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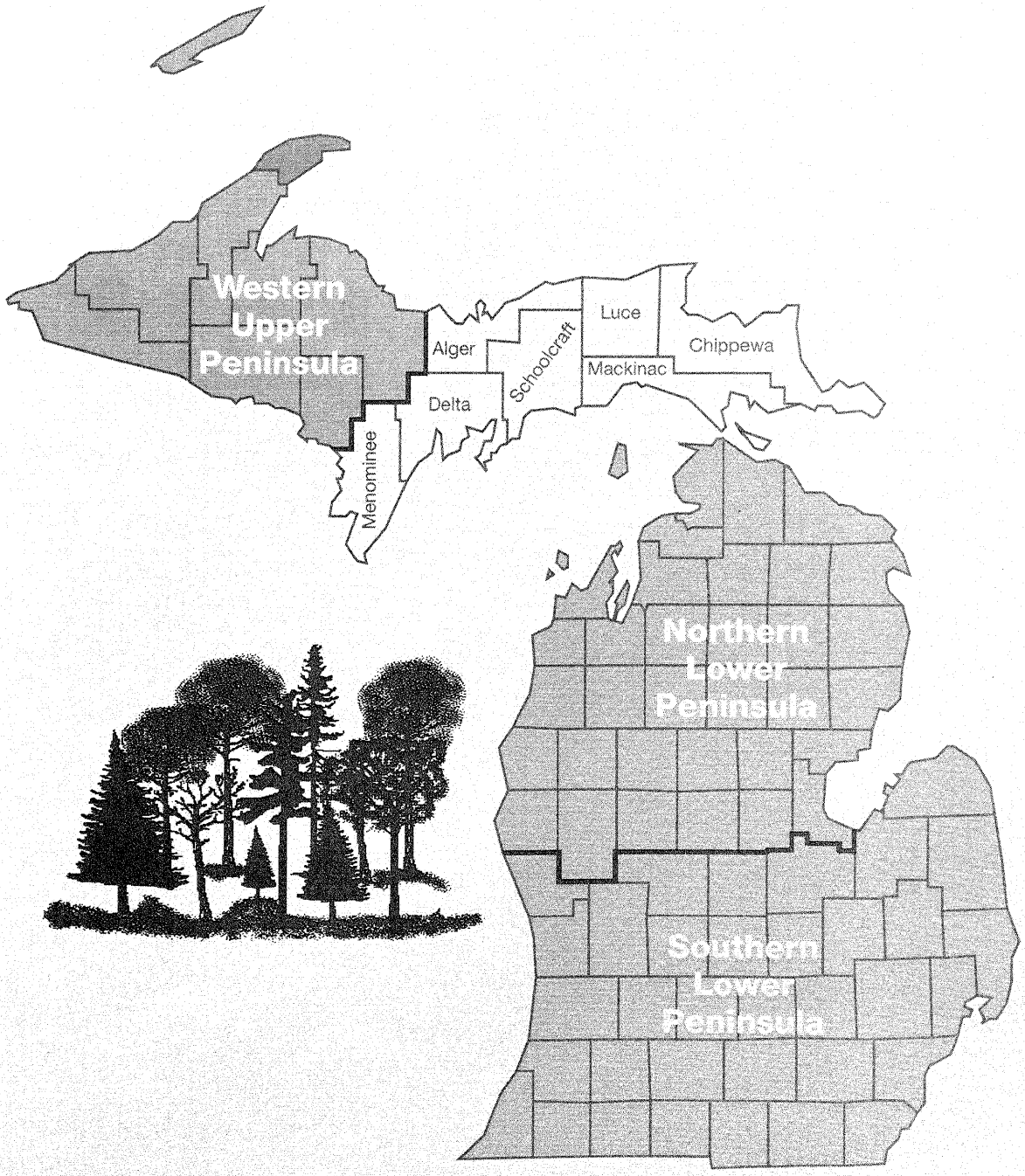
Forest Statistics for Michigan's Eastern Upper Peninsula Unit, 1993

Thomas L. Schmidt



This report includes the most commonly used U.S. Department of Agriculture, Forest Service, Forest Inventory and Analysis (FIA) statistics. Additional forest resource data can be provided to interested users. Persons requesting additional information from the raw inventory data are expected to pay the retrieval costs. These costs range from less than $100 for a relatively simple request to more than $2,000 for a complex retrieval involving the services of a Forest Inventory and Analysis computer programmer. Requests will be filled so as to minimize the impact on the Forest Inventory and Analysis Work Unit.

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FOREWORD

Forest Inventory and Analysis (FIA) is a continuing endeavor as mandated by the Renewable Resources Research Act of 1978. Prior inventories were mandated by the McSweeney-McNary Forest Research Act of 1928. The objective of FIA is to periodically inventory the Nation's forest land to determine its extent, condition, and volume of timber, growth, and removals. Up-to-date resource information is essential to frame forest policies and programs. USDA Forest Service regional experiment stations are responsible for conducting these inventories and publishing summary reports for individual States. The North Central Forest Experiment Station is responsible for forest inventory and analysis in Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, and Wisconsin.

Fieldwork for the fifth forest inventory of Michigan's Eastern Upper Peninsula Unit forest inventory was begun in April of 1991 and completed in September of 1992. Reports of the four previous inventories of Michigan's timber resource are dated 1935, 1955, 1966, and 1980.

More accurate survey information was obtained during this survey than otherwise would have been feasible because of intensified field sampling. Sampling intensity was increased from a single intensity level to a triple intensity level, providing reliable data at a county level. Such sampling was made possible through the cooperation, assistance, and additional funding provided by the State of Michigan and Michigan forest industries and associations. To aid in determining current timber removals, the Michigan Department of Natural Resources (MiDNR) also surveyed primary wood-using plants in the State. Aerial photographs used were black and white, infrared taken in 1986 at a scale of 1:15,840 (nominal). These photographs were purchased by the MiDNR and loaned to the Forest Service.

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HIGHLIGHTS

NOTE: *Data from new forest inventories are often compared with data from earlier inventories to determine trends in forest resources. However, for the comparisons to be valid, the procedures used in the two inventories must be similar. As a result of our ongoing efforts to improve the inventory's efficiency and reliability, we have made several changes in procedures and definitions since the last Michigan inventory in 1980. Because some of these changes make it inappropriate to directly compare the 1993 data with those published for 1980, data from the 1980 inventory have been re-processed using the current procedures. Please refer to the appendix section labeled "Comparing the Fifth Inventory of Michigan's Eastern Upper Peninsula With the Fourth Inventory" for more details.*

All area and volume data and tables were based on what existed as of January 1, 1993, in the Eastern Upper Peninsula of Michigan. The time period used for growth, removals, and mortality was January 1, 1980, to December 31,1992. ***The data in this report are subject to change when inventory data for the entire State have been compiled. It is expected, however, that any such changes will be minor.***

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General

The Eastern Upper Peninsula of Michigan (fig. 1) is comprised of seven counties. Historically, the forest resource has been one of the principal economic, social, and environmental factors in this area. Forest products from this region range from bathroom tissue to construction lumber, and are used throughout the world. The forest resource provides recreational and scenic values of growing economic importance. Thus, the status and condition of Michigan's Eastern Upper Peninsula's forest resource are of utmost concern on a local, national, and international level.

The Upper Peninsula forest resource was exposed to heavy cutting followed by widespread uncontrolled fires, in the late 1800's. With fire protection well established by the 1920's, the forest quickly responded and reestablished itself. The forest reached seedling and sapling size by 1935 and poletimber size by 1955 (Chase and Pfeifer 1970). The result is a forest resource that is currently well stocked with large size classes. The following are a few major highlights from the 1993 inventory of the Eastern Upper Peninsula Survey Unit.

Area

- Forest land accounted for more than 3,973,100 acres in 1993, 80 percent of the total land area. Forest land is comprised of timberland (77 percent of all land area), productive-reserved forest land (2 percent of all land area), and unproductive forest land (1 percent of all land area). The remaining land area is comprised of cropland, pasture, and developed land such as roads and towns.

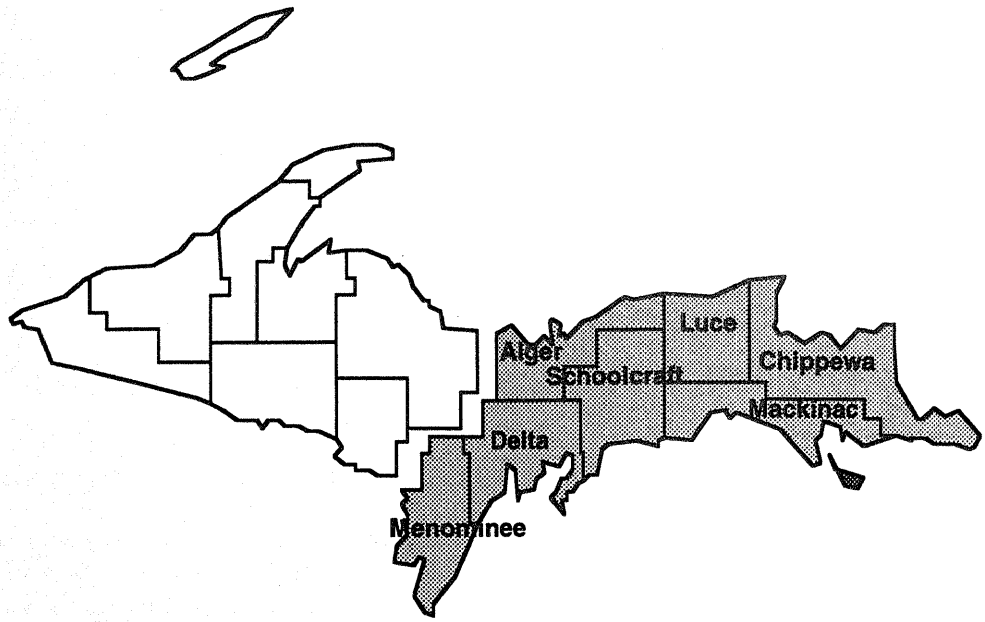

Figure 1.—*Eastern Upper Peninsula Survey Unit, 1993.*

- The total area of forest land declined by an average of 4,500 acres per year between 1980 and 1993—from 4,031,600 acres in 1980 to 3,973,100 acres in 1993. This decline represented a decrease in the area of forest land of 0.1 percent per year.

- While total acreage of forest land declined slightly, total acreage of timberland increased slightly. There were 3,810,000 acres of timberland in 1993, a gain of 8,400 acres since 1980. The increase in timberland occurred as marginal forest lands, previously classified as unproductive, were classified in 1993 as being productive enough to be timberland.

- As in all past inventories, Chippewa County had the largest area of timberland in the Eastern Upper Peninsula—704,800 acres in 1993 (fig. 2).

- Alger County had the highest percentage of land in forests (90 percent), while Schoolcraft County had the lowest percentage of land occupied by forest (72 percent).

- Individuals and farmers were the largest class of timberland owners in 1993, with 32 percent of the total timberland (fig. 3).

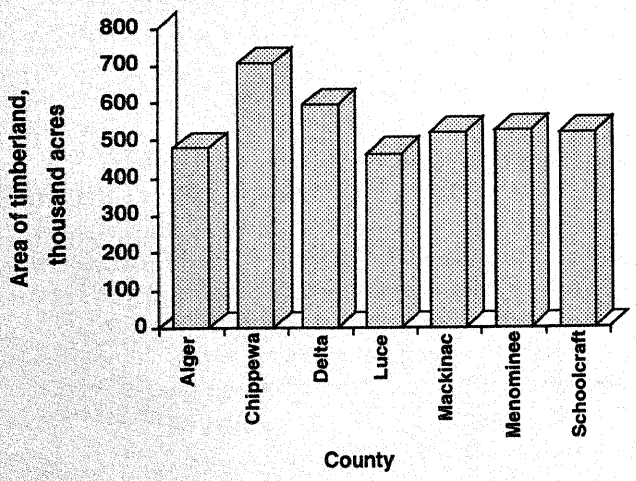

Figure 2.—*Area of timberland, by county, Eastern Upper Peninsula, 1993.*

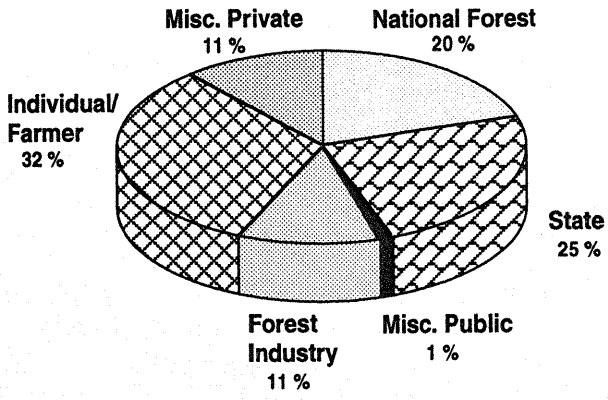

Figure 3.—*Area of timberland by ownership class, Eastern Upper Peninsula, 1993.*

- Although hardwood forest types dominated in terms of acreages occupied in 1993, there were more live softwood trees on timberland (1.4 billion) than hardwoods (1.3 billion).

- As in previous inventories, maple-birch was the dominant forest type with more than 33 percent of all timberland. Maple-birch had twice as many acres as the second largest forest type, northern white-cedar (fig. 4).

- Almost 41 percent of all timberland was in the sawtimber stand-size class in 1993—an increase of 13 percent since 1980. While total area of timberland has declined, the nonstocked area has decreased from the 1930's (fig. 5). [Note: data from 1935, 1955, and 1966 have not been adjusted to reflect current inventory methods and definitions (Cunningham *et al.* 1936, Findell *et al.* 1960, Chase and Pfeifer 1970). Thus, comparisons between inventory results only reflect general trends].

Volume

- Total growing-stock volume on timberland rose to 5.2 billion cubic feet in 1993 from 4.1 billion cubic feet in 1980—a gain of almost 25 percent. The volume averaged more than 1,353 cubic feet per acre of timberland in 1993 compared to 1,089 cubic feet per acre in 1980.

- Softwoods accounted for more growing-stock volume than hardwoods for all trees less than 8.9 inches in diameter at breast height (d.b.h. = 4.5 feet above ground level). The greater volumes in the smaller size classes reflect the heavier stocking rates at younger ages often found in softwood stands.

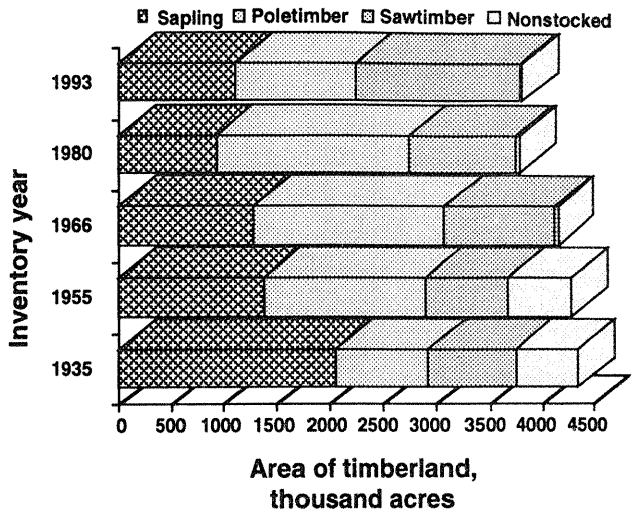

Figure 5.—*Area of timberland by stand-size class, for selected inventory years for the Eastern Upper Peninsula.*

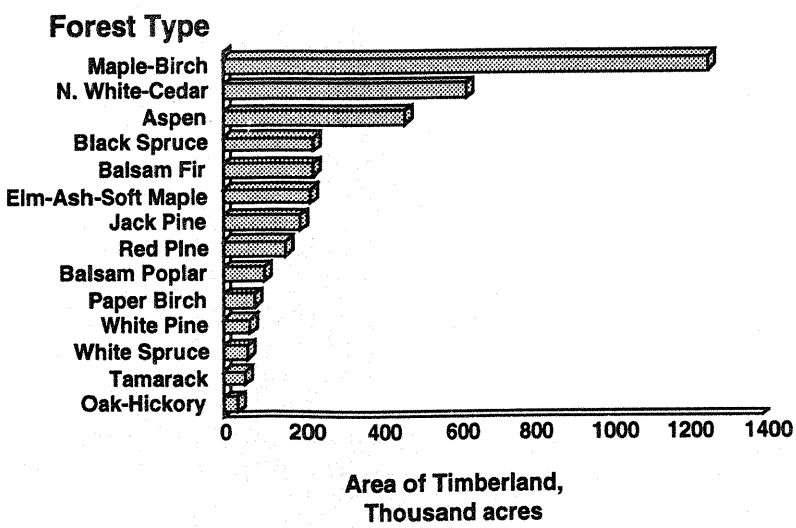

Figure 4.—*Area of timberland, by forest type, Eastern Upper Peninsula, 1993.*

- Softwood growing-stock volume totaled more than 2.3 billion cubic feet in 1993. Figure 6 shows the softwood growing-stock volume by species group.

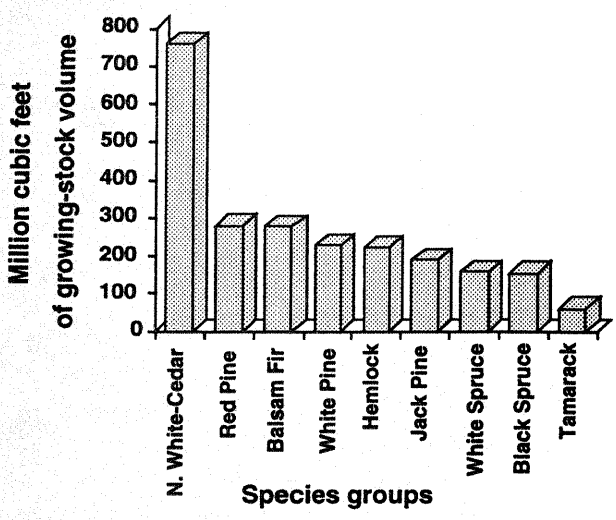

Figure 6.—*Growing-stock volume for softwoods, by species groups, Eastern Upper Peninsula, 1993.*

- Softwoods also accounted for more growing-stock volume in trees greater than 21 inches d.b.h. because of older white pine and hemlock. White pine alone accounted for 32 percent of all growing-stock volume greater than 21 inches d.b.h., but it accounted for only 4 percent of the total net volume.

- Hardwood growing-stock volume accounted for more than 2.8 billion cubic feet in 1993. Figure 7 shows the hardwood growing-stock volume by species group.

- All four major species groups increased in volume from 1980 to 1993 (fig. 8). The greatest proportional increase was in pine, which increased 52 percent, followed by hard hardwoods (32 percent), other softwoods (20 percent), and soft hardwoods (16 percent).

- Growing-stock volume increased between 1980 and 1993 for all forest types except white spruce, black spruce, and paper birch.

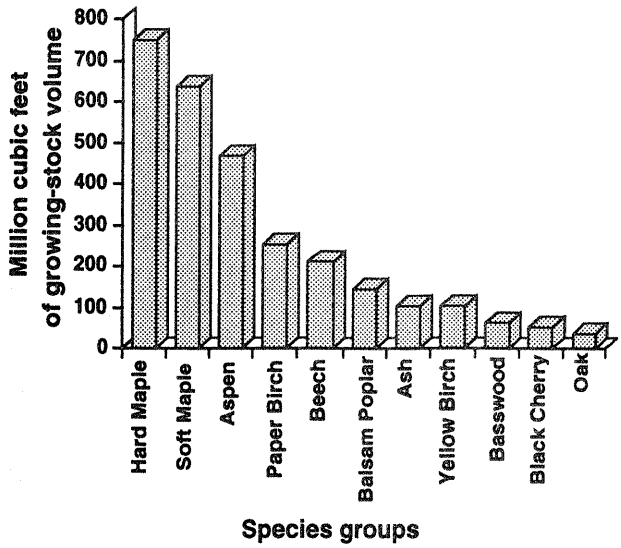

Figure 7.—*Growing-stock volume for hardwoods by species groups, Eastern Upper Peninsula, 1993.*

- Individuals and farmers, State, and National Forest owners accounted for more than 75 percent of all growing-stock volume.

- Hard maple accounted for 31 percent of all hardwood volume graded as the best quality tree grade.

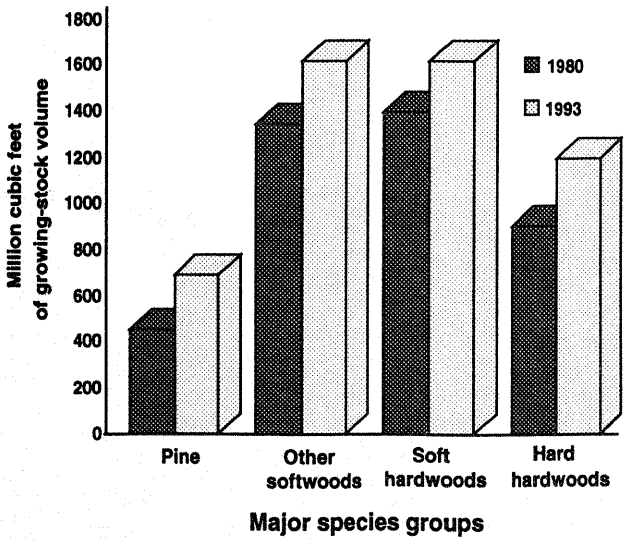

Figure 8.—*Net volume of growing stock by major species groups, Eastern Upper Peninsula, 1980 and 1993.*

Growth

- Average annual net growth on timberland was 132.6 million cubic feet for growing stock from 1980 through 1992. The Eastern Upper Peninsula of Michigan had an average net growth of 35 cubic feet per acre.

- Annual sawtimber net growth averaged 472.6 million board feet on timberland from 1980 through 1992. On average, every acre of timberland in the Unit grew more than 124 board feet of sawtimber each year.

- For growing stock, softwoods accounted for 64 million cubic feet (48 percent) of average annual net growth between 1980 and 1992. Hardwoods accounted for more than 68 million cubic feet (52 percent).

- The red pine forest type averaged the greatest annual net growth per acre at 71 cubic feet; tamarack averaged the lowest, only 16 cubic feet per acre per year (fig. 9). Tamarack, black spruce, and northern white-cedar (swamp conifers) had low growth rates primarily because of the low growth potential of the sites where they are found. These swamp conifers primarily occupy sites where excess water inhibits their growth.

- Average annual net growth of growing stock between 1980 and 1992 was 2.6 percent of inventory. If current improved techniques of measuring growth had been used in 1980, net growth in 1980 would probably have ranged from 2.5 to 2.7 percent of total volume, instead of the 3.3 percent reported.

Removals

- An average of 52.5 million cubic feet of growing stock and 142.4 million board feet of sawtimber were removed each year between inventories, both well below the annual growth rate.

- From 1980 to 1992, the highest total softwood sawtimber removals were from the white spruce, white pine, hemlock, and northern white-cedar species groups. Highest total hardwood sawtimber removals were for beech, hard maple, and quaking aspen.

- State-owned lands were first in terms of growing-stock removals of pine, with an average of more than 3.5 million cubic feet removed annually between 1980 and 1992.

- Individual owners accounted for 29 percent of all sawtimber removals between 1980 and 1992.

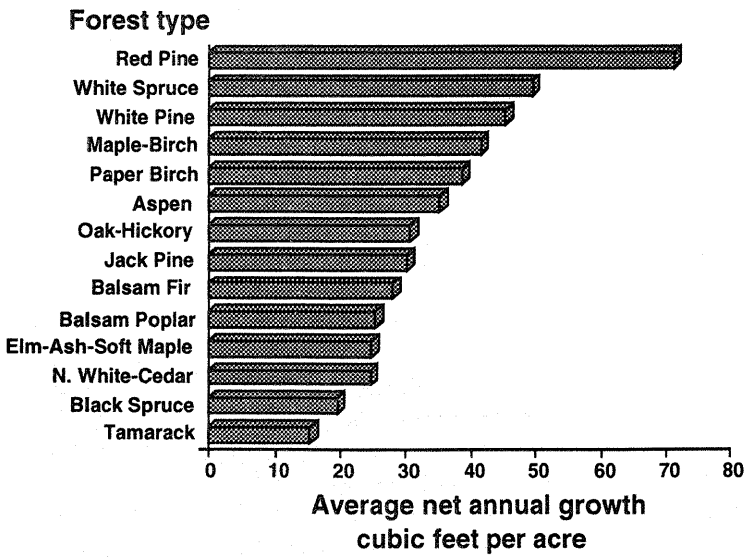

Figure 9.—*Average net annual growth per acre, by forest type, Eastern Upper Peninsula, 1980 - 1992.*

- Growing-stock removals on timberland averaged almost 40 percent of growing-stock growth from 1980 through 1992—52.5 million cubic feet of removals compared to 132.6 million cubic feet of growth.

- Growing-stock removals on timberland averaged 13.8 cubic feet per acre, representing about 1 percent of the total volume per acre.

Mortality

- Growing-stock mortality averaged more than 42 million cubic feet each year between inventories. Sawtimber mortality averaged more than 88 million board feet during this period. These totals represent an annual loss of less than 1 percent of all volumes.

- From 1980 through 1992, red pine, white pine, northern white-cedar, select red oak, beech, and hard maple had the lowest levels of growing-stock mortality as a percent of their total volume. All these species groups had less than 0.2 percent of their total growing-stock volume reported as mortality per year.

- Balsam fir and quaking aspen species groups accounted for more than 37 percent of all mortality.

- Balsam fir, white spruce, balsam poplar, and quaking aspen had more than 48 percent of all sawtimber mortality between 1980 and 1992.

- As a percent of sawtimber inventory volume, red pine, white pine, select red oak, beech, hard maple, and white and green ash species groups had less than 0.2 percent in mortality each year from 1980 to 1992.

APPENDIX

ACCURACY OF THE SURVEY

Forest Inventory and Analysis (FIA) information is based on a sampling procedure designed to provide reliable statistics at the State and Survey Unit levels. Consequently, the reported figures are estimates only. A measure of reliability of these figures is given by sampling errors. The level of sampling error utilized by FIA means 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 Eastern Upper Peninsula Unit in Michigan in 1993, 5,156.4 million cubic feet, has a sampling error of ± 1.33 percent (± 68.6 million cubic feet). Based on this sampling error, growing-stock volume from a 100-percent inventory would be expected to fall between 5,087.8 and 5,225.0 million cubic feet (5,156.4 ± 68.6), there being a one in three chance that this is not the case. The following tabulation shows the sampling errors for Michigan's Eastern Upper Peninsula Forest Inventory:

Item	Unit totals	Sampling error
Growing stock	Million cubic feet	Percent
Volume (1993)	5,156.4	1.33
Average annual growth (1980-1992)	132.6	2.06
Average annual removals (1980 - 1992)	52.5	7.02
Sawtimber	Million board feet	
Volume (1993)	13,399.1	1.97
Average annual growth (1980-1992)	472.6	2.34
Average annual removals (1980 - 1992)	142.4	7.81
Timberland	Thousand acres	
area (1993)	3,810.0	0.72

As survey data are broken down into sections smaller than Survey Unit totals, the sampling error increases. For example, the sampling error for timberland area in a particular county is higher than that for total timberland area in the Unit. This tabulation shows the sampling errors for Unit totals. To estimate sampling error for data smaller than Unit totals, use the following formula:

$$E = \frac{(SE)\ \sqrt{(\text{Unit total area or volume})}}{\sqrt{(\text{Volume or area smaller than Unit total})}}$$

where:

E = sampling error in percent
SE= Unit total error for area or volume

For example, to compute the error on the area of timberland in the maple-birch type for the Unit, proceed as follows:

1. Total area of timberland in the maple-birch forest type in the Unit from table 3 = 1,263,100 acres;

2. Total area of all timberland in the Unit from table 3 = 3,810,000 acres;

3. Unit total error for timberland area from the above tabulation = 0.72 percent.

Using the above formula:

$$E = \frac{(0.72)\ \sqrt{(3{,}810{,}000)}}{\sqrt{(1{,}263{,}100)}} = \pm\ 1.25 \text{ percent.}$$

County Data

A standard FIA inventory is designed to provide sampling errors of no more than 3 percent per million acres of timberland. Thus, this Unit's 3.81 million acres of timberland would require a sampling error of 1.54 percent to meet national FIA standards. The State of Michigan funded the collection of additional field data to substantially reduce sampling error. The goal was to provide a sampling error of less than 10 percent for total timberland area by county. The sampling error within a county depends on county size and total area of timberland. To provide for a sampling error of less than 10 percent for total timberland area by county, a minimum acreage level of about 35,000 acres was required. The heavily forested nature of the seven counties in the Eastern Upper Peninsula, in combination with the intensified sample size provided by the Michigan Department of Natural Resources (MiDNR), resulted in sampling errors for each county of well below 5 percent.

COMPARING THE FIFTH INVENTORY OF THE EASTERN UPPER PENINSULA WITH THE FOURTH INVENTORY

A new volume estimation procedure was developed for the Lake States. We used this procedure to compute the 1993 volumes and to re-compute the 1980 volume for growth calculations. Although the adjustment will differ by species, the re-computed 1980 volumes will generally be greater than those shown in the original 1980 report.

Past surveys used only growing-stock trees to determine stand-size class. Current survey procedures require that stand-size class be determined on the basis of all live trees. Therefore, direct comparisons of current inventory data to old inventory data by stand-size class may be misleading.

The basic building block for estimating forest area and timber volume has been changed from the Survey Unit (as utilized during the 1980 inventory) to the county (current methodology). In the past, statistics were developed at the Unit level and prorated back to the county on the basis of photo-interpretation results. Direct development of county-level data helps users interested in more precise local data, but can make the outcome of comparisons with past estimates uncertain.

SURVEY PROCEDURES

The 1993 survey of Michigan's Eastern Upper Peninsula used a growth model-enhanced, two-phase sample design. Using this sampling scheme and associated estimators is similar to sampling with partial replacement, in that a set of randomly located plots is available for remeasurement and a random set of new plots is established and measured. A significant feature of the new design is stratification for disturbance on the old sample and use of a growth model to improve regression estimates made on old undisturbed forest plots (fig. 10). Detailed descriptions of the sampling and estimation procedures are presented by Hansen (1990). The growth model used in the survey design for Michigan's Eastern Upper Peninsula was the Lake States Stand and Tree Evaluation and Modeling System (STEMS) (Belcher *et al.* 1982).

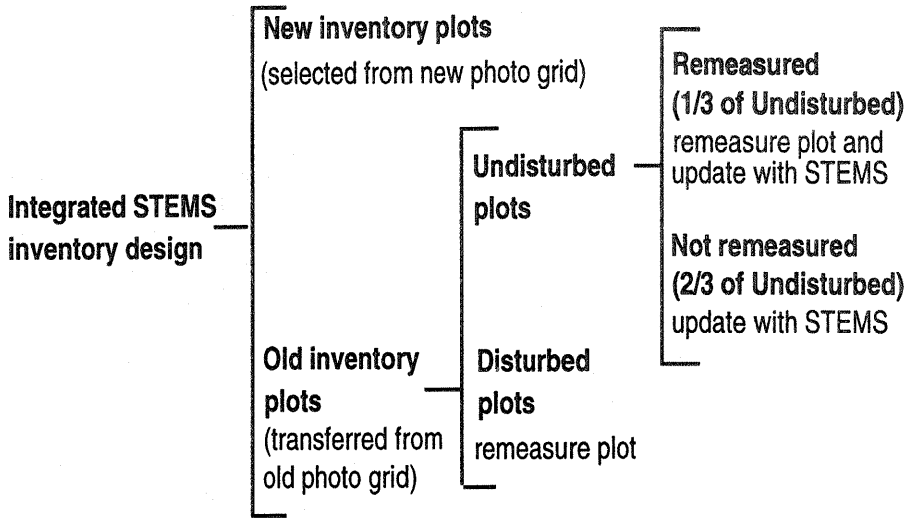

Figure 10.—*Overview of the sample design for Michigan's Eastern Upper Peninsula 1993 survey.*

Major Steps in the New Survey Design

1. Aerial photography (Phase 1)

In this phase, two sets of random points were located on current aerial photographs. The first set was new photo plots and the second set was relocated, old ground plot locations from the 1980 inventory. Locations of the plots used in the 1980 inventory were transferred to the new photographs. The photographs were then assembled into township mosaics, and a systematic grid of 121 one-acre photo plots (each plot representing approximately 190.4 acres) was overlaid on each township mosaic. Each photo plot was examined by aerial photogrammetrists and classified stereoscopically as to its land use. If trees were present, forest type and stand-size/density classes were recorded. All of the 1980 ground plot locations were also examined for disturbance (logging, fire, catastrophic mortality, etc.). After this examination, all the old "disturbed" sample locations and one-third of the old "undisturbed" forested plots were sent to the field for survey crews to verify the photo classification and to take further measurements. All photo plot locations for the 1993 inventory were examined and classified as shown in the following tabulation.

Photo land class	Photo plots
Timberland	19,937
Reserved forest land	325
Other forest land	9
Questionable	958
Nonforest with trees	681
Nonforest without trees	4,202
Water	693
All classes	26,805

2. Plot measurements (Phase 2)

On plots classified as timberland, wooded pasture, or windbreak (at least 120 feet wide), a ground plot was established, remeasured, or modeled. Old plots sent to the field for remeasurement that could not be relocated were replaced with a new plot at the approximate location of the old one. Each ground plot consisted of a 10-point cluster covering 1 acre. At each point, trees 5.0 inches or more in d.b.h. were sampled on a 37.5 basal area factor variable-radius plot, and trees less than 5.0 inches d.b.h. were sampled on a 1/300-acre fixed-radius plot. The measurement procedure for both the new and old sample locations was as follows:

a. New inventory plots

A random sample of the new photo plots was selected for field measurement. Ground plots were established, and measures of current

classification such as land use, forest type, and ownership, as well as size and condition of all trees on the plot, were recorded. These locations were monumented for future remeasurement.

b. Old inventory plots

These plots were originally established, monumented, and measured as part of the 1980 field inventory. Procedures for these old plots were different from those for the new plots. Old plots were classed as "undisturbed" or "disturbed" in the aerial photo phase of the sampling process. All disturbed plots and a one-third sample of the undisturbed forested plots were remeasured to obtain estimates of current condition and changes since the last inventory. All trees measured on these plots in 1980 were remeasured or otherwise accounted for, and all new trees were identified and measured.

All sample plots that were forested at the time of the 1980 inventory and determined to be undisturbed until the 1993 inventory were projected to the current time (1993) using STEMS. This procedure gives projected estimates of current volume and growth for undisturbed plots. Comparison of the projected and observed values on the one-third sample of the undisturbed forest plots that were remeasured provided local calibration data to adjust the projected values of the undisturbed plots that were not remeasured. The adjustment procedure is a modified version of the method described by Smith (1983).

Undisturbed forested plots that were not remeasured played a crucial role in the new survey design. These plots, after careful comparison of past and current aerial photography, were determined to be undisturbed and had conditions that could be simulated by STEMS. The STEMS growth model was used to "grow" the old plot and tree data to produce an estimate of current data. Thus, these plots were treated as ground plots, even though they were never visited. The plot record for each modeled plot was sent to the field for verification of current ownership information.

All old plots classified as disturbed were sent to the field for remeasurement to assess and verify changes since the last inventory. Disturbance referred to any change on a plot that was detected on aerial photos and that the STEMS growth processor could not predict, such as catastrophic mortality, cutting, seedling stands, and/or land use change.

The estimation procedure for computing statistics from this sampling design was more complicated than the simple two-phase estimation procedure used in the past. In fact, this procedure yielded two independent samples, one coming from the new photo points and the other from the old photo points that were remeasured or modeled. The following tabulation summarizes the distribution of all ground plots for the new inventory design by type of plot:

Ground land use class	Old plots remeasured	Old plots updated	New plots	Total plots
Timberland	991	1,080	526	2,597
Reserved forest land	14	5	72	91
Other forest land	25	0	10	35
Nonforest with trees	43	23	23	89
Nonforest without trees	62	404	144	610
Water	9	65	23	97
Total	1,144	1,577	798	3,519

3. Area estimates

Area estimates were made using two-phase estimation methods. In this type of estimation, a preliminary estimate of area by land use is made from the aerial photographs (Phase 1) and corrected by the plot measurements (Phase 2). A complete description of this estimation method is presented by Loetsch and Haller (1964). All area estimates were based on what existed as of January 1, 1993, in the Eastern Upper Peninsula of Michigan.

4. Volume estimates

Estimates of volume per acre were made from the trees measured or modeled on the 10-point plots. Estimates of volume per acre were multiplied by the area estimates to obtain estimates of total volume. Volume estimates were based on what existed as of January 1, 1993, in the Eastern Upper Peninsula of Michigan. Net cubic foot volumes were based on a modification of the method presented by Hahn (1984) for use in the Lake States. For the Eastern Upper Peninsula inventory, the merchantable height equation presented was used in conjunction with Hahn's Board Foot Volume Equation (adapted from Stone's equation—Hahn 1984) to estimate gross volume. This estimate was then corrected by species for variation in bark and cull volume to yield an estimate of net volume (Hahn 1984).

The Forest Service reports all board foot volume in International 1/4-inch rule. In Michigan, the Scribner log rule is commonly used. Scribner log rule conversion factors were derived from full tree measurements taken throughout the Lake States (Michigan, Wisconsin, and Minnesota) and an equation developed by Wiant and Castenaeda (1977). Factors, or multipliers, that can be used to convert board foot International volumes to the Scribner rule are shown in the following tabulation:

D.b.h. (inches)	Scribner rule conversion factor Softwoods	Hardwoods
9.0-10.9	0.7830	—
11.0-12.9	.8287	0.8317
13.0-14.9	.8577	.8611
15.0-16.9	.8784	.8827
17.0-18.9	.8945	.8999
19.0-20.9	.9079	.9132
21.0-22.9	.9168	.9239
23.0-24.9	.9240	.9325
25.0-26.9	.9299	.9396
27.0-28.9	.9321	.9454
29.0+	.9357	.9544

5. Growth and mortality estimates

On remeasured plots, estimates of growth and mortality per acre come from the remeasured diameters of trees and from observation of trees that died between inventories. Growth reported as the average net annual growth between the two inventories (1980 and 1992) was computed from data on remeasurement plots and modeled plots using methods presented by VanDeusen *et al.* (1986). Mortality was also reported as average annual for the remeasurement period. On new plots, where trees were not remeasured, estimates of growth and mortality were obtained by using STEMS to project the growth and mortality of trees for 1 year. Growth and mortality estimates for old undisturbed plots that were updated were derived in the same manner as remeasured plots. The STEMS growth model was adjusted to meet local conditions, using data from the undisturbed remeasurement plots. As with volume, total growth and mortality estimates were obtained by multiplying the per acre estimates by area estimates. Current annual growth for 1992 was computed by using the adjusted STEMS model to grow all current inventory plots for 1 year. All growth and mortality estimates were based on growth and mortality through December 31, 1992, in the Eastern Upper Peninsula of Michigan.

6. Average annual removals estimates

Average annual growing-stock and sawtimber removals (1980 to 1992) were estimated only from the remeasured plots; new plots were not used to estimate removals. These estimates are obtained from trees measured in the last survey and cut or otherwise removed from the timberland base. All removal estimates were based on removals through December 31, 1992, in the Eastern Upper Peninsula of Michigan. Because remeasurement plots make up about one-half of the total ground plots, average annual removals estimates have greater sampling errors than volume and growth estimates.

Tree and Log Grades

On approximately one-third of the sample plots in Michigan's Eastern Upper Peninsula, all sawtimber sample trees were graded for quality and assigned either a tree grade (hardwoods) or a log grade (softwoods). Tree and log

grades were based on the evaluation of external characteristics as indicators of quality. The volume yield by grade for this sample was used to distribute the volume of the ungraded sample trees by species group. Hardwood sawtimber trees were graded according to "Hardwood tree grades for factory lumber" (Hanks 1976). The best 12-foot section of the lowest 16-foot hardwood log was used for grading. Hardwood sawtimber trees that did not meet minimum tree grade specifications for grades 1 through 3 were assigned grade 4 according to Forest Service standard specifications for hardwood construction logs described in "A guide to hardwood log grading" (Rast *et al.* 1973). Red pine and jack pine sawtimber trees were graded based on specifications described in "Forest Service log grades for southern pines" (Campbell 1964). White pine and other softwood sawtimber trees were graded according to specifications described in the circular "Log grades" (Peterson 1965). For all softwoods, the first merchantable 16-foot log, or shorter lengths down to 12 feet, was used for grading.

Hardwood Tree Grades for Factory Lumber

Grade factor	Tree grade 1	Tree grade 2	Tree grade 3
Length of grading zone (feet)	Butt 16	Butt 16	Butt 16
Length of grading section [a] (feet)	Best 12	Best 12	Best 12
D.b.h., minimum (inches)	16[b]	13	11
Diameter, minimum inside bark at top of grading section (inches)	13[b] 16 20	11[c] 12	8
Clear cuttings (on the three best faces)[d]			
Length, minimum (feet)	7 5 3	3 3	2
Number on face (maximum)	2	2 3	e
Yield in face length (minimum)	5/6	4/6	3/6
Cull deduction (including crook and sweep, but excluding shake) maximum within grading section (percent)	9	g[f]	50

[a] *Whenever a 14- or 16-foot section of the butt 16-foot log is better than the best 12-foot section, the grade of the longer section will become the grade of the tree. This longer section, when used, is the basis for determining the grading factors.*

[b] *In basswood and ash, diameter inside bark (d.i.b.) at top of grading section must be 12 inches and d.b.h. must be 15 inches.*

[c] *Grade 2 trees can be 10 inches d.i.b. at top of grading section if otherwise meeting surface requirements for small grade 1's.*

[d] *A clear cutting is a portion of a face free of defects, extending the width of the face. A face is one-fourth of the surface of the grading section as divided lengthwise.*

[e] *Unlimited.*

[f] *Fifteen percent crook and sweep or 40 percent total cull deduction are permitted in grade 2, if size and surface of grading section qualify as grade 1. If rot shortens the required clear cuttings to the extent of dropping the butt log to grade 2, do not drop the tree's grade to 3 unless the cull deduction for rot is greater than 40 percent.*

Forest Service Standard Specifications for Hardwood Construction Logs (tie and timber logs) [a]

Position in tree	Butts and uppers
Min. diameter, small end	8 inches +
Min. length without trim	8 feet +
Clear cuttings	No requirements
Sweep allowance	One-fourth small end d.i.b. for each 8 feet of length. One-half dib for logs 16 feet long.
Sound surface defects:	
Single knots	Any number, if no knot has an average diameter above the callus in excess of one-third of the log diameter at point of occurrence.
Whorled knots	Any number, if the sum of knot diameters above the callus does not exceed one-third of the log diameter at point of occurrence.
Holes	Any number not exceeding knot specifications as long as they do not extend over 3 inches into contained tie or timber.
Unsound defects :	
Surface	Same requirements as for sound defects if they extend into included timber. No limit if they do not.
Interior	None permitted except one shake not more than one-third the width of contained tie or timber, and one split, not over 5 inches.

a *These specifications are minimum for the class. If, from a group of logs, factory logs are selected first, thus leaving only nonfactory logs from which to select construction logs, then the quality range of the construction logs so selected is limited, and the class may be considered a grade. If selection for construction logs is given first priority, it may be necessary to subdivide the class into grades.*

Log Grades for Jack Pine and Red Pine

Grade 1: Logs with three or four clear faces on the 16-foot grading section. [a]
Grade 2: Logs with one or two clear faces on the 16-foot grading section.
Grade 3: Logs with no clear faces on the 16-foot grading section.

After the tentative grade is established from above, the log will be reduced one grade for each of the following defects, except that no log can be reduced below grade 3. Net scale after deduction for defect must be at least 50 percent of the gross contents of the log.

1. **Sweep.** Degrade any tentative grade 1 or 2 log one grade if sweep amounts to 3 or more inches and equals or exceeds one-third of the diameter inside bark at the small end.
2. **Heart rot.** Degrade any tentative grade 1 or 2 log one grade if conk, punk knots, massed hyphae, or other evidence of advanced heart rot is found anywhere on the log.

a *A face is one-fourth of the circumference in width extending full length of the log. Clear faces are those free of: knots measuring more than 1/2-inch in diameter, overgrown knots of any size, and holes more than 1/4-inch in diameter. Faces may be rotated to obtain the maximum number of clear ones.*

Eastern White Pine Sawlog Grade Specifications

Grading factor	Log grade 1	Log grade 2	Log grade 3	Log grade 4
1. Minimum scaling diameter (inches)	14[a]	6	6	6
2. Minimum log length (feet)	10[b]	8	8	8
3. Maximum weevil injury (number)	None	None	2 injuries [c]	No limit
4. Minimum face requirements	Two full length or four 50%[d] length good faces (in addition, log knots on balence of faces shall not exceel size limit of grade 2 logs	NO GOOD FACES REQUIRED Maximum diameter of log knots on three best faces: SOUND RED KNOTS not to exceed 1/6 scaling diameter and 3" maximum OVERGROWN/DEAD/BLACK KNOTS not to exceed 1/12 scaling diameter and 1 1/2" max.	not to exceed 1/3 scaling diameter and 5" maximum not to exceed 1/6 scaling diameter and 2 1/2" max.	Includes all logs not qualifying for No. 3 or better and have at least 1/3 of their gross volume in sound wood suitable for manufacture into standard lumber
5. Maximum sweep or crook (%)	20	30	40	66 2/3
6. Maximum total scaling deduction (%)	50	50	50	66 2/3

AFTER THE TENTATIVE LOG GRADE IS ESTABLISHED FROM FACE EXAMINATION, THE LOG WILL BE REDUCED IN GRADE WHENEVER THE FOLLOWING DEFECTS ARE EVIDENT

7. Conks, punk knots, and pine borer damage on bark surface [e].
   Degrade one grade if present on one face.
   Degrade two grades if present on two faces.
   Degrade three grades if present on three or more faces.

8. Log end defects: red rot, ring shake, heavy stain and pine borer damage outside the heart center of log[e]. Consider log as having a total of 8 quarters (4 on each end) and degrade as indicated.
   Degrade one grade if present in 2 quarters of log ends.
   Degrade two grades if present in 3 or 4 quarters of log ends.
   Degrade three grades if present in 5 or more quarters of log ends.

a. 12 and 13 inch logs with four full-length good faces are acceptable.
b. 8 foot logs with four full-length good faces are acceptable.
c. 8 foot Number 3 logs limited to one weevil injury.
d. Minimum 50% length good face must be at least 6 feet.
e. Factors 7 and 8 are not cumulative (total degrade based on more serious of the two). No log to be degraded below grade 4 if net scale is at least one third of gross scale.

Log Grades for All Other Softwood Logs

Grade 1

1. Trees must be 16 inches dib or larger, 10 feet in length or longer, and with deduction for defect, not over 30 percent of gross scale.
2. Logs must be at least 75 percent clear on each of three faces.
3. All knots outside clear cutting must be sound and not more than 2-1/2 inches in size.

Grade 2

1. Logs must be 12 inches dib or larger, 10 feet in length or longer, and with a net scale after deduction for defect of at least 50 percent of the gross contents of the log.
2. Logs must be at least 50 percent clear on each of three faces or 75 percent clear on two faces.

Grade 3

1. Logs must be 6 inches dib or larger, 8 feet in length or longer, and with a net scale after deduction for defect of at least 50 percent of the gross contents of the log.

Note: Diameters are d.i.b. at small end of grading section, and percent clear refers to percent clear in one continuous section.

METRIC EQUIVALENTS OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare.
1,000 acres = 405 hectares.
1 cubic foot = 0.0283 cubic meter.
1 foot = 30.48 centimeters or 0.3048 meter.
1 inch = 25.4 millimeters, 2.54 centimeters, or 0.0254 meter.
1 pound = 0.454 kilogram.
1 ton = 0.907 metric ton.

TREE SPECIES GROUPS IN MICHIGAN'S EASTERN UPPER PENINSULA

Species names are based on Little, 1981.

SOFTWOODS

Balsam fir ..... *Abies balsamea*
Tamarack ..... *Larix laricina*
White spruce ..... *Picea glauca*
Black spruce ..... *Picea mariana*
Jack pine ..... *Pinus banksiana*
Red pine ..... *Pinus resinosa*
Eastern white pine ..... *Pinus strobus*
Northern white-cedar ..... *Thuja occidentalis*
Eastern hemlock ..... *Tsuga canadensis*
Other softwoods:
- Engelmann spruce ..... *Picea engelmannii*
- Eastern redcedar ..... *Juniperus virginiana*
- Scotch pine ..... *Pinus sylvestris*

HARDWOODS

Hard maple[1]
- Sugar maple ..... *Acer saccharum*

Soft maple[2]
- Red maple ..... *Acer rubrum*
- Silver maple ..... *Acer saccharinum*

Birch
- Yellow birch[1] ..... *Betula alleghaniensis*
- River birch[2] ..... *Betula nigra*
- Paper birch[2] ..... *Betula papyrifera*

Bitternut hickory[1] ..... *Carya cordiformis*
Hackberry ..... *Celtis occidentalis*
Persimmon ..... *Diospyros virginiana*
American beech ..... *Fagus grandifolia*
Ash
- White ash[1] ..... *Fraxinus americana*
- Black ash[2] ..... *Fraxinus nigra*
- Green ash[1] ..... *Fraxinus pennsylvanica*

Butternut[2] ..... *Juglans cinerea*
Black walnut[1] ..... *Juglans nigra*
White poplar ..... *Populus alba*
Balsam poplar ..... *Populus balsamifera*
Cottonwood ..... *Populus deltoides*
Bigtooth aspen[2] ..... *Populus grandidentata*
Quaking aspen[2] ..... *Populus tremuloides*
Black cherry ..... *Prunus serotina*
White oak[1]
- White oak ..... *Quercus alba*
- Swamp white oak ..... *Quercus bicolor*
- Bur oak ..... *Quercus macrocarpa*

Red oak[1]
- Northern pin oak ..... *Quercus ellipsoidalis*
- Pin oak ..... *Quercus palustris*
- Northern red oak ..... *Quercus rubra*

[1]*This species or species group is considered a hard hardwood, with an average specific gravity greater than or equal to 0.50.*

[2]*This species or species group is considered a soft hardwood, with an average specific gravity of less than 0.50.*

American basswood ..... *Tilia americana*
Elm
Winged elm[2] ..... *Ulmus alata*
American elm[2] ..... *Ulmus americana*
Slippery elm[2] ..... *Ulmus rubra*
Rock elm[1] ..... *Ulmus thomasii*
Other hardwoods
Boxelder ..... *Acer negundo*
Ohio Buckeye ..... *Aesculus glabra*
Sweet birch[1] ..... *Betula lenta*
Northern catalpa ..... *Catalpa speciosa*
Noncommercial species
Striped maple ..... *Acer pennsylvanicum*
Mountain maple ..... *Acer spicatum*
American hornbeam ..... *Carpinus caroliniana*
Hawthorn ..... *Crataegus* spp.
Apple ..... *Malus* spp.
Eastern hophornbeam ..... *Ostrya virginiana*
Canada plum ..... *Prunus nigra*
Pin cherry ..... *Prunus pensylvanica*
Wild plum ..... *Prunus* spp.
Chokecherry ..... *Prunus virginiana*
Peachleaf willow ..... *Salix amygdaloides*
Black willow ..... *Salix nigra*
Willow spp. ..... *Salix* spp.

DEFINITION OF TERMS

Average annual removals from growing stock.—The average net growing-stock volume in growing-stock trees removed annually for forest products (including roundwood products and logging residues) and for other uses (see Other removals). Average annual removals of growing stock are reported for a period of several years (1980 to 1993 in this report) and are based on information obtained from remeasurement plots (see Survey Procedures in Appendix).

Average annual removals from sawtimber.—The average net board foot sawtimber volume of live sawtimber trees removed annually for forest products (including roundwood products and other uses [see Other removals]). Average annual removals of sawtimber are reported for a period of several years (1980 to 1993 in this report) and are based on information obtained from remeasurement plots (see Survey Procedures in Appendix).

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

Average net annual growth of sawtimber.—The annual change in the volume of live sawtimber trees and the total volume of trees reaching sawtimber size, less volume losses resulting from natural causes.

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

Butt log.—The first 12 to 16 feet from a 1-foot stump that could be, or is, cut. Minimum standards for butt logs vary by species.

Clear panel.—A section of hardwood tree surface one-fourth the circumference of the tree and at least 2 feet long, free of limbs, knots, bumps, and other indications of defect that preclude clear cuttings.

Commercial species.—Tree species presently or prospectively suitable for industrial wood products. (Note: Excludes species of typically small size, poor form, or inferior quality such as hophornbeam, osage-orange, and redbud.)

County and municipal land.—Land owned by counties and local public agencies or municipalities, or land leased to these governmental units for 50 years or more.

Cropland.—Land under cultivation within the past 24 months; including cropland harvested, crop failures, cultivated summer fallow, idle cropland used only for pasture, orchards, and land in soil improvement crops, but excluding land cultivated in developing improved pasture.

Cull.—Portions of a tree that are unusable for industrial wood products because of rot, missing or dead material, or other defect.

Diameter class.—A classification of trees based on diameter outside bark, measured at breast height (d.b.h.). Two-inch diameter classes are commonly used in Forest Inventory and Analysis, with the even inch the

approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h.

Diameter at breast height (d.b.h.).—The outside bark diameter at 4.5 feet (1.37 m) above the forest floor on the uphill side of the tree. For determining breast height, the forest floor includes the duff layer that may be present, but does not include unincorporated woody debris that may rise above the ground line.

Face.—A section of the tree surface one-fourth the circumference of the tree extending the full length of the log.

Farm.—Either a place operated as a unit of 10 acres or more from which the sale of agricultural products totals $50.00 or more annually, or a place operated as a unit of less than 10 acres from which the sale of agricultural products for a year amounts to at least $250.00. Places having less than the $50.00 or $250.00 minimum estimated sales in a given year are also counted as farms if they can normally be expected to produce products in sufficient quantity to meet the requirements of the definition.

Farmer-owned land.—Land owned by farm operators whether part of the farmstead or not. (Note: Excludes land leased by farm operators from nonfarm owners, such as railroad companies and States.)

Forest industry land.—Land owned by companies or individuals operating wood-using plants.

Forest land.—Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use. (Note: Stocking is measured by comparing specified standards with basal area and/or number of trees, age or size, and spacing.) The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, or other bodies of water or clearings in forest areas shall be classed as forest if less than 120 feet wide. (See definitions for Land, Timberland, Reserved forest land, Other forest land, Stocking, and Water.)

Forest type.—A classification of forest land based on the species forming a plurality of live tree stocking. Major forest types in the State are:

Jack pine.—Forests in which jack pine comprises a plurality of the stocking. (Common associates include eastern white pine, red pine, aspen, birch, and maple.)

Red pine.—Forests in which red pine comprises a plurality of the stocking. (Common associates include eastern white pine, jack pine, aspen, birch, and maple.)

Eastern white pine.—Forests in which eastern white pine comprises a plurality of the stocking. (Common associates include red pine, jack pine, aspen, birch, and maple.)

Balsam fir.—Forests in which balsam fir and white spruce comprise a plurality of stocking with balsam fir the most common. (Common associates include white spruce, aspen, maple, birch, northern white-cedar, and tamarack.)

White spruce.—Forests in which white spruce and balsam fir comprise a plurality of the stocking with white spruce the most common. (Common associates include balsam fir, aspen, maple, birch, northern white-cedar, and tamarack.)

Black spruce.—Forests in which swamp conifers comprise a plurality of the stocking with black spruce the most common. (Common associates include tamarack and northern white-cedar.)

Northern white-cedar.—Forests in which swamp conifer species comprise a plurality of the stocking with northern white-cedar the most common. (Common associates include tamarack and black spruce.)

Tamarack.—Forests in which swamp conifers comprise a plurality of the stocking with tamarack the most common. (Common associates include black spruce and northern white-cedar.)

Oak-hickory.—Forests in which northern red oak, white oak, bur oak, or hickories, singly or in combination, comprise a plurality of the stocking. (Common associates include jack pine, beech, yellow-poplar, elm, and maple.)

Elm-ash-soft maple.—Forests in which lowland elm, ash, red maple, silver maple, and cottonwood, singly or in combination, comprise a plurality of the stocking. (Common associates include birch, spruce, and balsam fir.)

Maple-birch.—Forests in which sugar maple, basswood, yellow birch, upland American elm, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include birch, spruce, and balsam fir.)

Aspen.—Forests in which quaking aspen or bigtooth aspen, singly or in combination, comprise a plurality of the stocking. (Common associates include balsam poplar, balsam fir, and paper birch.)

Paper birch.—Forests in which paper birch comprises a plurality of the stocking. (Common associates include maple, aspen, and balsam fir.)

Balsam poplar.—Forests in which balsam poplar comprises a plurality of the stocking. (Common associates include aspen, elm, and ash.)

Growing-stock tree.—A live tree of commercial species that meets specified standards of size, quality, and merchantability. (Note: Excludes rough, rotten, and dead trees.)

Growing-stock volume.—Net volume in cubic feet of growing-stock trees 5.0 inches d.b.h. and over, from 1 foot above the ground to a minimum 4.0 inch top diameter (outside bark) of the central stem or to the point where the central stem breaks into limbs.

Hard hardwoods.—Hardwood species with an average specific gravity greater than 0.50 such as oaks, hard maple, and hickories.

Hardwoods.—Dicotyledonous trees, usually broad-leaved and deciduous. (See Soft hardwoods and Hard hardwoods.)

Improved pasture.—Land currently improved for grazing by cultivation, seeding, irrigation, or clearing of trees and brush.

Indian owned land.—Land held in trust by the United States for tribes or individual Native Americans.

Industrial wood.—All roundwood products except residential fuelwood.

Land.—A. *Bureau of the Census.* Dry land and land temporarily or partly covered by water such as marshes, swamps, and river flood plains (omitting tidal flats below mean high tide); streams, sloughs, estuaries, and canals less than one-eighth of a statute mile wide; and lakes, reservoirs, and ponds less than 40 acres in area.

B. *Forest Inventory and Analysis.* The same as the Bureau of the Census, except minimum width of streams, etc., is 120 feet and minimum size of lakes, etc., is less than 1 acre.

Live trees.—Growing-stock, rough, and rotten trees 1.0 inch d.b.h. and larger.

Log grade.—A log classification based on external characteristics as indicators of quality or value. (See Appendix for specific grading factors used.)

Marsh.—Nonforest land that characteristically supports low, generally herbaceous or shrubby vegetation and that is intermittently covered with water.

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

Miscellaneous Federal land.—Federal land other than National Forest and land administered by the Bureau of Land Management or Bureau of Indian Affairs.

Miscellaneous private land.—Privately owned land other than forest-industry and farmer-owned land.

Mortality.—The volume of sound wood in growing-stock and sawtimber trees that die annually.

National Forest land.—Federal land that has been legally designated as National Forest or purchase units, and other land administered by the USDA Forest Service.

Net volume.—Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.

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

Nonforest land.—Land that has never supported forests, and land formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved

pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide and more than 1 acre in area to qualify as nonforest land.)

a. *Nonforest land without trees.*—Nonforest land with no live trees present.

b. *Nonforest land with trees.*—Nonforest land with one or more trees per acre at least 5 inches d.b.h.

Nonstocked land.—Forest land less than 16.7 percent stocked with all live trees.

Other forest land.—Forest land not capable of producing 20 cubic feet per acre per year of industrial wood crops under natural conditions and not associated with urban or rural development. These sites often contain tree species that are not currently utilized for industrial wood production or trees of poor form, small size, or inferior quality that are unfit for industrial products. Unproductivity may be the result of adverse site conditions such as sterile soil, dry climate, poor drainage, high elevation, and rockiness. This land is not withdrawn from timber utilization.

Other removals.—Growing-stock trees removed but not utilized for products, or trees left standing but "removed" from the timberland classification by land use change. Examples are removals from cultural operations such as timber stand improvement work, land clearing, and changes in land use.

Ownership size class.—The amount of timberland owned by one owner, regardless of the number of parcels.

Pasture.—Land presently used for grazing or under cultivation to develop grazing.

Poletimber stand.—(See Stand-size class.)

Poletimber tree.—A tree of commercial species at least 5.0 inches d.b.h. but smaller than sawtimber size.

Potential productivity class.—A classification of forest lands in terms of inherent capacity to grow crops of industrial wood. The class identifies the potential growth in merchantable cubic feet/acre/year at culmination of mean annual increment of fully stocked natural stands.

Reserved forest land.—Forest land withdrawn from timber utilization through statute, administrative regulation, designation, or exclusive use for Christmas tree production, as indicated by annual shearing.

Rotten tree.—A tree that does not meet regional merchantability standards because of excessive unsound cull. May include noncommercial tree species.

Rough tree.—A tree that does not meet regional merchantability standards because of excessive sound cull. May include noncommercial tree species.

Roundwood products.—Logs, bolts or other round sections (including chips from roundwood) cut from trees for industrial or consumer uses. (Note: Includes saw logs, veneer logs and bolts; cooperage logs and bolts; pulpwood; fuelwood; pilings; poles; posts; hewn ties; mine timbers; and various other round, split, or hewn products.)

Salvable dead tree.—A standing or down dead tree considered merchantable by regional standards.

Sapling.—A live tree 1.0 to 5.0 inches d.b.h.

Sapling-seedling stand.—(See Stand-size class.)

Saw log.—A log meeting minimum standards of diameter, length, and defect. A saw log must be at least 8 feet long, sound, straight, have a minimum diameter outside bark (d.o.b.) of 7.0 inches for softwoods and 9.0 inches for hardwoods, or have other combinations of size and defect specified by regional standards.

Saw-log portion.—That part of the bole of sawtimber trees between the stump and the saw-log top.

Saw-log top.—The point on the bole of sawtimber trees above which a saw log cannot be produced. The minimum saw-log top is 7.0 inches d.o.b. for softwoods and 9.0 inches d.o.b. for hardwoods.

Sawtimber stand.—(See Stand-size class.)

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

Sawtimber volume.—Net volume of the saw-log portion of live sawtimber in board feet, International 1/4-inch rule (unless specified otherwise), from the stump to a minimum 7 inches top d.o.b. for softwoods and a minimum 9 inches top d.o.b. for hardwoods.

Seedling.—A live tree less than 1.0 inch d.b.h. that is expected to survive. Only softwood seedlings more than 6 inches tall and hardwood seedlings more than 1 foot tall are counted.

Short-log (rough tree).—Sawtimber-size trees of commercial species that contain at least one merchantable 8- to 11-foot saw log but not a 12-foot saw log.

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

Soft hardwoods.—Hardwood species with an average specific gravity less than 0.50 such as gum, yellow-poplar, cottonwood, red maple, basswood, and willow.

Softwoods.—Coniferous trees, usually evergreen, having needles or scale-like leaves.

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

Stand-age class.—Age of main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Stand-size class.—A classification of stocked (see Stocking) forest land based on the size class of live trees on the area; that is, sawtimber, poletimber, or seedlings and saplings.

a. Sawtimber stands.—Stands with half or more of live stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

b. Poletimber stands.—Stands with half or more live stocking in poletimber and/or sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

c. Sapling-seedling stands.—Stands with more than half of the live stocking in saplings and/or seedlings.

State land.—Land owned by States, or leased to them for 50 years or more.

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

A stocking percent of 100 indicates full utilization of the site and is equivalent to 80 square feet of basal area per acre in trees 5.0 inches d.b.h. and larger. In a stand of trees less than 5 inches d.b.h., a stocking percent of 100 would indicate that the present number of trees is sufficient to produce 80 square feet of basal area per acre when the trees reach 5 inches d.b.h.

Stands are grouped into the following stocking classes:

Overstocked stands.—Stands in which stocking of live trees is 133 percent or more.

Fully stocked stands.—Stands in which stocking of live trees is from 100.0 to 132.9 percent.

Medium stocked stands.—Stands in which stocking of live trees is from 60.0 to 99.9 percent.

Poorly stocked stands.—Stands in which stocking of live trees is from 16.7 to 59.9 percent.

Nonstocked areas.—Timberland on which stocking of live trees is less than 16.7 percent.

Timberland.—Forest land that is producing, or capable of producing, in excess of 20 cubic feet per acre per year of industrial wood crops under natural conditions. In addition, the forest land must not be withdrawn from timber utilization, and not associated with urban or rural development. Currently inaccessible and inoperable areas are included.

Tree.—A woody plant usually having one or more perennial stems, a more or less definitely formed crown of foliage, and a height of at least 12 feet at maturity.

Tree grade.—A tree classification based on external characteristics as indicators of quality or value, used for hardwood species. (See Appendix for specific grading factors used.)

Tree size class.—A classification of trees based on diameter at breast height, including sawtimber trees, poletimber trees, saplings, and seedlings.

Unproductive forest land.—Forest land incapable of producing 20 cubic feet per acre per year of industrial wood under natural conditions because of adverse site conditions. (Note: Adverse conditions include sterile soils, dry climate, poor drainage, high elevation, steepness, and rockiness.)

Upper stem portion.—That part of the bole of sawtimber trees above the saw-log top to a minimum top diameter of 4.0 inches outside bark, or to the point where the central stem breaks into limbs.

Water.—*(a) Bureau of the Census.*—Permanent inland water surfaces, such as lakes, reservoirs, and ponds at least 40 acres in area; and streams, sloughs, estuaries, and canals at least one-eighth of a statute mile wide.

(b) Noncensus.—Permanent inland water surfaces, such as lakes, reservoirs, and ponds from 1 to 39.9 acres in area; and streams, sloughs, estuaries, and canals from 120 feet to one-eighth of a statute mile wide.

Wooded pasture.—Improved pasture with more than 16.7 percent stocking in live trees but less than 25 percent stocking in growing-stock trees. Area is currently improved for grazing or there is evidence of grazing.

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Table 1.--Area of land by county and major land-use class, Eastern Upper Peninsula, Michigan, 1993

(In thousand acres)

County	Total area	Forest land: All forest land	Forest land: Timberland	Forest land: Other forest land	Forest land: Reserved timber-land	Nonforest land	Census water
Alger	3,228.4	531.5	480.4	6.7	44.4	56.0	2,640.9
Chippewa	1,726.7	746.3	704.8	14.7	26.8	252.8	727.6
Delta	1,274.7	603.1	596.4	5.2	1.5	145.8	525.8
Luce	1,223.6	472.7	464.2	5.3	3.2	105.2	645.7
Mackinac	1,344.4	554.6	519.7	7.1	27.8	99.2	690.6
Menominee	856.4	524.6	523.3	- -	1.3	143.3	188.5
Schoolcraft	1,205.6	540.3	521.2	7.0	12.1	213.7	451.6
All counties	10,859.8	3,973.1	3,810.0	46.0	117.1	1,016.0	5,870.7

Table 2.--Area of timberland by county and ownership class, Eastern Upper Peninsula, Michigan, 1993

(In thousand acres)

	Ownership class								
County	All owners	National forest	Misc. federal	State	County and municipal	Indian	Forest industry	Misc. private-corporation	Misc. private-individual/ farmer
Alger	480.4	107.1	8.6	81.5	--	--	33.6	157.8	91.8
Chippewa	704.8	212.8	0.9	153.4	1.1	1.3	56.7	52.4	226.2
Delta	596.4	226.6	1.5	61.0	4.7	--	67.3	19.6	215.7
Luce	464.2	--	--	215.4	--	--	84.0	48.4	116.4
Mackinac	519.7	121.1	--	165.0	1.7	--	20.5	44.8	166.6
Menominee	523.3	--	--	72.6	2.3	6.9	118.1	19.6	303.8
Schoolcraft	521.2	100.6	14.2	187.5	2.7	--	39.6	60.1	116.5
All counties	3,810.0	768.2	25.2	936.4	12.5	8.2	419.8	402.7	1,237.0

Table 3.--Area of timberland by county and forest type, Eastern Upper Peninsula, Michigan, 1993

(In thousand acres)

County	All types	Forest type														
		Jack pine	Red pine	White pine	Balsam fir	White spruce	Black spruce	Northern white-cedar	Tamarack	Oak-hickory	Elm-ash-soft maple	Maple-birch	Aspen	Paper birch	Balsam poplar	Non-stocked
Alger	480.4	8.4	29.0	14.1	12.9	5.4	11.5	34.7	- -	- -	20.3	323.4	16.0	1.3	1.3	2.1
Chippewa	704.8	72.1	22.3	10.7	45.9	17.6	47.8	89.0	14.3	16.5	39.1	165.7	129.4	14.5	19.9	- -
Delta	596.4	15.2	28.6	2.1	51.4	14.2	35.9	121.3	7.0	7.5	41.4	140.1	88.3	7.7	35.7	- -
Luce	464.2	45.5	19.0	12.2	10.5	- -	43.9	65.1	7.1	3.0	18.6	202.7	30.1	2.1	1.7	2.7
Mackinac	519.7	9.8	32.2	9.9	45.5	13.1	25.3	109.5	3.5	- -	22.9	128.6	73.3	19.7	24.0	2.4
Menominee	523.3	1.2	3.4	8.5	34.8	6.7	19.6	126.0	14.5	6.5	56.9	138.8	70.4	21.1	13.8	1.1
Schoolcraft	521.2	45.3	26.2	9.6	26.2	3.4	46.2	83.2	8.0	3.7	21.8	163.8	59.6	13.6	6.7	3.9
All counties	3,810.0	197.5	160.7	67.1	227.2	60.4	230.2	628.8	54.4	37.2	221.0	1,263.1	467.1	80.0	103.1	12.2

Table 4.--Area of timberland by county and stand-size class, Eastern Upper Peninsula, Michigan, 1993

(In thousand acres)

County	All stands	Stand-size class			
		Sawtimber	Poletimber	Sapling and Seedling	Non-stocked
Alger	480.4	269.8	116.7	91.8	2.1
Chippewa	704.8	282.5	185.0	237.3	- -
Delta	596.4	199.5	200.1	196.8	- -
Luce	464.2	265.3	102.4	93.8	2.7
Mackinac	519.7	191.9	181.5	143.9	2.4
Menominee	523.3	120.3	201.5	200.4	1.1
Schoolcraft	521.2	232.5	130.1	154.7	3.9
All counties	3,810.0	1,561.8	1,117.3	1,118.7	12.2

Table 5.--Area of timberland by county and potential productivity class, Eastern Upper Peninsula, Michigan, 1993

(In thousand acres)

County	All classes	Potential productivity class (cubic feet of growth per acre per year)				
		165+	120-164	85-119	50-84	20-49
Alger	480.4	- -	12.7	57.4	59.3	351.0
Chippewa	704.8	- -	- -	64.1	113.8	526.9
Delta	596.4	- -	5.5	66.3	117.7	406.9
Luce	464.2	- -	- -	31.4	61.8	371.0
Mackinac	519.7	- -	4.6	46.0	76.6	392.5
Menominee	523.3	2.4	7.6	61.8	79.9	371.6
Schoolcraft	521.2	- -	3.5	37.0	89.8	390.9
All counties	3,810.0	2.4	33.9	364.0	598.9	2,810.8

Table 6.--Area of timberland by county and stocking class of growing-stock trees [1], Eastern Upper Peninsula, Michigan, 1993

(In thousand acres)

County	Stocking class of growing-stock trees					
	All classes	Non-[2] stocked	Poorly stocked	Moderately stocked	Fully stocked	Over-stocked
Alger	480.4	3.3	30.9	156.5	157.1	132.6
Chippewa	704.8	1.3	80.3	213.5	166.4	243.3
Delta	596.4	--	67.6	169.4	133.4	226.0
Luce	464.2	2.7	62.8	244.1	133.6	21.0
Mackinac	519.7	3.5	46.4	157.0	143.8	169.0
Menominee	523.3	3.8	49.1	172.9	157.8	139.7
Schoolcraft	521.2	5.1	94.0	147.5	108.7	165.9
All counties	3,810.0	19.7	431.1	1,260.9	1,000.8	1,097.5

[1] This table is based on the stocking percent of growing-stock trees rather than that of all live trees. To use the definitions of stocking for this table, replace the term "all live" by "growing-stock."

[2] Timberland insufficiently stocked with growing-stock trees.

Table 7.--Area of timberland by forest type and ownership class, Eastern Upper Peninsula, Michigan, 1993

(In thousand acres)

Forest type	Ownership class								
	All owners	National forest	Misc. federal	State	County and municipal	Indian	Forest industry	Misc. private-corporation	Misc. private-individual/farmer
Jack pine	197.5	72.8	7.8	92.7	--	--	4.2	2.4	17.6
Red pine	160.7	84.3	2.4	48.8	2.7	--	7.1	4.9	10.5
White pine	67.1	18.1	--	23.9	--	--	2.2	11.2	11.7
Balsam fir	227.2	32.0	2.8	43.3	--	--	24.3	25.5	99.3
White spruce	60.4	21.8	--	12.2	--	--	2.9	6.0	17.5
Black spruce	230.2	60.8	--	88.9	--	--	17.8	21.4	41.3
Northern white-cedar	628.8	85.8	0.9	160.0	1.1	1.6	95.6	55.4	228.4
Tamarack	54.4	5.2	--	14.4	--	--	7.7	7.7	19.4
Oak-hickory	37.2	15.3	--	7.3	2.8	--	--	1.3	10.5
Elm-ash-soft maple	221.0	25.8	--	52.7	--	1.8	18.1	16.9	105.7
Maple-birch	1,263.1	238.1	7.7	233.5	5.9	3.9	172.5	201.5	400.0
Aspen	467.1	89.0	--	108.8	--	--	49.4	27.3	192.6
Paper birch	80.0	5.0	1.0	36.1	--	0.9	5.1	11.6	20.3
Balsam poplar	103.1	14.2	--	6.5	--	--	12.9	9.6	59.9
Nonstocked	12.2	--	2.6	7.3	--	--	--	--	2.3
All types	3,810.0	768.2	25.2	936.4	12.5	8.2	419.8	402.7	1,237.0

Table 8.--Area of timberland by ownership class and stocking class of growing-stock trees [1], Eastern Upper Peninsula, Michigan, 1993

(In thousand acres)

Ownership class	All classes	Stocking class of growing-stock trees				
		Non-[2] stocked	Poorly stocked	Moderately stocked	Fully stocked	Over-stocked
National forest	768.2	--	33.2	112.3	215.4	407.3
Misc. federal	25.2	2.6	6.1	10.5	2.2	3.8
State	936.4	9.8	144.5	333.4	239.1	209.6
County and municipal	12.5	--	1.1	5.9	1.6	3.9
Indian	8.2	--	--	3.1	1.3	3.8
Forest industry	419.8	--	41.1	179.3	116.4	83.0
Misc. private-corporation	402.7	1.1	34.0	164.1	109.7	93.8
Misc. private-individual/farmer	1,237.0	6.2	171.1	452.3	315.1	292.3
All owners	3,810.0	19.7	431.1	1,260.9	1,000.8	1,097.5

[1] This table is based on the stocking percent of growing-stock trees rather than that of all live trees. To use the definitions of stocking for this table, replace the term "all live" by "growing-stock."

[2] Timberland insufficiently stocked with growing-stock trees.

Table 9.--Area of timberland by forest type and stand-size class, Eastern Upper Peninsula, Michigan, 1993

(In thousand acres)

Forest type	All stands	Stand-size class			
		Sawtimber	Poletimber	Sapling and seedling	Non-stocked
Jack pine	197.5	86.0	82.9	28.6	--
Red pine	160.7	93.3	27.1	40.3	--
White pine	67.1	49.5	5.1	12.5	--
Balsam fir	227.2	50.3	53.3	123.6	--
White spruce	60.4	21.9	13.0	25.5	--
Black spruce	230.2	23.9	56.3	150.0	--
Northern white-cedar	628.8	242.5	277.4	108.9	--
Tamarack	54.4	8.0	10.2	36.2	--
Oak-hickory	37.2	10.8	8.8	17.6	--
Elm-ash-soft maple	221.0	73.1	72.8	75.1	--
Maple-birch	1,263.1	710.8	318.6	233.7	--
Aspen	467.1	134.9	119.8	212.4	--
Paper birch	80.0	23.0	48.2	8.8	--
Balsam poplar	103.1	33.8	23.8	45.5	--
Nonstocked	12.2	--	--	--	12.2
All types	3,810.0	1,561.8	1,117.3	1,118.7	12.2

Table 10.--Number of all live trees on timberland by species group and diameter class, Eastern Upper Peninsula, Michigan, 1993

(In thousand trees)

Species group	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9-	29.0+
Softwoods													
Jack pine	66,893	17,449	13,087	15,534	12,538	5,429	2,233	483	116	21	--	3	--
Red pine	50,823	11,537	11,083	8,574	7,107	5,399	3,900	2,009	609	354	172	79	--
White pine	32,884	12,305	6,470	4,274	2,785	2,001	1,566	1,071	779	563	383	627	60
White spruce	59,680	26,913	15,970	6,476	4,359	2,630	1,722	868	397	218	79	48	--
Black spruce	156,873	73,059	47,419	25,586	8,105	1,933	571	150	19	16	12	3	--
Balsam fir	430,426	270,617	99,631	36,791	15,900	5,563	1,338	413	132	33	8	--	--
Hemlock	35,416	10,576	7,429	4,684	3,339	3,075	2,171	1,597	1,150	654	331	398	12
Tamarack	51,040	23,826	14,986	7,782	2,764	1,025	466	118	50	13	10	--	--
Eastern redcedar	8	--	--	--	--	--	8	--	--	--	--	--	--
Northern white-cedar	508,595	191,671	139,112	92,241	49,086	21,557	9,055	3,827	1,341	465	149	86	5
Other softwoods	894	87	171	203	157	162	104	4	6	--	--	--	--
Total	1,393,532	638,040	355,358	202,145	106,140	48,774	23,134	10,540	4,599	2,337	1,144	1,244	77
Hardwoods													
Select white oak	259	93	42	42	12	28	24	12	--	3	3	--	--
Select red oak	7,862	2,682	1,245	1,236	1,038	656	462	228	122	85	52	53	3
Hickory	94	78	--	--	--	8	7	--	--	--	--	1	--
Basswood	10,955	2,442	2,464	1,431	1,638	1,256	745	516	266	114	37	46	--
Beech	64,661	36,166	9,409	5,672	3,590	2,663	2,121	1,952	1,427	834	443	377	7
Yellow birch	26,011	8,633	5,647	4,055	2,565	1,551	1,135	874	735	382	196	228	10
Hard maple	275,384	130,132	55,180	38,287	21,723	13,924	7,574	3,826	2,392	1,255	570	495	26
Soft maple	271,985	117,436	63,411	38,798	24,843	13,558	6,514	3,691	1,881	1,010	464	357	22
Elm	7,257	3,897	1,743	860	368	179	73	41	46	20	13	17	--
Black ash	111,068	61,661	33,329	10,565	3,736	1,012	469	238	38	9	9	2	--
White & green ash	13,605	6,906	2,191	1,487	1,188	905	450	218	166	46	25	23	--
Cottonwood	1,082	936	117	--	--	--	7	11	8	3	--	--	--
Willow	183	126	54	--	--	--	--	--	3	--	--	--	--
Balsam poplar	61,456	33,763	10,588	7,165	3,725	2,780	1,536	1,002	514	208	107	68	--
Bigtooth aspen	26,749	15,852	3,140	2,036	1,832	1,935	1,001	459	275	114	68	37	--
Quaking aspen	214,262	130,976	33,425	17,390	12,985	8,826	5,475	2,805	1,401	672	221	84	2
Paper birch	94,511	29,369	24,023	19,235	11,091	6,257	2,794	1,197	379	108	36	21	1
Black cherry	30,712	18,217	4,143	2,766	2,224	1,752	744	551	223	56	28	8	--
Butternut	21	--	--	--	--	--	8	5	8	--	--	--	--
Other hardwoods	363	225	72	33	14	14	--	5	--	--	--	--	--
Noncommercial spp.	51,078	38,576	7,932	3,203	970	222	144	25	--	--	--	6	--
Total	1,269,558	638,166	258,155	154,261	93,542	57,526	31,283	17,656	9,884	4,919	2,272	1,823	71
All species	2,663,090	1,276,206	613,513	356,406	199,682	106,300	54,417	28,196	14,483	7,256	3,416	3,067	148

Table 11.--Number of growing-stock trees on timberland by species group and diameter class, Eastern Upper Peninsula, Michigan, 1993

(In thousand trees)

Species group	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9-	29.0+
Softwoods													
Jack pine	64,497	17,239	12,527	15,038	12,037	5,049	2,062	458	69	15	--	3	--
Red pine	50,363	11,537	10,981	8,386	6,974	5,399	3,881	2,005	604	351	168	77	--
White pine	31,327	12,278	6,329	3,989	2,425	1,676	1,445	972	698	526	343	587	59
White spruce	58,998	26,808	15,835	6,256	4,318	2,525	1,681	848	397	209	76	45	--
Black spruce	154,180	71,578	46,797	25,265	7,926	1,848	566	150	19	16	12	3	--
Balsam fir	426,412	269,331	98,141	36,062	15,615	5,444	1,283	367	132	29	8	--	--
Hemlock	32,210	10,242	7,010	4,111	2,866	2,454	1,839	1,458	970	596	308	344	12
Tamarack	49,625	23,598	14,497	7,504	2,523	909	425	106	46	9	8	--	--
Eastern redcedar	8	--	--	--	--	--	8	--	--	--	--	--	--
Northern white-cedar	470,662	186,667	130,434	82,243	42,455	17,358	7,186	2,858	995	324	91	47	4
Other softwoods	796	87	105	203	142	155	97	4	3	--	--	--	--
Total	1,339,078	629,365	342,656	189,057	97,281	42,817	20,473	9,226	3,933	2,075	1,014	1,106	75
Hardwoods													
Select white oak	185	93	42	--	12	17	7	8	--	3	3	--	--
Select red oak	6,634	2,631	663	1,041	881	529	426	194	108	71	48	41	1
Hickory	94	78	--	--	--	8	7	--	--	--	--	1	--
Basswood	10,492	2,403	2,464	1,354	1,567	1,172	702	450	218	95	37	30	--
Beech	57,861	34,564	8,379	4,939	2,860	1,988	1,528	1,425	993	671	271	236	7
Yellow birch	21,877	8,293	4,792	3,275	1,753	1,201	820	671	547	272	133	117	3
Hard maple	260,015	125,323	52,129	35,728	20,202	12,771	6,596	3,215	2,042	1,095	478	425	11
Soft maple	248,422	113,459	55,580	34,391	22,281	11,539	5,235	2,994	1,551	755	354	276	7
Elm	6,342	3,591	1,422	705	300	156	64	28	40	15	9	12	--
Black ash	104,678	60,096	30,709	9,234	3,099	886	397	207	33	6	9	2	--
White & green ash	13,004	6,906	2,044	1,318	1,058	854	388	202	149	42	22	21	--
Cottonwood	993	858	117	--	--	--	7	--	8	3	--	--	--
Willow	129	126	--	--	--	--	--	--	3	--	--	--	--
Balsam poplar	59,133	33,694	9,805	6,497	3,421	2,541	1,370	961	475	202	105	62	--
Bigtooth aspen	24,926	15,777	2,505	1,559	1,695	1,706	906	377	237	88	56	20	--
Quaking aspen	205,164	130,496	31,685	15,291	11,583	7,731	4,401	2,220	1,098	455	135	67	2
Paper birch	86,314	28,627	21,708	16,976	9,435	5,677	2,412	1,046	319	83	26	5	--
Black cherry	25,173	17,083	2,991	1,545	1,190	1,185	567	406	148	36	16	6	--
Butternut	21	--	--	--	--	--	8	5	8	--	--	--	--
Other hardwoods	363	225	72	33	14	14	--	5	--	--	--	--	--
Total	1,131,820	584,323	227,107	133,886	81,351	49,975	25,841	14,414	7,977	3,892	1,702	1,321	31
All species	2,470,898	1,213,688	569,763	322,943	178,632	92,792	46,314	23,640	11,910	5,967	2,716	2,427	106

Table 12.--Net volume of growing-stock trees on timberland by species group and diameter class, Eastern Upper Peninsula, Michigan, 1993

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods											
Jack pine	190,172	34,979	63,007	47,537	31,324	10,372	2,083	650	--	220	--
Red pine	278,923	22,476	40,390	55,805	62,589	47,190	20,289	15,168	9,569	5,447	--
White pine	225,181	9,497	12,728	16,600	23,226	23,675	24,079	24,469	20,907	57,860	12,140
White spruce	156,649	16,511	26,589	27,476	30,011	22,960	14,663	9,952	4,603	3,884	--
Black spruce	153,322	69,621	48,182	19,776	9,588	3,805	641	814	663	232	--
Balsam fir	275,394	92,123	90,142	56,615	21,526	8,730	4,485	1,325	448	--	--
Hemlock	222,400	9,318	15,100	23,804	28,208	34,900	33,033	26,927	17,498	31,313	2,299
Tamarack	59,838	22,278	15,490	9,778	7,334	2,597	1,500	437	424	--	--
Eastern redcedar	126	--	--	--	126	--	--	--	--	--	--
Northern white-cedar	759,064	187,560	215,110	154,115	98,739	56,844	27,362	11,761	4,367	2,689	517
Other softwoods	4,429	504	790	1,480	1,466	89	100	--	--	--	--
Total	2,325,498	464,867	527,528	412,986	314,137	211,162	128,235	91,503	58,479	101,645	14,956
Hardwoods											
Select white oak	779	--	79	168	95	162	--	118	157	--	--
Select red oak	35,682	2,662	4,779	4,962	6,380	4,527	3,538	3,062	2,528	3,098	146
Hickory	342	--	--	91	94	--	--	--	--	157	--
Basswood	65,039	3,548	9,616	12,875	12,241	11,256	7,353	3,937	2,017	2,196	--
Beech	209,772	13,587	18,053	22,731	26,542	34,928	33,444	28,841	14,095	16,773	778
Yellow birch	102,083	8,363	10,300	12,849	12,492	15,532	16,471	10,612	6,374	8,588	502
Hard maple	751,241	100,994	129,146	145,245	115,894	81,032	69,408	48,464	25,620	33,920	1,518
Soft maple	636,422	90,158	136,108	125,881	88,522	72,127	51,116	32,844	18,695	20,034	937
Elm	9,433	1,494	1,581	1,634	1,050	595	1,276	555	465	783	--
Black ash	63,861	23,686	17,537	9,228	6,705	4,824	1,042	258	454	127	--
White & green ash	38,875	3,348	5,985	8,527	6,229	4,920	5,017	1,849	1,310	1,690	--
Cottonwood	536	--	--	--	96	--	292	148	--	--	--
Willow	110	--	--	--	--	--	110	--	--	--	--
Balsam poplar	144,726	16,560	20,078	26,945	22,372	23,035	15,914	9,066	6,048	4,708	--
Bigtooth aspen	73,293	4,531	10,603	17,846	14,572	9,171	7,939	4,043	3,171	1,417	--
Quaking aspen	392,072	40,212	68,604	82,538	74,673	54,643	37,414	20,683	7,550	5,482	273
Paper birch	251,443	46,823	59,669	62,544	41,033	25,365	10,668	3,481	1,428	432	--
Black cherry	54,302	4,872	7,882	13,311	10,259	10,185	5,124	1,406	814	449	--
Butternut	540	--	--	--	129	136	275	--	--	--	--
Other hardwoods	322	45	56	102	--	119	--	--	--	--	--
Total	2,830,873	360,883	500,076	547,477	439,378	352,557	266,401	169,367	90,726	99,854	4,154
All species	5,156,371	825,750	1,027,604	960,463	753,515	563,719	394,636	260,870	149,205	201,499	19,110

Table 13.--Net volume of growing-stock trees in the saw-log portion of sawtimber trees on timberland by species group and diameter class, Eastern Upper Peninsula, Michigan 1993

(In thousand cubic feet)

		Diameter class (inches at breast height)							
Species group	All classes	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods									
Jack pine	77,976	38,708	27,353	9,255	1,875	586	--	199	--
Red pine	198,010	49,327	57,805	43,969	18,897	14,099	8,861	5,052	--
White pine	174,802	12,921	19,515	20,394	20,893	21,314	18,282	50,737	10,746
White spruce	102,294	23,521	27,200	21,087	13,497	9,164	4,243	3,582	--
Black spruce	32,858	17,949	9,070	3,619	609	768	624	219	--
Balsam fir	77,833	45,820	18,688	7,733	4,001	1,188	403	--	--
Hemlock	176,065	19,948	24,948	31,296	29,676	24,190	15,759	28,165	2,083
Tamarack	19,452	8,297	6,610	2,376	1,376	402	391	--	--
Eastern redcedar	112	--	112	--	--	--	--	--	--
Northern white-cedar	302,498	124,749	85,587	50,352	24,456	10,542	3,920	2,422	470
Other softwoods	2,651	1,204	1,279	79	89	--	--	--	--
Total	1,164,551	342,444	278,167	190,160	115,369	82,253	52,483	90,376	13,299
Hardwoods									
Select white oak	376	--	54	113	--	88	121	--	--
Select red oak	16,732	--	4,077	3,232	2,643	2,322	1,945	2,399	114
Hickory	171	--	51	--	--	--	--	120	--
Basswood	28,531	--	8,228	8,317	5,618	3,062	1,575	1,731	--
Beech	119,508	--	18,091	26,310	26,262	23,090	11,417	13,694	644
Yellow birch	53,908	--	8,372	11,692	12,847	8,460	5,142	6,980	415
Hard maple	269,864	--	74,779	58,188	52,109	37,121	19,879	26,577	1,211
Soft maple	200,707	--	56,220	51,129	37,828	24,883	14,355	15,548	744
Elm	3,302	--	637	403	921	407	345	589	--
Black ash	9,726	--	4,604	3,647	809	203	362	101	--
White and green ash	15,331	--	4,161	3,611	3,804	1,420	1,017	1,318	--
Cottonwood	369	--	57	--	206	106	--	--	--
Willow	79	--	--	--	79	--	--	--	--
Balsam poplar	59,438	--	15,089	16,973	12,081	6,965	4,664	3,666	--
Bigtooth aspen	29,879	--	9,996	6,919	6,149	3,174	2,511	1,130	--
Quaking aspen	146,725	--	50,985	40,610	28,663	16,041	5,905	4,306	215
Paper birch	56,426	--	26,518	18,035	7,861	2,604	1,077	331	--
Black cherry	19,904	--	6,686	7,327	3,833	1,076	632	350	--
Butternut	406	--	87	104	215	--	--	--	--
Other hardwoods	90	--	--	90	--	--	--	--	--
Total	1,031,472	--	288,692	256,700	201,928	131,022	70,947	78,840	3,343
All species	2,196,023	342,444	566,859	446,860	317,297	213,275	123,430	169,216	16,642

Table 14.--Net volume of sawtimber trees on timberland by species group and diameter class, Eastern Upper Peninsula, Michigan, 1993

(In thousand board feet)[1]

Species group	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods									
Jack pine	451,321	227,377	154,650	53,338	11,101	3,591	--	1,264	--
Red pine	1,135,528	282,057	321,880	249,767	110,747	84,638	54,611	31,828	--
White pine	1,071,521	76,065	109,843	116,818	123,167	129,406	113,829	329,288	73,105
White spruce	607,820	139,358	156,565	123,907	81,339	56,624	26,747	23,280	--
Black spruce	189,010	102,896	51,306	21,039	3,654	4,755	3,956	1,404	--
Balsam fir	453,630	269,377	106,047	44,638	23,797	7,267	2,504	--	--
Hemlock	1,044,412	112,217	137,567	177,872	174,537	146,881	98,247	182,906	14,185
Tamarack	114,230	49,034	38,064	13,951	8,247	2,484	2,450	--	--
Eastern redcedar	677	--	677	--	--	--	--	--	--
Northern white-cedar	1,815,802	768,042	499,517	294,964	146,070	64,252	24,437	15,383	3,137
Other softwoods	15,212	7,036	7,195	451	530	--	--	--	--
Total	6,899,163	2,033,459	1,583,311	1,096,745	683,189	499,898	326,781	585,353	90,427
Hardwoods									
Select white oak	2,354	--	356	687	--	543	768	--	--
Select red oak	104,869	--	25,780	19,707	16,228	14,467	12,321	15,596	770
Hickory	1,138	--	341	--	--	--	--	797	--
Basswood	177,849	--	51,724	51,099	34,673	19,138	9,983	11,232	--
Beech	762,172	--	117,069	165,661	165,505	146,804	73,356	89,435	4,342
Yellow birch	341,504	--	54,137	72,879	80,152	53,287	32,738	45,506	2,805
Hard maple	1,707,024	--	478,129	361,767	324,769	234,026	126,868	173,288	8,177
Soft maple	1,270,550	--	361,398	318,635	235,960	156,908	91,589	101,065	4,995
Elm	20,854	--	4,102	2,507	5,726	2,539	2,186	3,794	--
Black ash	60,845	--	29,083	22,521	5,003	1,281	2,303	654	--
White and green ash	94,770	--	25,781	21,878	23,261	8,843	6,450	8,557	--
Cottonwood	2,282	--	362	--	1,260	660	--	--	--
Willow	485	--	--	--	485	--	--	--	--
Balsam poplar	370,960	--	94,816	104,212	74,736	43,659	29,703	23,834	--
Bigtooth aspen	186,495	--	62,883	42,400	37,968	19,931	15,998	7,315	--
Quaking aspen	912,524	--	318,909	248,778	177,063	100,650	37,533	28,141	1,450
Paper birch	354,973	--	168,738	111,860	48,925	16,395	6,891	2,164	--
Black cherry	125,177	--	42,725	45,595	23,850	6,733	4,006	2,268	--
Butternut	2,543	--	556	648	1,339	--	--	--	--
Other hardwoods	546	--	--	546	--	--	--	--	--
Total	6,499,914	--	1,836,889	1,591,380	1,256,903	825,864	452,693	513,646	22,539
All species	13,399,077	2,033,459	3,420,200	2,688,125	1,940,092	1,325,762	779,474	1,098,999	112,966

[1]International 1/4-inch rule.

Table 15.--Net volume of growing-stock and sawtimber on timberland by county and major species group, Eastern Upper Peninsula, Michigan, 1993

County	Growing-stock					Sawtimber				
		Species group					Species group			
	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods
	Thousand cubic feet					*Thousand board feet*[1]				
Alger	810,730	108,285	192,445	206,362	303,638	2,492,921	499,396	695,806	446,306	851,413
Chippewa	919,427	146,450	282,515	341,966	148,496	2,306,135	467,988	698,761	781,293	358,093
Delta	769,900	91,456	267,157	289,013	122,274	1,762,250	294,230	608,639	548,236	311,145
Luce	657,377	116,655	195,457	179,933	165,332	2,007,902	458,659	617,180	418,935	513,128
Mackinac	709,072	78,860	252,069	248,720	129,423	1,765,911	344,353	621,511	485,872	314,175
Menominee	651,306	34,015	244,938	228,782	143,571	1,327,995	140,463	496,979	388,861	301,692
Schoolcraft	638,559	122,862	192,334	197,001	126,362	1,735,963	468,493	486,705	416,034	364,731
All counties	5,156,371	698,583	1,626,915	1,691,777	1,139,096	13,399,077	2,673,582	4,225,581	3,485,537	3,014,377

[1] International 1/4-inch rule.

Table 16.--Net volume of timber on timberland by class of timber and major species group, Eastern Upper Peninsula, Michigan, 1993

(In thousand cubic feet)

Class of timber	All species	Species group: Pine	Other softwoods	Soft hardwoods	Hard hardwoods
Live trees					
Growing-stock trees					
Sawtimber					
Saw log portion	2,196,023	453,439	711,112	555,492	475,980
Upper stem portion	559,517	60,895	107,657	219,921	171,044
Total	2,755,540	514,334	818,769	775,413	647,024
Poletimber	2,400,831	184,249	808,146	916,364	492,072
All growing-stock trees	5,156,371	698,583	1,626,915	1,691,777	1,139,096
Cull trees					
Short-log trees	108,374	7,619	21,789	36,796	42,170
Rough trees					
Sawtimber	165,399	13,092	44,221	58,377	49,709
Poletimber	186,196	6,526	40,661	85,257	53,752
Total	351,595	19,618	84,882	143,634	103,461
Rotten trees					
Sawtimber	84,103	1,089	24,495	28,858	29,661
Poletimber	28,156	124	8,808	14,127	5,097
Total	112,259	1,213	33,303	42,985	34,758
All cull trees	572,228	28,450	139,974	223,415	180,389
All live trees	5,728,599	727,033	1,766,889	1,915,192	1,319,485
Salvable dead trees					
Sawtimber	55,506	4,140	18,736	30,956	1,674
Poletimber	18,883	1,922	7,593	8,545	823
Total	74,389	6,062	26,329	39,501	2,497
All classes	5,802,988	733,095	1,793,218	1,954,693	1,321,982

Table 17.--Net volume of live and growing-stock trees on timberland by ownership class and major species group, Eastern Upper Peninsula, Michigan, 1993

(In thousand cubic feet)

	Live trees					Growing-stock trees				
		Species group					Species group			
Ownership class	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods
National forest	1,139,278	305,635	272,881	334,936	225,826	1,026,061	295,253	252,473	287,396	190,939
Misc. federal	38,800	11,895	8,662	4,775	13,468	35,474	11,621	7,349	4,312	12,192
State	1,359,447	249,464	445,306	448,023	216,654	1,224,992	238,562	412,703	390,987	182,740
County and municipal	17,992	7,046	1,939	6,292	2,715	16,250	6,131	1,706	5,937	2,476
Indian	11,066	--	1,476	3,936	5,654	10,448	--	1,476	3,673	5,299
Forest industry	640,049	24,635	242,578	185,561	187,275	579,277	24,157	220,995	168,208	165,917
Misc. private-corporation	641,182	37,301	201,273	194,830	207,778	576,181	36,122	184,604	172,234	183,221
Misc. private-individual/farmer	1,880,785	91,057	592,774	736,839	460,115	1,687,688	86,737	545,609	659,030	396,312
All owners	5,728,599	727,033	1,766,889	1,915,192	1,319,485	5,156,371	698,583	1,626,915	1,691,777	1,139,096

Table 18.--Average annual net growth of growing stock and sawtimber on timberland by county and major species group, Eastern Upper Peninsula, Michigan, 1980-1992

County	Growing-stock					Sawtimber				
		Species group					Species group			
	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods
	Thousand cubic feet					*Thousand board feet*[1]				
Alger	19,860	3,531	4,144	4,428	7,757	78,590	18,940	19,140	13,816	26,694
Chippewa	23,204	5,467	6,112	7,367	4,258	83,864	20,726	22,390	28,578	12,170
Delta	21,171	3,548	8,041	6,793	2,789	69,956	13,357	25,437	20,085	11,077
Luce	14,212	3,817	2,517	3,924	3,954	59,708	18,026	12,075	14,440	15,167
Mackinac	16,967	2,981	4,996	5,225	3,765	65,143	14,786	20,921	18,228	11,208
Menominee	19,691	1,623	7,461	6,437	4,170	54,168	7,123	19,433	15,124	12,488
Schoolcraft	17,497	4,710	5,016	4,682	3,089	61,198	20,130	15,456	15,192	10,420
All counties	132,602	25,677	38,287	38,856	29,782	472,627	113,088	134,852	125,463	99,224

[1]International 1/4-inch rule.

Table 19.--Average annual removals of growing stock and sawtimber on timberland by county and major species group, Eastern Upper Peninsula, Michigan, 1980-1992

County	Growing-stock					Sawtimber				
		Species group					Species group			
	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods
	Thousand cubic feet					*Thousand board feet* [1]				
Alger	8,818	1,623	1,302	1,723	4,170	30,977	4,566	5,047	3,741	17,623
Chippewa	7,915	1,104	3,454	1,909	1,448	18,960	2,939	6,806	3,702	5,513
Delta	8,191	955	3,345	3,506	385	20,230	1,831	10,535	6,747	1,117
Luce	6,682	231	1,420	1,525	3,506	26,091	1,047	4,798	3,508	16,738
Mackinac	6,806	1,936	1,501	2,265	1,104	13,824	4,272	3,062	3,357	3,133
Menominee	6,883	631	2,300	3,195	757	13,285	2,759	4,916	4,859	751
Schoolcraft	7,200	2,007	1,930	2,460	803	19,006	5,406	4,957	6,493	2,150
All counties	52,495	8,487	15,252	16,583	12,173	142,373	22,820	40,121	32,407	47,025

[1] International 1/4-inch rule.

Table 20.--Average net annual growth, average annual mortality, and average annual removals of growing stock and sawtimber on timberland by species group, Eastern Upper Peninsula, Michigan, 1980-1992

Species group	Growing-stock			Sawtimber		
	Net growth [1]	Mortality	Removals	Net growth [1]	Mortality	Removals
	Thousand cubic feet			*Thousand board feet* [2]		
Softwoods						
Jack pine	5,124	1,894	4,368	20,593	4,394	7,196
Red pine	12,451	20	1,996	51,918	143	4,736
White pine	7,890	389	2,123	39,098	1,755	10,888
White spruce	6,200	1,964	3,454	24,958	7,095	13,612
Black spruce	1,201	3,512	1,232	1,171	5,195	1,907
Balsam fir	4,313	8,817	3,754	15,118	13,691	5,849
Hemlock	4,114	853	2,198	24,681	3,736	9,856
Tamarack	1,649	432	267	4,612	893	774
Eastern redcedar	3	--	--	17	--	--
Northern white-cedar	20,802	1,576	4,347	64,295	4,582	8,123
Other softwoods	217	23	--	1,479	74	--
Total	63,964	19,480	23,739	247,940	41,558	62,941
Hardwoods						
Select white oak	18	--	--	126	--	--
Select red oak	1,007	69	115	4,396	148	346
Hickory	4	2	--	11	10	--
Basswood	1,509	232	319	6,230	602	1,157
Beech	5,828	396	3,349	24,860	1,479	14,783
Yellow birch	254	1,438	710	2,543	5,057	3,260
Hard maple	21,292	1,572	7,618	62,909	3,514	28,588
Soft maple	17,247	2,271	4,309	44,865	4,061	6,836
Elm	-845	1,235	362	-1,953	2,971	1,101
Black ash	1,687	619	376	1,779	537	103
White and green ash	1,373	45	381	4,368	105	48
Cottonwood	14	--	--	66	1	--
Willow	--	--	--	4	--	--
Balsam poplar	2,227	3,673	1,167	7,754	8,961	3,264
Bigtooth aspen	2,353	649	1,649	9,821	883	4,020
Quaking aspen	10,255	7,005	5,756	41,955	12,737	12,589
Paper birch	3,403	3,347	2,348	10,482	4,699	3,055
Black cherry	998	311	297	4,413	285	282
Butternut	8	--	--	47	7	--
Other hardwoods	6	4	--	11	--	--
Total	68,638	22,868	28,756	224,687	46,057	79,432
All species	132,602	42,348	52,495	472,627	87,615	142,373

[1] An estimate of average gross growth may be computed by adding average mortality to average net growth.
[2] International 1/4-inch rule.

Table 21.--Average annual net growth and average annual removals of growing stock on timberland by ownership class and major species group, Eastern Upper Peninsula, Michigan, 1980-1992

(In thousand cubic feet)

	Growth					Removals				
		Species group					Species group			
Ownership class	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods
National forest	26,138	10,846	5,507	5,760	4,025	10,921	3,477	4,103	2,435	906
Misc. federal	984	428	100	143	313	--	--	--	--	--
State	32,079	8,939	8,797	9,273	5,070	9,172	3,562	1,356	3,588	666
County and municipal	600	309	62	149	80	--	--	--	--	--
Indian	203	--	58	40	105	--	--	--	--	--
Forest industry	13,982	752	4,540	4,414	4,276	8,836	822	3,778	3,451	785
Misc. private-corporation	14,128	999	3,922	3,861	5,346	7,182	227	1,176	855	4,924
Misc. private-individual/farmer	44,488	3,404	15,301	15,216	10,567	16,384	399	4,839	6,254	4,892
All owners	132,602	25,677	38,287	38,856	29,782	52,495	8,487	15,252	16,583	12,173

Table 22.--Average annual net growth and average annual removals of sawtimber on timberland by ownership class and major species group, Eastern Upper Peninsula, Michigan, 1980-1992

(In thousand board feet) [1]

Ownership class	Growth					Removals				
		Species group					Species group			
	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods	All species	Pine	Other softwoods	Soft hardwoods	Hard hardwoods
National forest	100,480	47,333	18,551	18,685	15,911	23,267	6,167	10,997	3,418	2,685
Misc. federal	3,517	1,258	643	209	1,407	--	--	--	--	--
State	114,634	39,270	32,930	28,739	13,695	23,306	9,871	3,230	8,081	2,124
County and municipal	1,362	951	140	146	125	--	--	--	--	--
Indian	374	--	91	-120	403	--	--	--	--	--
Forest industry	48,794	3,960	18,140	12,677	14,017	23,824	4,049	10,349	6,928	2,498
Misc. private-corporation	55,135	4,935	18,520	12,055	19,625	31,211	1,110	4,995	1,950	23,156
Misc. private-individual/farmer	148,331	15,381	45,837	53,072	34,041	40,765	1,623	10,550	12,030	16,562
All owners	472,627	113,088	134,852	125,463	99,224	142,373	22,820	40,121	32,407	47,025

[1] International 1/4-inch rule.

Table 23. Current annual net growth and mortality, and 1990 removals of growing stock and sawtimber on timberland by species group, Eastern Upper Peninsula, Michigan, 1992.

Species group	Growing stock			Sawtimber		
	1992 Net Growth[1]	1992 Mortality	1990 Removals[2]	1992 Net Growth[1]	1992 Mortality	1990 Removals[2]
	Thousand cubic feet			*Thousand board feet*[3]		
Softwoods						
Jack pine	5,144	2,349	5,255	23,974	5,763	11,460
Red pine	13,229	6	2,928	59,035	156	11,354
White pine	8,546	227	1,531	43,879	1,701	7,480
White spruce	8,324	1,768	2,613	32,247	7,106	7,818
Black spruce	943	4,029	*	482	6,708	*
Balsam fir	5,144	9,109	4,226	20,456	15,211	11,806
Hemlock	4,130	1,224	2,186	23,258	4,873	5,683
Tamarack	1,734	630	399	5,397	1,044	1,074
N. white-cedar	21,111	635	3,821	69,136	4,996	10,694
Other softwoods	221	0	0	1,393	0	0
Total	68,526	19,977	22,959	279,257	47,558	67,369
Hardwoods						
Select white oak	23	0	22	72	1	98
Select red oak	1,189	171	589	4,893	353	924
Hickory	4	2	0	11	10	0
Basswood	1,696	219	1,053	7,858	629	2,551
Beech	5,936	304	2,915	23,960	1,890	13,866
Yellow birch	455	1,572	1,255	3,132	5,587	3,993
Hard maple	21,844	2,329	7,505	72,513	5,674	29,366
Soft maple	18,355	2,862	5,354	55,947	5,252	12,760
Elm	71	386	687	468	813	1,019
Black ash	2,119	702	429	1,897	606	1,187
White / green ash	1,565	54	**	5,621	84	**
Cottonwood	11	2	0	57	9	0
Willow	3	0	0	16	2	0
Balsam poplar	2,748	3,599	2,875	12,144	9,148	4,517
Bigtooth aspen	2,690	878	***	12,006	2,290	***
Quaking aspen	12,400	7,428	20,050	54,202	16,238	41,968
Paper birch	3,584	3,537	5,318	13,530	5,414	10,914
Black cherry	1,200	321	0	4,352	321	0
Butternut	8	0	0	47	7	0
Other hardwoods	0	8	354	1	9	728
Total	75,901	24,374	48,406	272,727	54,337	123,891
All species	144,427	44,351	71,365	551,984	101,895	191,260

1 An estimate of current gross growth may be computed by adding current mortality to current net growth.

2 Based on mill survey data (Hackett and Pilon 1993). For the Eastern Upper Peninsula, 1990 is the most current mill survey.

3 International 1/4 inch rule.

* Removals for the black spruce species group are included in the removals for white spruce.

** Removals for the white and green ash species group are included in the removals for black ash.

*** Removals for the bigtooth aspen species group are included in the removals for quaking aspen.

Table 24.--Net volume of sawtimber trees on timberland by species group and butt log grade or tree grade, Eastern Upper Peninsula, Michigan, 1993

(In thousand board feet)[1]

Species	All grades	Butt log grade 1	2	3	Tie and timber
Softwoods					
Jack pine	451,321	--	1,696	449,625	--
Red pine	1,135,528	13,271	36,702	1,085,555	--
White pine	1,071,521	201,464	262,845	411,407	195,805
White spruce	607,820	1,203	14,088	592,529	--
Black spruce	189,010	--	2,019	186,991	--
Balsam fir	453,630	--	--	453,630	--
Hemlock	1,044,412	62,967	157,054	824,390	--
Tamarack	114,230	--	13,433	100,797	--
Eastern redcedar	677	--	--	677	--
Northern white-cedar	1,815,802	7,616	28,046	1,780,140	--
Other softwoods	15,212	--	--	15,212	--
Total	6,899,163	286,523	515,882	5,900,953	195,805

Species	All grades	Tree grade 1	2	3	Tie and timber
Hardwoods					
Select white oak	2,354	--	--	2,354	--
Select red oak	104,869	12,522	34,981	25,549	31,817
Hickory	1,138	--	--	1,138	--
Basswood	177,849	19,038	59,386	63,068	36,357
Beech	762,172	64,905	248,776	270,880	177,612
Yellow birch	341,504	31,692	115,708	125,099	69,005
Hard maple	1,707,024	183,060	591,043	756,979	175,942
Soft maple	1,270,550	86,634	360,140	619,239	204,537
Elm	20,854	1,350	5,957	10,358	3,188
Black ash	60,845	2,318	21,235	32,105	5,187
White and green ash	94,770	42,469	18,056	31,199	3,047
Cottonwood	2,282	--	--	--	2,282
Willow	485	--	--	--	485
Balsam poplar	370,960	29,416	114,177	156,019	71,348
Bigtooth aspen	186,495	26,677	36,264	97,760	25,795
Quaking aspen	912,524	86,578	279,483	407,513	138,950
Paper birch	354,973	8,560	92,443	209,898	44,071
Black cherry	125,177	2,330	56,715	60,020	6,112
Butternut	2,543	--	677	1,866	--
Other hardwoods	546	--	145	401	--
Total	6,499,914	597,549	2,035,186	2,871,446	995,733
All species	13,399,077	884,072	2,551,069	8,772,399	1,191,537

[1]International 1/4-inch rule.

Table 25.--Comparison of adjusted 1980 and 1993 area and growing-stock volume by forest type, Eastern Upper Peninsula, Michigan

Forest type	Area 1980	Area 1993	Change in area amount	Percent change in area 1980-93	Growing-stock volume 1980	Growing-stock volume/ acre 1980	Growing-stock volume 1993	Growing-stock volume/ acre 1993	Change in growing-stock volume amount	Percent change in growing-stock 1980-93
	(thousand acres)	*(thousand acres)*	*(thousand acres)*	*(%)*	*(million cubic feet)*	*(cubic feet per acre)*	*(million cubic feet)*	*(cubic feet per acre)*	*(million cubic feet)*	*(%)*
Jack pine	227.5	197.5	-30.0	-13.2	172.9	760.1	206.6	1,046.1	33.7	19.5
Red pine	118.1	160.7	42.6	36.1	119.5	1,011.7	251.7	1,566.2	132.2	110.7
White pine	68.3	67.1	-1.2	-1.8	79.4	1,162.4	121.0	1,803.9	41.7	52.5
Balsam fir	246.0	227.2	-18.8	-7.6	189.1	768.5	216.1	951.4	27.1	14.3
White spruce	63.8	60.4	-3.4	-5.3	83.7	1,311.9	64.6	1,070.3	-19.0	-22.8
Black spruce	268.1	230.2	-37.9	-14.1	166.3	620.1	147.5	640.9	-18.7	-11.3
Northern white-cedar	607.7	628.8	21.1	3.5	692.9	1,140.2	896.8	1,426.1	203.9	29.4
Tamarack	45.3	54.4	9.1	20.1	24.3	536.2	27.9	512.9	3.6	14.9
Oak-hickory	20.5	37.2	16.7	81.5	18.1	884.8	37.2	1,000.3	19.1	105.2
Elm-ash-soft maple	210.5	221.0	10.5	5.0	223.2	1,060.3	271.7	1,229.3	48.5	21.7
Maple-birch	1,146.2	1,263.1	116.9	10.2	1,640.2	1,431.0	2,146.8	1,699.6	506.6	30.9
Aspen	521.6	467.1	-54.5	-10.5	465.9	893.3	516.5	1,105.8	50.6	10.9
Paper birch	114.7	80.0	-34.7	-30.3	139.3	1,214.3	133.0	1,662.4	-6.3	-4.5
Balsam poplar	111.1	103.1	-8.0	-7.2	111.2	1,000.9	117.0	1,134.5	5.8	5.2
Nonstocked	20.8	12.2	-8.6	-41.4	0.5	23.7	1.9	152.8	1.4	278.1
Total/average	3,790.2	3,810.0	19.8	0.5	4,126.4	1,088.7	5,156.4	1,353.4	1,029.9	25.0

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