28,249,005	225,845,156	168,201,275	57,643,881	18,223,711	13,411,621	4,812,090
Private								
Softwoods	94,184,866	11,760,004	77,985,839	59,674,582	18,311,257	4,439,024	3,297,564	1,141,461
Hardwoods	401,999,202	36,240,733	330,061,229	239,254,718	90,806,510	35,697,240	26,120,378	9,576,862
Total	496,184,068	48,000,736	408,047,067	298,929,300	109,117,767	40,136,264	29,417,942	10,718,323
All ownerships								
Softwoods	179,967,142	21,449,002	150,865,122	117,010,901	33,854,221	7,653,018	5,756,329	1,896,689
Hardwoods	588,534,798	54,800,740	483,027,101	350,119,674	132,907,427	50,706,957	37,073,233	13,633,724
Total	768,501,940	76,249,741	633,892,223	467,130,575	166,761,648	58,359,975	42,829,563	15,530,413

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

Table 10. -- Average annual net growth of growing stock on timberland by species group and owner category, Michigan, 1993 to 2000-2003

(In thousand cubic feet per year)

Species group	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Other yellow pines	12,672	71	12,601	- -
Eastern white and red pines	123,681	57,760	65,921	- -
Jack pine	14,076	10,322	3,754	- -
Spruce and balsam fir	41,846	13,889	27,957	- -
Eastern hemlock	23,744	6,579	17,165	- -
Other eastern softwoods	81,886	29,254	52,632	- -
Total softwoods	297,906	117,876	180,030	- -
Hardwoods				
Select white oaks	20,374	4,624	15,750	- -
Select red oaks	48,458	11,307	37,151	- -
Other red oaks	26,566	4,784	21,782	- -
Hickory	5,035	278	4,757	- -
Yellow birch	9,182	2,377	6,805	- -
Hard maple	129,143	42,074	87,070	- -
Soft maple	141,300	42,170	99,130	- -
Beech	17,203	9,261	7,942	- -
Tupelo and blackgum	111	- -	111	- -
Ash	51,246	7,558	43,688	- -
Cottonwood and aspen	110,446	43,383	67,062	- -
Basswood	12,177	1,118	11,059	- -
Yellow-poplar	4,160	1,867	2,293	- -
Black walnut	4,128	91	4,037	- -
Other eastern soft hardwoods	50,337	9,121	41,217	- -
Other eastern hard hardwoods	2,369	171	2,198	- -
Total hardwoods	632,236	180,184	452,052	- -
All species groups	930,142	298,060	632,082	- -

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

Table 11. -- Average annual removals of growing stock on timberland by species group and owner category, Michigan, 1993 to 2000-2003

(In thousand cubic feet per year)

Species group	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Other yellow pines	8,843	1,852	6,991	- -
Eastern white and red pines	27,618	17,928	9,689	- -
Jack pine	14,542	12,253	2,289	- -
Spruce and balsam fir	25,595	7,571	18,023	- -
Eastern hemlock	4,048	1,115	2,933	- -
Other eastern softwoods	12,461	2,317	10,144	- -
Total softwoods	93,106	43,037	50,069	- -
Hardwoods				
Select white oaks	4,853	1,202	3,652	- -
Select red oaks	21,828	4,869	16,960	- -
Other red oaks	4,365	1,567	2,798	- -
Hickory	1,071	- -	1,071	- -
Yellow birch	2,450	1,104	1,346	- -
Hard maple	36,887	7,680	29,206	- -
Soft maple	29,329	10,027	19,302	- -
Beech	7,634	1,205	6,430	- -
Ash	8,007	1,361	6,647	- -
Cottonwood and aspen	69,097	18,970	50,127	- -
Basswood	6,852	2,238	4,614	- -
Yellow-poplar	1,353	- -	1,353	- -
Black walnut	391	- -	391	- -
Other eastern soft hardwoods	22,688	4,979	17,709	- -
Other eastern hard hardwoods	830	- -	830	- -
Total hardwoods	217,636	55,202	162,434	- -
All species groups	310,742	98,239	212,503	- -

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

Table 12. -- Average annual mortality of growing stock on timberland by species group and owner category, Michigan, 1993 to 2000-2003

(In thousand cubic feet per year)

Species group	Owner category			
	All owners	Public	Private	Unidentified owner
Softwoods				
Other yellow pines	2,520	474	2,047	- -
Eastern white and red pines	9,438	7,259	2,179	- -
Jack pine	9,724	7,904	1,820	- -
Spruce and balsam fir	33,950	15,542	18,408	- -
Eastern hemlock	2,582	1,101	1,481	- -
Other eastern softwoods	11,846	7,138	4,708	- -
Total softwoods	70,060	39,417	30,643	- -
Hardwoods				
Select white oaks	3,783	966	2,817	- -
Select red oaks	10,742	4,016	6,726	- -
Other red oaks	4,815	2,620	2,195	- -
Hickory	506	- -	506	- -
Yellow birch	3,556	1,211	2,345	- -
Hard maple	11,844	4,375	7,469	- -
Soft maple	13,862	3,750	10,111	- -
Beech	799	- -	799	- -
Ash	7,610	2,228	5,381	- -
Cottonwood and aspen	61,147	23,405	37,741	- -
Basswood	5,245	3,000	2,245	- -
Black walnut	460	- -	460	- -
Other eastern soft hardwoods	33,195	8,555	24,640	- -
Other eastern hard hardwoods	- -	- -	- -	- -
Total hardwoods	157,562	54,126	103,436	- -
All species groups	227,623	93,543	134,079	- -

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

Leatherberry, Earl C.; Haugen, David; Brand, Gary J.
2005. **Michigan's forest resources in 2003.** Resour. Bull. NC-245. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 39 p.

Reports the initial results of the first four annual panels (2000-2003) of the sixth forest inventory of Michigan. Includes information on forest area; volume; biomass; growth, removals, and mortality; and forest health.

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

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410, or call (202) 720-5964 (voice or TDD). USDA is an equal opportunity provider and employer.

Printed on recyclable paper.

MISSION STATEMENT

We believe the good life has its roots in clean air, sparkling water, rich soil, healthy economies and a diverse living landscape. Maintaining the good life for generations to come begins with everyday choices about natural resources. The North Central Research Station provides the knowledge and the tools to help people make informed choices. That's how the science we do enhances the quality of people's lives.

For further information contact:

North Central
Research Station
USDA Forest Service
1992 Folwell Ave., St. Paul, MN 55108

Or visit our web site:
www.ncrs.fs.fed.us

The Forest inventory and Analysis web site is:
www.fia.fs.fed.us